

References

- [1] R. A. Oliveira, T. S. Pereira, and M. Quartin, “CMB statistical isotropy confirmation at all scales using multipole vectors,” *Phys. Dark Univ.* **30** (2020) 100608, [arXiv:1812.02654 \[astro-ph.CO\]](#).
- [2] A. Notari, M. Quartin, and R. Catena, “Cmb aberration and doppler effects as a source of hemispherical asymmetries,” *JCAP* **03** (2014) 019, [arXiv:1304.3506 \[astro-ph.CO\]](#).
- [3] M. Quartin and A. Notari, “On the significance of power asymmetries in planck cmb data at all scales,” *JCAP* **01** (2015) 008, [arXiv:1408.5792 \[astro-ph.CO\]](#).
- [4] **CORE** Collaboration, C. Burigana *et al.*, “Exploring cosmic origins with core: effects of observer peculiar motion,” *JCAP* **04** (2018) 021, [arXiv:1704.05764 \[astro-ph.CO\]](#).
- [5] A. Notari and M. Quartin, “Cmb all-scale blackbody distortions induced by linearizing temperature,” *Phys. Rev. D* **94** no. 4, (2016) 043006, [arXiv:1510.08793 \[astro-ph.CO\]](#).
- [6] A. Notari and M. Quartin, “On the proper kinetic quadrupole cmb removal and the quadrupole anomalies,” *JCAP* **06** (2015) 047, [arXiv:1504.02076 \[astro-ph.CO\]](#).
- [7] O. Roldan, A. Notari, and M. Quartin, “Interpreting the cmb aberration and doppler measurements: boost or intrinsic dipole?,” *JCAP* **06** (2016) 026, [arXiv:1603.02664 \[astro-ph.CO\]](#).
- [8] L. Amendola, R. Catena, I. Masina, A. Notari, M. Quartin, and C. Quercellini, “Measuring our peculiar velocity on the cmb with high-multipole off-diagonal correlations,” *JCAP* **07** (2011) 027, [arXiv:1008.1183 \[astro-ph.CO\]](#).
- [9] P. d. S. Ferreira and M. Quartin, “Disentangling doppler modulation, aberration and the temperature dipole in the cmb,” *Phys. Rev. D* **104** no. 6, (2021) 063503, [arXiv:2107.10846 \[astro-ph.CO\]](#).
- [10] A. Notari and M. Quartin, “Measuring our peculiar velocity by ‘pre-deboosting’ the cmb,” *JCAP* **02** (2012) 026, [arXiv:1112.1400 \[astro-ph.CO\]](#).
- [11] I. Masina and A. Notari, “The cold spot as a large void: Rees-sciamia effect on cmb power spectrum and bispectrum,” *JCAP* **02** (2009) 019, [arXiv:0808.1811 \[astro-ph\]](#).
- [12] I. Masina and A. Notari, “The cold spot as a large void: Lensing effect on cmb two and three point correlation functions,” *JCAP* **07** (2009) 035, [arXiv:0905.1073 \[astro-ph.CO\]](#).
- [13] I. Masina and A. Notari, “Detecting the cold spot as a void with the non-diagonal two-point function,” *JCAP* **09** (2010) 028, [arXiv:1007.0204 \[astro-ph.CO\]](#).
- [14] Z. Vlah, M. White, and A. Aviles, “A lagrangian effective field theory,” *JCAP* **09** (2015) 014, [arXiv:1506.05264 \[astro-ph.CO\]](#).
- [15] S.-F. Chen, Z. Vlah, E. Castorina, and M. White, “Redshift-space distortions in lagrangian perturbation theory,” *JCAP* **03** (2021) 100, [arXiv:2012.04636 \[astro-ph.CO\]](#).
- [16] T. L. Smith, M. Lucca, V. Poulin, G. F. Abellan, L. Balkenhol, K. Benabed, S. Galli, and R. Murgia, “Hints of early dark energy in planck, spt, and act data: new physics or systematics?,” (2, 2022) , [arXiv:2202.09379 \[astro-ph.CO\]](#).
- [17] L. Amendola and S. Tsujikawa, “Scaling solutions and weak gravity in dark energy with energy and momentum couplings,” *JCAP* **06** (2020) 020, [arXiv:2003.02686 \[gr-qc\]](#).
- [18] T. Konstandin, R. A. Porto, and H. Rubira, “The effective field theory of large scale structure at three loops,” *JCAP* **11** (2019) 027, [arXiv:1906.00997 \[astro-ph.CO\]](#).
- [19] M. M. Ivanov, O. H. E. Philcox, T. Nishimichi, M. Simonović, M. Takada, and M. Zaldarriaga, “Precision analysis of the redshift-space galaxy bispectrum,” (10, 2021) , [arXiv:2110.10161 \[astro-ph.CO\]](#).
- [20] A. Chudaykin, M. M. Ivanov, and M. Simonović, “Optimizing large-scale structure data analysis with the theoretical error likelihood,” *Phys. Rev. D* **103** no. 4, (2021) 043525, [arXiv:2009.10724 \[astro-ph.CO\]](#).

- [21] M. Lucca, “Multi-interacting dark energy and its cosmological implications,” *Phys. Rev. D* **104** no. 8, (2021) 083510, [arXiv:2106.15196 \[astro-ph.CO\]](#).
- [22] X. Ding, K. Liao, S. Birrer, A. J. Shajib, T. Treu, and L. Yang, “Improved time-delay lens modelling and h_0 inference with transient sources,” *Mon. Not. Roy. Astron. Soc.* **504** (2021) 5621, [arXiv:2103.08609 \[astro-ph.CO\]](#).
- [23] T. Treu and P. J. Marshall, “Time delay cosmography,” *Astron. Astrophys. Rev.* **24** no. 1, (2016) 11, [arXiv:1605.05333 \[astro-ph.CO\]](#).
- [24] S. Brieden, H. Gil-Marín, and L. Verde, “Shapefit: extracting the power spectrum shape information in galaxy surveys beyond bao and rsd,” *JCAP* **12** no. 12, (2021) 054, [arXiv:2106.07641 \[astro-ph.CO\]](#).
- [25] K. Harrington *et al.*, “The cosmology large angular scale surveyor,” *Proc. SPIE Int. Soc. Opt. Eng.* **9914** (2016) 99141K, [arXiv:1608.08234 \[astro-ph.IM\]](#).
- [26] S. Brieden, H. Gil-Marín, and L. Verde, “Model-independent versus model-dependent interpretation of the sdss-iii boss power spectrum: Bridging the divide,” *Phys. Rev. D* **104** no. 12, (2021) L121301, [arXiv:2106.11931 \[astro-ph.CO\]](#).
- [27] B. B. P. Perera *et al.*, “The international pulsar timing array: Second data release,” *Mon. Not. Roy. Astron. Soc.* **490** no. 4, (2019) 4666–4687, [arXiv:1909.04534 \[astro-ph.HE\]](#).
- [28] B. C. Joshi *et al.*, “Precision pulsar timing with the ort and the gmrt and its applications in pulsar astrophysics,” *J. Astrophys. Astron.* **39** no. 51, (2018) 51.
- [29] G. Desvignes *et al.*, “High-precision timing of 42 millisecond pulsars with the european pulsar timing array,” *Mon. Not. Roy. Astron. Soc.* **458** no. 3, (2016) 3341–3380, [arXiv:1602.08511 \[astro-ph.HE\]](#).
- [30] M. Kerr *et al.*, “The parkes pulsar timing array project: second data release,” *Publ. Astron. Soc. Austral.* **37** (2020) e020, [arXiv:2003.09780 \[astro-ph.IM\]](#).
- [31] G. Hobbs, “The parkes pulsar timing array,” *Class. Quant. Grav.* **30** (2013) 224007, [arXiv:1307.2629 \[astro-ph.IM\]](#).
- [32] **SPIDER** Collaboration, R. Gualtieri *et al.*, “Spider: Cmb polarimetry from the edge of space,” *J. Low Temp. Phys.* **193** no. 5-6, (2018) 1112–1121, [arXiv:1711.10596 \[astro-ph.CO\]](#).
- [33] **SPT** Collaboration, J. T. Sayre *et al.*, “Measurements of b-mode polarization of the cosmic microwave background from 500 square degrees of sptpol data,” *Phys. Rev. D* **101** no. 12, (2020) 122003, [arXiv:1910.05748 \[astro-ph.CO\]](#).
- [34] **POLARBEAR** Collaboration, A. Suzuki *et al.*, “The polarbear-2 and the simons array experiment,” *J. Low Temp. Phys.* **184** no. 3-4, (2016) 805–810, [arXiv:1512.07299 \[astro-ph.IM\]](#).
- [35] R. C. Batista, “A short review on clustering dark energy,” *Universe* **8** no. 1, (2021) 22.
- [36] F. Renzi, E. Di Valentino, and A. Melchiorri, “Cornering the planck a_{lens} anomaly with future cmb data,” *Phys. Rev. D* **97** no. 12, (2018) 123534, [arXiv:1712.08758 \[astro-ph.CO\]](#).
- [37] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2013 results. xvi. cosmological parameters,” *Astron. Astrophys.* **571** (2014) A16, [arXiv:1303.5076 \[astro-ph.CO\]](#).
- [38] E. Di Valentino, S. Galli, M. Lattanzi, A. Melchiorri, P. Natoli, L. Pagano, and N. Said, “Tickling the cmb damping tail: Scrutinizing the tension between the atacama cosmology telescope and south pole telescope experiments,” *Phys. Rev. D* **88** no. 2, (2013) 023501, [arXiv:1301.7343 \[astro-ph.CO\]](#).
- [39] J. Valiviita, “Power spectra based planck constraints on compensated isocurvature, and forecasts for litebird and core space missions,” *JCAP* **04** (2017) 014, [arXiv:1701.07039 \[astro-ph.CO\]](#).
- [40] J. B. Muñoz, D. Grin, L. Dai, M. Kamionkowski, and E. D. Kovetz, “Search for compensated isocurvature perturbations with planck power spectra,” *Phys. Rev. D* **93** no. 4, (2016) 043008, [arXiv:1511.04441 \[astro-ph.CO\]](#).

- [41] G. Cabass, E. Di Valentino, A. Melchiorri, E. Pajer, and J. Silk, “Constraints on the running of the running of the scalar tilt from cmb anisotropies and spectral distortions,” *Phys. Rev. D* **94** no. 2, (2016) 023523, [arXiv:1605.00209 \[astro-ph.CO\]](#).
- [42] M. G. Dainotti, G. Sarracino, and S. Capozziello, “Gamma-ray bursts, supernovae ia and baryon acoustic oscillations: a binned cosmological analysis,” *Submitted to PASJ* (August, 2021) .
- [43] M. G. Dainotti, R. Willingale, S. Capozziello, V. F. Cardone, and M. Ostrowski, “Discovery of a tight correlation for gamma ray burst afterglows with ‘canonical’ light curves,” *Astrophys. J. Lett.* **722** (2010) L215, [arXiv:1009.1663 \[astro-ph.HE\]](#).
- [44] S. S. Boruah, M. J. Hudson, and G. Lavaux, “Cosmic flows in the nearby universe: new peculiar velocities from sne and cosmological constraints,” *Mon. Not. Roy. Astron. Soc.* **498** no. 2, (2020) 2703–2718, [arXiv:1912.09383 \[astro-ph.CO\]](#).
- [45] M. G. Dainotti, R. Del Vecchio, N. Shigehiro, and S. Capozziello, “Selection effects in gamma-ray burst correlations: Consequences on the ratio between gamma-ray burst and star formation rates,” *Astrophys. J.* **800** no. 1, (2015) 31, [arXiv:1412.3969 \[astro-ph.HE\]](#).
- [46] M. G. Dainotti, V. Petrosian, R. Willingale, P. O’Brien, M. Ostrowski, and S. Nagataki, “Luminosity–time and luminosity–luminosity correlations for grb prompt and afterglow plateau emissions,” *Mon. Not. Roy. Astron. Soc.* **451** no. 4, (2015) 3898–3908, [arXiv:1506.00702 \[astro-ph.HE\]](#).
- [47] R. Del Vecchio, M. G. Dainotti, and M. Ostrowski, “Study of grb light curve decay indices in the afterglow phase,” *Astrophys. J.* **828** no. 1, (2016) 36, [arXiv:1603.04183 \[astro-ph.HE\]](#).
- [48] M. G. Dainotti, S. Nagataki, K. Maeda, S. Postnikov, and E. Pian, “A study of gamma ray bursts with afterglow plateau phases associated with supernovae,” *Astron. Astrophys.* **600** (2017) A98, [arXiv:1612.02917 \[astro-ph.HE\]](#).
- [49] M. G. Dainotti, X. Hernandez, S. Postnikov, S. Nagataki, P. Obrien, R. Willingale, and S. Striegel, “A study of the gamma-ray burst fundamental plane,” *Astrophys. J.* **848** no. 2, (2017) 88, [arXiv:1704.04908 \[astro-ph.HE\]](#).
- [50] M. G. Dainotti, A. Lenart, G. Sarracino, S. Nagataki, S. Capozziello, and N. Fraija, “The x-ray fundamental plane of the platinum sample, the kilonovae and the sne ib/c associated with grbs,” *Astrophys. J.* **904** no. 2, (2020) 97, [arXiv:2010.02092 \[astro-ph.HE\]](#).
- [51] M. G. Dainotti, S. Livermore, D. A. Kann, L. Li, S. Oates, S. Yi, B. Zhang, B. Gendre, B. Cenko, and N. Fraija, “The optical luminosity–time correlation for more than 100 gamma-ray burst afterglows,” *Astrophys. J. Lett.* **905** no. 2, (2020) L26, [arXiv:2011.14493 \[astro-ph.HE\]](#).
- [52] M. G. Dainotti *et al.*, “On the existence of the plateau emission in high-energy gamma-ray burst lightcurves observed byfermi-lat,” *Astrophys. J. Suppl.* **255** (2021) , [arXiv:2105.07357 \[astro-ph.HE\]](#).
- [53] M. Dainotti and R. Del Vecchio, “Gamma ray burst afterglow and prompt-afterglow relations: an overview,” *New Astron. Rev.* **77** (2017) 23–61, [arXiv:1703.06876 \[astro-ph.HE\]](#).
- [54] M. Dainotti, R. Del Vecchio, and M. Tarnopolski, “Gamma ray burst prompt correlations,” *Adv. Astron.* **2018** (2018) 4969503, [arXiv:1612.00618 \[astro-ph.HE\]](#).
- [55] A. Cucchiara *et al.*, “A photometric redshift of $z \sim 9.4$ for grb 090429b,” *Astrophys. J.* **736** no. 1, (July, 2011) 7, [arXiv:1105.4915 \[astro-ph.CO\]](#).
- [56] G. Stratta, M. G. Dainotti, S. Dall’Osso, X. Hernandez, and G. De Cesare, “On the magnetar origin of the grbs presenting x-ray afterglow plateaus,” *Astrophys. J.* **869** no. 2, (2018) 155, [arXiv:1804.08652 \[astro-ph.HE\]](#).
- [57] M. G. Dainotti, V. Petrosian, and L. Bowden, “Cosmological evolution of the formation rate of short gamma-ray bursts with and without extended emission,” *Astrophys. J. Lett.* **914** no. 2, (2021) L40, [arXiv:2104.13555 \[astro-ph.HE\]](#).

- [58] G. P. Srinivasaragavan, M. G. Dainotti, N. Fraija, X. Hernandez, S. Nagataki, A. Lenart, L. Bowden, and R. Wagner, “On the investigation of the closure relations for gamma-ray bursts observed by swift in the post-plateau phase and the grb fundamental plane,” *Astrophys. J.* **903** no. 1, (2020) 18, [arXiv:2009.06740 \[astro-ph.HE\]](#).
- [59] J. Hamann, S. Hannestad, J. Lesgourgues, C. Rampf, and Y. Y. Y. Wong, “Cosmological parameters from large scale structure - geometric versus shape information,” *JCAP* **07** (2010) 022, [arXiv:1003.3999 \[astro-ph.CO\]](#).
- [60] L. Amati *et al.*, “Intrinsic spectra and energetics of beposax gamma-ray bursts with known redshifts,” *Astron. Astrophys.* **390** (2002) 81, [arXiv:astro-ph/0205230](#).
- [61] F. F. Dirisa, S. Razzaque, F. Piron, M. Arimoto, M. Axelsson, D. Kocevski, F. Longo, M. Ohno, and S. Zhu, “Spectral analysis of fermi-lat gamma-ray bursts with known redshift and their potential use as cosmological standard candles,” *Astrophys. J.* **887** (2019) 13, [arXiv:1910.07009 \[astro-ph.HE\]](#).
- [62] L. Amati, R. D’Agostino, O. Luongo, M. Muccino, and M. Tantalò, “Addressing the circularity problem in the $e_p - e_{\text{iso}}$ correlation of gamma-ray bursts,” *Mon. Not. Roy. Astron. Soc.* **486** no. 1, (2019) L46–L51, [arXiv:1811.08934 \[astro-ph.HE\]](#).
- [63] D. Bettoni, J. M. Ezquiaga, K. Hinterbichler, and M. Zumalacárregui, “Speed of gravitational waves and the fate of scalar-tensor gravity,” *Phys. Rev. D* **95** no. 8, (2017) 084029, [arXiv:1608.01982 \[gr-qc\]](#).
- [64] E. Belgacem, Y. Dirian, S. Foffa, and M. Maggiore, “Gravitational-wave luminosity distance in modified gravity theories,” *Phys. Rev. D* **97** no. 10, (2018) 104066, [arXiv:1712.08108 \[astro-ph.CO\]](#).
- [65] J. M. Ezquiaga and M. Zumalacárregui, “Gravitational wave lensing beyond general relativity: birefringence, echoes and shadows,” *Phys. Rev. D* **102** no. 12, (2020) 124048, [arXiv:2009.12187 \[gr-qc\]](#).
- [66] D. E. Holz and R. M. Wald, “A new method for determining cumulative gravitational lensing effects in inhomogeneous universes,” *Phys. Rev. D* **58** (1998) 063501, [arXiv:astro-ph/9708036](#).
- [67] P. Brax, A.-C. Davis, and J. Noller, “Gravitational waves in doubly coupled bigravity,” *Phys. Rev. D* **96** no. 2, (2017) 023518, [arXiv:1703.08016 \[gr-qc\]](#).
- [68] D. Yonetoku, T. Murakami, T. Nakamura, R. Yamazaki, A. K. Inoue, and K. Ioka, “Gamma-ray burst formation rates inferred from the spectral peak energy-peak luminosity relation,” *Astrophys. J.* **609** (2004) 935, [arXiv:astro-ph/0309217](#).
- [69] M. Dainotti, D. Levine, N. Fraija, and P. Chandra, “Accounting for selection bias and redshift evolution in grb radio afterglow data,” *Galaxies* **9** no. 4, (2021) 95, [arXiv:2111.10435 \[astro-ph.HE\]](#).
- [70] B. Efron and V. Petrosian, “A simple test of independence for truncated data with applications to redshift surveys,” *Astrophys. J.* **399** (November, 1992) 345.
- [71] R. Jimenez, R. Maartens, A. R. Khalifeh, R. R. Caldwell, A. F. Heavens, and L. Verde, “Measuring the homogeneity of the universe using polarization drift,” *JCAP* **05** (2019) 048, [arXiv:1902.11298 \[astro-ph.CO\]](#).
- [72] P. Parashari, S. Anand, P. Chaulbal, G. Lambiase, S. Mohanty, A. Mazumdar, and A. Narang, “Status of σ_8 tension in different cosmological models,” *Springer Proc. Phys.* **261** (2021) 907–912.
- [73] D. Q. Lamb, “Gamma-ray bursts as a probe of cosmology,” *AIP Conf. Proc.* **662** no. 1, (2003) 433–437, [arXiv:astro-ph/0210434](#).
- [74] M. G. Dainotti, V. F. Cardone, and S. Capozziello, “A time - luminosity correlation for gamma ray bursts in the x - rays,” *Mon. Not. Roy. Astron. Soc.* **391** (2008) 79, [arXiv:0809.1389 \[astro-ph\]](#).
- [75] V. F. Cardone, S. Capozziello, and M. G. Dainotti, “An updated gamma ray bursts hubble diagram,” *Mon. Not. Roy. Astron. Soc.* **400** no. 2, (2009) 775–790, [arXiv:0901.3194 \[astro-ph.CO\]](#).

- [76] V. F. Cardone, M. G. Dainotti, S. Capozziello, and R. Willingale, “Constraining cosmological parameters by gamma ray burst x - ray afterglow lightcurves,” *Mon. Not. Roy. Astron. Soc.* **408** (2010) 1181, [arXiv:1005.0122 \[astro-ph.CO\]](#).
- [77] M. G. Dainotti, V. F. Cardone, S. Capozziello, M. Ostrowski, and R. Willingale, “Study of possible systematics in the $l^*x - ta^*$ correlation of gamma ray bursts,” *Astrophys. J.* **730** (2011) 135, [arXiv:1101.1676 \[astro-ph.HE\]](#).
- [78] M. G. Dainotti, M. Ostrowski, and R. Willingale, “Toward a standard gamma ray burst: tight correlations between the prompt and the afterglow plateau phase emission,” *Mon. Not. Roy. Astron. Soc.* **418** (2011) 2202, [arXiv:1103.1138 \[astro-ph.HE\]](#).
- [79] M. G. Dainotti, S. Postnikov, X. Hernandez, and M. Ostrowski, “A fundamental plane for long gamma-ray bursts with x-ray plateaus,” *Astrophys. J. Lett.* **825** no. 2, (2016) L20, [arXiv:1604.06840 \[astro-ph.HE\]](#).
- [80] S. Postnikov, M. G. Dainotti, X. Hernandez, and S. Capozziello, “Nonparametric study of the evolution of the cosmological equation of state with sneia, bao, and high-redshift grbs,” *Astrophys. J.* **783** (2014) 126, [arXiv:1401.2939 \[astro-ph.CO\]](#).
- [81] M. G. Dainotti, B. De Simone, T. Schiavone, G. Montani, E. Rinaldi, and G. Lambiase, “On the hubble constant tension in the sne ia pantheon sample,” *Astrophys. J.* **912** no. 2, (2021) 150, [arXiv:2103.02117 \[astro-ph.CO\]](#).
- [82] M. G. Dainotti, V. F. Cardone, E. Piedipalumbo, and S. Capozziello, “Slope evolution of grb correlations and cosmology,” *Mon. Not. Roy. Astron. Soc.* **436** (2013) 82, [arXiv:1308.1918 \[astro-ph.HE\]](#).
- [83] J. P. Norris and J. T. Bonnell, “Short gamma-ray bursts with extended emission,” *Astrophys. J.* **643** (2006) 266–275, [arXiv:astro-ph/0601190](#).
- [84] G. S. Farren, O. H. E. Philcox, and B. D. Sherwin, “Determining the hubble constant without the sound horizon: Perspectives with future galaxy surveys,” (12, 2021) , [arXiv:2112.10749 \[astro-ph.CO\]](#).
- [85] O. H. E. Philcox and M. M. Ivanov, “Boss dr12 full-shape cosmology: Λ cdm constraints from the large-scale galaxy power spectrum and bispectrum monopole,” *Phys. Rev. D* **105** no. 4, (2022) 043517, [arXiv:2112.04515 \[astro-ph.CO\]](#).
- [86] P. Zhang, G. D’Amico, L. Senatore, C. Zhao, and Y. Cai, “Boss correlation function analysis from the effective field theory of large-scale structure,” *JCAP* **02** no. 02, (2022) 036, [arXiv:2110.07539 \[astro-ph.CO\]](#).
- [87] M. M. Ivanov, O. H. E. Philcox, M. Simonović, M. Zaldarriaga, T. Nishimichi, and M. Takada, “Cosmological constraints without fingers of god,” (9, 2021) , [arXiv:2110.00006 \[astro-ph.CO\]](#).
- [88] G. Cabass, M. M. Ivanov, O. H. E. Philcox, M. Simonović, and M. Zaldarriaga, “Constraints on single-field inflation from the boss galaxy survey,” (1, 2022) , [arXiv:2201.07238 \[astro-ph.CO\]](#).
- [89] T. Baldauf, M. Garny, P. Taule, and T. Steele, “Two-loop bispectrum of large-scale structure,” *Phys. Rev. D* **104** no. 12, (2021) 123551, [arXiv:2110.13930 \[astro-ph.CO\]](#).
- [90] T. Steele and T. Baldauf, “Precise calibration of the one-loop trispectrum in the effective field theory of large scale structure,” *Phys. Rev. D* **103** no. 10, (2021) 103518, [arXiv:2101.10289 \[astro-ph.CO\]](#).
- [91] J. J. M. Carrasco, S. Foreman, D. Green, and L. Senatore, “The effective field theory of large scale structures at two loops,” *JCAP* **07** (2014) 057, [arXiv:1310.0464 \[astro-ph.CO\]](#).
- [92] T. Baldauf, L. Mercolli, and M. Zaldarriaga, “Effective field theory of large scale structure at two loops: The apparent scale dependence of the speed of sound,” *Phys. Rev. D* **92** no. 12, (2015) 123007, [arXiv:1507.02256 \[astro-ph.CO\]](#).
- [93] A. Eggemeier, R. Scoccimarro, and R. E. Smith, “Bias loop corrections to the galaxy bispectrum,” *Phys. Rev. D* **99** no. 12, (2019) 123514, [arXiv:1812.03208 \[astro-ph.CO\]](#).

- [94] D. Gualdi, H. Gil-Marín, and L. Verde, “Joint analysis of anisotropic power spectrum, bispectrum and trispectrum: application to n-body simulations,” (4, 2021) , [arXiv:2104.03976 \[astro-ph.CO\]](#).
- [95] D. Gualdi and L. Verde, “Galaxy redshift-space bispectrum: the importance of being anisotropic,” *JCAP* **06** (2020) 041, [arXiv:2003.12075 \[astro-ph.CO\]](#).
- [96] D. Gualdi and L. Verde, “Integrated trispectrum detection from boss dr12 ngc cmass,” (1, 2022) , [arXiv:2201.06932 \[astro-ph.CO\]](#).
- [97] O. H. E. Philcox, J. Hou, and Z. Slepian, “A first detection of the connected 4-point correlation function of galaxies using the boss cmass sample,” (8, 2021) , [arXiv:2108.01670 \[astro-ph.CO\]](#).
- [98] F. Schmidt, “Sigma-eight at the percent level: The eft likelihood in real space,” *JCAP* **04** (2021) 032, [arXiv:2009.14176 \[astro-ph.CO\]](#).
- [99] F. Schmidt, G. Cabass, J. Jasche, and G. Lavaux, “Unbiased cosmology inference from biased tracers using the eft likelihood,” *JCAP* **11** (2020) 008, [arXiv:2004.06707 \[astro-ph.CO\]](#).
- [100] U. Seljak, G. Aslanyan, Y. Feng, and C. Modi, “Towards optimal extraction of cosmological information from nonlinear data,” *JCAP* **12** (2017) 009, [arXiv:1706.06645 \[astro-ph.CO\]](#).
- [101] A. Chudaykin and M. M. Ivanov, “Measuring neutrino masses with large-scale structure: Euclid forecast with controlled theoretical error,” *JCAP* **11** (2019) 034, [arXiv:1907.06666 \[astro-ph.CO\]](#).
- [102] O. H. E. Philcox and Z. Slepian, “Efficient computation of n -point correlation functions in d dimensions,” (6, 2021) , [arXiv:2106.10278 \[astro-ph.IM\]](#).
- [103] G. Cabass and F. Schmidt, “The eft likelihood for large-scale structure,” *JCAP* **04** (2020) 042, [arXiv:1909.04022 \[astro-ph.CO\]](#).
- [104] G. D’Amico, M. Lewandowski, L. Senatore, and P. Zhang, “Limits on primordial non-gaussianities from boss galaxy-clustering data,” (1, 2022) , [arXiv:2201.11518 \[astro-ph.CO\]](#).
- [105] T. Nishimichi, G. D’Amico, M. M. Ivanov, L. Senatore, M. Simonović, M. Takada, M. Zaldarriaga, and P. Zhang, “Blinded challenge for precision cosmology with large-scale structure: results from effective field theory for the redshift-space galaxy power spectrum,” *Phys. Rev. D* **102** no. 12, (2020) 123541, [arXiv:2003.08277 \[astro-ph.CO\]](#).
- [106] F. Beutler and P. McDonald, “Unified galaxy power spectrum measurements from 6dfgs, boss, and eboss,” *JCAP* **11** (2021) 031, [arXiv:2106.06324 \[astro-ph.CO\]](#).
- [107] M. White *et al.*, “Cosmological constraints from the tomographic cross-correlation of desi luminous red galaxies and planck cmb lensing,” *JCAP* **02** no. 02, (2022) 007, [arXiv:2111.09898 \[astro-ph.CO\]](#).
- [108] E. Platts, A. Weltman, A. Walters, S. P. Tendulkar, J. E. B. Gordin, and S. Kandhai, “A living theory catalogue for fast radio bursts,” *Phys. Rept.* **821** (2019) 1–27, [arXiv:1810.05836 \[astro-ph.HE\]](#).
- [109] D. R. Lorimer, M. Bailes, M. A. McLaughlin, D. J. Narkevic, and F. Crawford, “A bright millisecond radio burst of extragalactic origin,” *Science* **318** (2007) 777, [arXiv:0709.4301 \[astro-ph\]](#).
- [110] J. P. Macquart *et al.*, “A census of baryons in the universe from localized fast radio bursts,” *Nature* **581** no. 7809, (2020) 391–395, [arXiv:2005.13161 \[astro-ph.CO\]](#).
- [111] A. Walters, A. Weltman, B. M. Gaensler, Y.-Z. Ma, and A. Witzemann, “Future cosmological constraints from fast radio bursts,” *Astrophys. J.* **856** no. 1, (2018) 65, [arXiv:1711.11277 \[astro-ph.CO\]](#).
- [112] S. P. Tendulkar *et al.*, “The host galaxy and redshift of the repeating fast radio burst frb 121102,” *Astrophys. J. Lett.* **834** no. 2, (2017) L7, [arXiv:1701.01100 \[astro-ph.HE\]](#).
- [113] A. Walters, Y.-Z. Ma, J. Sievers, and A. Weltman, “Probing diffuse gas with fast radio bursts,” *Phys. Rev. D* **100** no. 10, (2019) 103519, [arXiv:1909.02821 \[astro-ph.CO\]](#).

- [114] A. Weltman and A. Walters, “Fast radio burst cosmology and hirax,” in *54th Rencontres de Moriond on Gravitation*. 5, 2019. [arXiv:1905.07132](#) [[astro-ph.CO](#)].
- [115] S.-F. Chen, Z. Vlah, and M. White, “A new analysis of galaxy 2-point functions in the boss survey, including full-shape information and post-reconstruction bao,” *JCAP* **02** no. 02, (2022) 008, [arXiv:2110.05530](#) [[astro-ph.CO](#)].
- [116] C. Gomez and R. Jimenez, “The quantum de sitter root of quasi de sitter observables: a pedagogical review,” (11, 2021) , [arXiv:2111.05380](#) [[hep-th](#)].
- [117] G. Barenboim, P. B. Denton, and I. M. Oldengott, “Constraints on inflation with an extended neutrino sector,” *Phys. Rev. D* **99** no. 8, (2019) 083515, [arXiv:1903.02036](#) [[astro-ph.CO](#)].
- [118] M. Petronikolou, S. Basilakos, and E. N. Saridakis, “Alleviating h_0 tension in horndeski gravity,” (10, 2021) , [arXiv:2110.01338](#) [[gr-qc](#)].
- [119] C. e. Gómez and R. Jimenez, “The quantum cosmological tilt and the origin of dark matter,” *JCAP* **10** (2021) 055, [arXiv:2012.07883](#) [[hep-th](#)].
- [120] C. e. Gómez and R. Jimenez, “Quantum fisher cosmology: confronting observations and the trans-planckian problem,” *JCAP* **09** (2021) 016, [arXiv:2105.05251](#) [[astro-ph.CO](#)].
- [121] C. Gómez and R. Jimenez, “Model independent prediction of the spectral index of primordial quantum fluctuations,” (3, 2021) , [arXiv:2103.10144](#) [[hep-th](#)].
- [122] C. Gomez and R. Jimenez, “The quantum origin of quasi de sitter: a model independent quantum cosmological tilt,” (12, 2020) , [arXiv:2012.04003](#) [[hep-th](#)].
- [123] C. Gomez and R. Jimenez, “Dark matter from primordial quantum information,” *JCAP* **10** (2020) 004, [arXiv:2003.08402](#) [[astro-ph.CO](#)].
- [124] C. Gomez and R. Jimenez, “Cosmology from quantum information,” *Phys. Rev. D* **102** no. 6, (2020) 063511, [arXiv:2002.04294](#) [[hep-th](#)].
- [125] C. Gómez and R. Jimenez, “How gaussian can the sky be? primordial non-gaussianity from quantum information,” *JCAP* **07** (2020) 047, [arXiv:2005.09506](#) [[astro-ph.CO](#)].
- [126] L. Verde, P. Protopapas, and R. Jimenez, “The expansion rate of the intermediate universe in light of planck,” *Phys. Dark Univ.* **5-6** (2014) 307–314, [arXiv:1403.2181](#) [[astro-ph.CO](#)].
- [127] A. Heinesen, C. Blake, Y.-Z. Li, and D. L. Wiltshire, “Baryon acoustic oscillation methods for generic curvature: application to the sdss-iii baryon oscillation spectroscopic survey,” *JCAP* **03** (2019) 003, [arXiv:1811.11963](#) [[astro-ph.CO](#)].
- [128] J. L. Bernal, T. L. Smith, K. K. Boddy, and M. Kamionkowski, “Robustness of baryon acoustic oscillation constraints for early-universe modifications of Λ cdm cosmology,” *Phys. Rev. D* **102** no. 12, (2020) 123515, [arXiv:2004.07263](#) [[astro-ph.CO](#)].
- [129] J. P. Ostriker and P. J. Steinhardt, “The observational case for a low density universe with a nonzero cosmological constant,” *Nature* **377** (1995) 600–602.
- [130] **LSST Dark Energy Science** Collaboration, S. Huber *et al.*, “Strongly lensed sne ia in the era of lsst: observing cadence for lens discoveries and time-delay measurements,” *Astron. Astrophys.* **631** (2019) A161, [arXiv:1903.00510](#) [[astro-ph.IM](#)].
- [131] B. E. Stahl, T. de Jaeger, S. S. Boruah, W. Zheng, A. V. Filippenko, and M. J. Hudson, “Peculiar-velocity cosmology with types ia and ii supernovae,” *Mon. Not. Roy. Astron. Soc.* **505** no. 2, (2021) 2349–2360, [arXiv:2105.05185](#) [[astro-ph.CO](#)].
- [132] Z. Zhai, Y. Wang, and D. Scolnic, “Forecasting cosmological constraints from the weak lensing magnification of type ia supernovae measured by the nancy grace roman space telescope,” *Phys. Rev. D* **102** no. 12, (2020) 123513, [arXiv:2008.06804](#) [[astro-ph.CO](#)].

- [133] N. Christlieb, “Age determination of metal-poor halo stars using nucleochronometry,” *Astronomische Nachrichten* **337** no. 8-9, (September, 2016) 931.
- [134] Y. Wang *et al.*, “Atlas probe: Breakthrough science of galaxy evolution, cosmology, milky way, and the solar system,” (8, 2019) , [arXiv:1909.00070](#) [astro-ph.IM].
- [135] **SDSS-IV** Collaboration, R. Ahumada *et al.*, “The 16th data release of the sloan digital sky surveys: First release from the apogee-2 southern survey and full release of eboss spectra,” *Astrophys. J. Suppl.* **249** no. 1, (2020) 3, [arXiv:1912.02905](#) [astro-ph.GA].
- [136] M. Moresco *et al.*, “Spot the difference. impact of different selection criteria on observed properties of passive galaxies in zcosmos 20-k sample,” *Astron. Astrophys.* **558** (2013) A61, [arXiv:1305.1308](#) [astro-ph.CO].
- [137] M. Moresco, “Raising the bar: new constraints on the hubble parameter with cosmic chronometers at $z \sim 2$,” *Mon. Not. Roy. Astron. Soc.* **450** no. 1, (2015) L16–L20, [arXiv:1503.01116](#) [astro-ph.CO].
- [138] M. Moresco *et al.*, “Improved constraints on the expansion rate of the universe up to z 1.1 from the spectroscopic evolution of cosmic chronometers,” *JCAP* **1208** (2012) 006, [arXiv:1201.3609](#) [astro-ph.CO].
- [139] C. Zhang, H. Zhang, S. Yuan, T.-J. Zhang, and Y.-C. Sun, “Four new observational $h(z)$ data from luminous red galaxies in the sloan digital sky survey data release seven,” *Res. Astron. Astrophys.* **14** no. 10, (2014) 1221–1233, [arXiv:1207.4541](#) [astro-ph.CO].
- [140] A. L. Ratsimbazafy, S. I. Loubser, S. M. Crawford, C. M. Cress, B. A. Bassett, R. C. Nichol, and P. Väisänen, “Age-dating luminous red galaxies observed with the southern african large telescope,” *Mon. Not. Roy. Astron. Soc.* **467** no. 3, (2017) 3239–3254, [arXiv:1702.00418](#) [astro-ph.CO].
- [141] D. A. Vandenberg, M. Bolte, and P. B. Stetson, “The age of the galactic globular cluster system,” *Ann. Rev. Astron. Astrophys.* **34** (1996) 461–510.
- [142] D. R. Soderblom, “The ages of stars,” *Ann. Rev. Astron. Astrophys.* **48** (2010) 581–629, [arXiv:1003.6074](#) [astro-ph.SR].
- [143] D. Benisty and E. I. Guendelman, “Quintessential inflation from lorentzian slow roll,” *Eur. Phys. J. C* **80** no. 6, (2020) 577, [arXiv:2006.04129](#) [astro-ph.CO].
- [144] D. Benisty and E. I. Guendelman, “Lorentzian quintessential inflation,” *Int. J. Mod. Phys. D* **29** no. 14, (2020) 2042002, [arXiv:2004.00339](#) [astro-ph.CO].
- [145] M. Catelan, “The ages of (the oldest) stars,” in *Rediscovering Our Galaxy*, C. Chiappini, I. Minchev, E. Starkenburg, and M. Valentini, eds., vol. 334, pp. 11–20. August, 2018. [arXiv:1709.08656](#) [astro-ph.SR].
- [146] J. Simon, L. Verde, and R. Jimenez, “Constraints on the redshift dependence of the dark energy potential,” *Phys. Rev. D* **71** (2005) 123001, [arXiv:astro-ph/0412269](#).
- [147] D. Valcin, R. Jimenez, L. Verde, J. L. Bernal, and B. D. Wandelt, “The age of the universe with globular clusters: reducing systematic uncertainties,” *JCAP* **08** (2021) 017, [arXiv:2102.04486](#) [astro-ph.GA].
- [148] R. Wagner-Kaiser, A. Sarajedini, T. von Hippel, D. C. Stenning, D. A. van Dyk, E. Jeffery, E. Robinson, N. Stein, J. Anderson, and W. H. Jefferys, “The acs survey of galactic globular clusters - xiv. bayesian single-population analysis of 69 globular clusters,” *Mon. Not. Roy. Astron. Soc.* **468** no. 1, (June, 2017) 1038–1055, [arXiv:1702.08856](#) [astro-ph.SR].
- [149] R. Jimenez, P. Thejll, U. Jorgensen, J. MacDonald, and B. Pagel, “Ages of globular clusters: a new approach,” *Mon. Not. Roy. Astron. Soc.* **282** (1996) 926–942, [arXiv:astro-ph/9602132](#).
- [150] R. Jimenez and P. Padoan, “The ages and distances of globular clusters with the luminosity function method: the case of m5 and m55,” *Astrophys. J.* **498** (1998) 704, [arXiv:astro-ph/9701141](#).

- [151] P. Padoan and R. Jimenez, “Ages of globular clusters: breaking the age-distance degeneracy with the luminosity function,” *Astrophys. J.* **475** (1997) 580, [arXiv:astro-ph/9603060](#).
- [152] R. Jimenez and P. Padoan, “A new self-consistency check on the ages of globular clusters,” *Astrophys. J. Lett.* **463** (May, 1996) L17.
- [153] H. Spinrad, A. Dey, D. Stern, J. Dunlop, J. Peacock, R. Jimenez, and R. Windhorst, “Lbds 53w091: an old red galaxy at $z=1.552$,” *Astrophys. J.* **484** (1997) 581–601, [arXiv:astro-ph/9702233](#).
- [154] E. M. O’Malley, C. Gilligan, and B. Chaboyer, “Absolute ages and distances of 22 gcs using monte carlo main-sequence fitting,” *Astrophys. J.* **838** no. 2, (April, 2017) 162, [arXiv:1703.01915 \[astro-ph.SR\]](#).
- [155] J. Dunlop, J. Peacock, H. Spinrad, A. Dey, R. Jimenez, D. Stern, and R. Windhorst, “A 3.5 - gyr - old galaxy at redshift 1.55,” *Nature* **381** (1996) 581.
- [156] R. Jimenez and A. Loeb, “Constraining cosmological parameters based on relative galaxy ages,” *Astrophys. J.* **573** (2002) 37–42, [arXiv:astro-ph/0106145](#).
- [157] R. Jimenez, J. MacDonald, J. S. Dunlop, P. Padoan, and J. A. Peacock, “Synthetic stellar populations: Single stellar populations, stellar interior models and primordial proto-galaxies,” *Mon. Not. Roy. Astron. Soc.* **349** (2004) 240, [arXiv:astro-ph/0402271](#).
- [158] M. Moresco and F. Marulli, “Cosmological constraints from a joint analysis of cosmic growth and expansion,” *Mon. Not. Roy. Astron. Soc.* **471** no. 1, (2017) L82–L86, [arXiv:1705.07903 \[astro-ph.CO\]](#).
- [159] **EUCLID** Collaboration, R. Laureijs *et al.*, “Euclid definition study report,” (10, 2011) , [arXiv:1110.3193 \[astro-ph.CO\]](#).
- [160] S. Vagnozzi, L. Visinelli, P. Brax, A.-C. Davis, and J. Sakstein, “Direct detection of dark energy: The xenon1t excess and future prospects,” *Phys. Rev. D* **104** no. 6, (2021) 063023, [arXiv:2103.15834 \[hep-ph\]](#).
- [161] **PFS Team** Collaboration, R. Ellis *et al.*, “Extragalactic science, cosmology, and galactic archaeology with the subaru prime focus spectrograph,” *Publ. Astron. Soc. Jap.* **66** no. 1, (2014) R1, [arXiv:1206.0737 \[astro-ph.CO\]](#).
- [162] **GRAVITY** Collaboration, A. Amorim *et al.*, “A geometric distance to the supermassive black hole of ngc 3783,” *Astron. Astrophys.* **654** (2021) A85, [arXiv:2107.14262 \[astro-ph.GA\]](#).
- [163] Y.-R. Li, J.-M. Wang, Y.-Y. Songsheng, Z.-X. Zhang, P. Du, C. Hu, and M. Xiao, “Spectroastrometry and reverberation mapping: the mass and geometric distance of the supermassive black hole in the quasar 3c 273,” *arXiv e-prints* (January, 2022) [arXiv:2201.04470](#), [arXiv:2201.04470 \[astro-ph.GA\]](#).
- [164] Y.-R. Li, J.-M. Wang, Y.-Y. Songsheng, Z.-X. Zhang, P. Du, C. Hu, and M. Xiao, “Spectroastrometry and reverberation mapping: the mass and geometric distance of the supermassive black hole in the quasar 3c 273,” (1, 2022) , [arXiv:2201.04470 \[astro-ph.GA\]](#).
- [165] A. Mariano and L. Perivolaropoulos, “Is there correlation between fine structure and dark energy cosmic dipoles?,” *Phys. Rev. D* **86** (2012) 083517, [arXiv:1206.4055 \[astro-ph.CO\]](#).
- [166] M. Lulli, A. Marciano, and X. Shan, “Stochastic quantization of general relativity à la ricci-flow,” (12, 2021) , [arXiv:2112.01490 \[gr-qc\]](#).
- [167] C. A. P. Bengaly, T. M. Siewert, D. J. Schwarz, and R. Maartens, “Testing the standard model of cosmology with the ska: the cosmic radio dipole,” *Mon. Not. Roy. Astron. Soc.* **486** no. 1, (2019) 1350–1357, [arXiv:1810.04960 \[astro-ph.CO\]](#).
- [168] S. Capozziello, G. Lambiase, and H. J. Schmidt, “Nonminimal derivative couplings and inflation in generalized theories of gravity,” *Annalen Phys.* **9** (2000) 39–48, [arXiv:gr-qc/9906051](#).
- [169] M. Ishak, “Testing general relativity in cosmology,” *Living Rev. Rel.* **22** no. 1, (2019) 1, [arXiv:1806.10122 \[astro-ph.CO\]](#).

- [170] W. Lin and M. Ishak, “Cosmological discordances: A new measure, marginalization effects, and application to geometry versus growth current data sets,” *Phys. Rev. D* **96** no. 2, (2017) 023532, [arXiv:1705.05303 \[astro-ph.CO\]](#).
- [171] **DES** Collaboration, P. Lemos *et al.*, “Assessing tension metrics with dark energy survey and planck data,” *Mon. Not. Roy. Astron. Soc.* **505** no. 4, (2021) 6179–6194, [arXiv:2012.09554 \[astro-ph.CO\]](#).
- [172] M. J. Strassler and K. M. Zurek, “Echoes of a hidden valley at hadron colliders,” *Phys. Lett. B* **651** (2007) 374–379, [arXiv:hep-ph/0604261](#).
- [173] G. Scelfo, M. Spinelli, A. Raccanelli, L. Boco, A. Lapi, and M. Viel, “Gravitational waves \times hi intensity mapping: cosmological and astrophysical applications,” *JCAP* **01** no. 01, (2022) 004, [arXiv:2106.09786 \[astro-ph.CO\]](#).
- [174] M. Foxley-Marrable, T. E. Collett, G. Vernardos, D. A. Goldstein, and D. Bacon, “The impact of microlensing on the standardization of strongly lensed type ia supernovae,” *Mon. Not. Roy. Astron. Soc.* **478** no. 4, (2018) 5081–5090, [arXiv:1802.07738 \[astro-ph.CO\]](#).
- [175] S. Birrer, S. Dhawan, and A. J. Shajib, “The hubble constant from strongly lensed supernovae with standardizable magnifications,” *Astrophys. J.* **924** no. 1, (2022) 2, [arXiv:2107.12385 \[astro-ph.CO\]](#).
- [176] G. Scelfo, L. Boco, A. Lapi, and M. Viel, “Exploring galaxies-gravitational waves cross-correlations as an astrophysical probe,” *JCAP* **10** (2020) 045, [arXiv:2007.08534 \[astro-ph.CO\]](#).
- [177] M. Oguri, “Measuring the distance-redshift relation with the cross-correlation of gravitational wave standard sirens and galaxies,” *Phys. Rev. D* **93** no. 8, (2016) 083511, [arXiv:1603.02356 \[astro-ph.CO\]](#).
- [178] C. C. Diaz and S. Mukherjee, “Mapping the cosmic expansion history from ligo-virgo-kagra in synergy with desi and spherex,” *Mon. Not. Roy. Astron. Soc.* **511** no. 2, (2022) 2782–2795, [arXiv:2107.12787 \[astro-ph.CO\]](#).
- [179] T. M. Siewert, M. Schmidt-Rubart, and D. J. Schwarz, “Cosmic radio dipole: Estimators and frequency dependence,” *Astron. Astrophys.* **653** (2021) A9, [arXiv:2010.08366 \[astro-ph.CO\]](#).
- [180] N. J. Secrest, S. von Hausegger, M. Rameez, R. Mohayaee, S. Sarkar, and J. Colin, “A test of the cosmological principle with quasars,” *Astrophys. J. Lett.* **908** no. 2, (2021) L51, [arXiv:2009.14826 \[astro-ph.CO\]](#).
- [181] D. A. Yahalomi, P. L. Schechter, and J. Wambsganss, “A quadruply lensed sn ia: Gaining a time-delay...losing a standard candle,” (11, 2017) , [arXiv:1711.07919 \[astro-ph.CO\]](#).
- [182] P. Craig, K. O’Connor, S. Chakrabarti, S. A. Rodney, J. R. Pierel, C. McCully, and I. Perez-Fournon, “A targeted search for strongly lensed supernovae and expectations for targeted searches in the rubin era,” (11, 2021) , [arXiv:2111.01680 \[astro-ph.CO\]](#).
- [183] D. K. Ramanah, N. Arendse, and R. Wojtak, “Ai-driven spatio-temporal engine for finding gravitationally lensed supernovae,” (7, 2021) , [arXiv:2107.12399 \[astro-ph.IM\]](#).
- [184] N. Horstmann, Y. Pietschke, and D. J. Schwarz, “Inference of the cosmic rest-frame from supernovae ia,” (11, 2021) , [arXiv:2111.03055 \[astro-ph.CO\]](#).
- [185] P. Tiwari, R. Kothari, and P. Jain, “Superhorizon perturbations: A possible explanation of the hubble–lemaître tension and the large-scale anisotropy of the universe,” *Astrophys. J. Lett.* **924** no. 2, (2022) L36, [arXiv:2111.02685 \[astro-ph.CO\]](#).
- [186] L. A. Anchordoqui, V. Barger, D. Marfatia, M. H. Reno, and T. J. Weiler, “Oscillations of sterile neutrinos from dark matter decay eliminates the icecube-fermi tension,” *Phys. Rev. D* **103** no. 7, (2021) 075022, [arXiv:2101.09559 \[astro-ph.HE\]](#).
- [187] R. Maartens, C. Clarkson, and S. Chen, “The kinematic dipole in galaxy redshift surveys,” *JCAP* **01** (2018) 013, [arXiv:1709.04165 \[astro-ph.CO\]](#).

- [188] C. Dalang and C. Bonvin, “On the kinematic cosmic dipole tension,” (11, 2021) , [arXiv:2111.03616 \[astro-ph.CO\]](#).
- [189] T. Nadolny, R. Durrer, M. Kunz, and H. Padmanabhan, “A new way to test the cosmological principle: measuring our peculiar velocity and the large scale anisotropy independently,” *JCAP* **11** (2021) 009, [arXiv:2106.05284 \[astro-ph.CO\]](#).
- [190] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2015 results. xvi. isotropy and statistics of the cmb,” *Astron. Astrophys.* **594** (2016) A16, [arXiv:1506.07135 \[astro-ph.CO\]](#).
- [191] **WMAP** Collaboration, N. Jarosik *et al.*, “Seven-year wilkinson microwave anisotropy probe (wmap) observations: Sky maps, systematic errors, and basic results,” *Astrophys. J. Suppl.* **192** (2011) 14, [arXiv:1001.4744 \[astro-ph.CO\]](#).
- [192] **Planck** Collaboration, R. Adam *et al.*, “Planck 2015 results. i. overview of products and scientific results,” *Astron. Astrophys.* **594** (2016) A1, [arXiv:1502.01582 \[astro-ph.CO\]](#).
- [193] J. Creswell and P. Naselsky, “Ring of attraction: overlapping directions of the dipole modulation of the cmb, the parity asymmetry, and kinematic dipole percolation zone,” (5, 2021) , [arXiv:2105.08658 \[astro-ph.CO\]](#).
- [194] J. Creswell and P. Naselsky, “Asymmetry of the cmb map: local and global anomalies,” *JCAP* **03** (2021) 103, [arXiv:2102.13442 \[astro-ph.CO\]](#).
- [195] S. Shaikh, S. Mukherjee, S. Das, B. D. Wandelt, and T. Souradeep, “Joint bayesian analysis of large angular scale cmb temperature anomalies,” *JCAP* **08** (2019) 007, [arXiv:1902.10155 \[astro-ph.CO\]](#).
- [196] Y. Akrami, Y. Fantaye, A. Shafieloo, H. K. Eriksen, F. K. Hansen, A. J. Banday, and K. M. Górski, “Power asymmetry in wmap and planck temperature sky maps as measured by a local variance estimator,” *Astrophys. J. Lett.* **784** (2014) L42, [arXiv:1402.0870 \[astro-ph.CO\]](#).
- [197] F. Finelli, A. Gruppuso, F. Paci, and A. A. Starobinsky, “Searching for hidden mirror symmetries in cmb fluctuations from wmap 7 year maps,” *JCAP* **07** (2012) 049, [arXiv:1111.5362 \[astro-ph.CO\]](#).
- [198] C. L. Bennett *et al.*, “Seven-year wilkinson microwave anisotropy probe (wmap) observations: Are there cosmic microwave background anomalies?,” *Astrophys. J. Suppl.* **192** (2011) 17, [arXiv:1001.4758 \[astro-ph.CO\]](#).
- [199] J. Kim and P. Naselsky, “Anomalous parity asymmetry of wmap power spectrum data at low multipoles: is it cosmological or systematics?,” *Phys. Rev. D* **82** (2010) 063002, [arXiv:1002.0148 \[astro-ph.CO\]](#).
- [200] A. Gruppuso, F. Finelli, P. Natoli, F. Paci, P. Cabella, A. De Rosa, and N. Mandolesi, “New constraints on parity symmetry from a re-analysis of the wmap-7 low resolution power spectra,” *Mon. Not. Roy. Astron. Soc.* **411** (2011) 1445–1452, [arXiv:1006.1979 \[astro-ph.CO\]](#).
- [201] J.-S. Kim, P. Naselsky, and M. Hansen, “Symmetry and anti-symmetry of the cmb anisotropy pattern,” *Adv. Astron.* **2012** (2012) 960509, [arXiv:1202.0728 \[astro-ph.CO\]](#).
- [202] M. Hansen, A. M. Frejsel, J. Kim, P. Naselsky, and F. Nesti, “Pearson’s random walk in the space of the cmb phases. evidence for parity asymmetry,” *Phys. Rev. D* **83** (2011) 103508, [arXiv:1103.6135 \[astro-ph.CO\]](#).
- [203] P. K. Aluri and P. Jain, “Parity asymmetry in the cmbr temperature power spectrum,” *Mon. Not. Roy. Astron. Soc.* **419** (2012) 3378, [arXiv:1108.5894 \[astro-ph.CO\]](#).
- [204] J. Kim and P. Naselsky, “Anomalous parity asymmetry of the wilkinson microwave anisotropy probe power spectrum data at low multipoles,” *Astrophys. J. Lett.* **714** (2010) L265–L267, [arXiv:1001.4613 \[astro-ph.CO\]](#).
- [205] F. K. Hansen, A. J. Banday, K. M. Gorski, H. K. Eriksen, and P. B. Lilje, “Power asymmetry in cosmic microwave background fluctuations from full sky to sub-degree scales: Is the universe isotropic?,” *Astrophys. J.* **704** (2009) 1448–1458, [arXiv:0812.3795 \[astro-ph\]](#).

- [206] M. Axelsson, Y. Fantaye, F. K. Hansen, A. J. Banday, H. K. Eriksen, and K. M. Gorski, “Directional dependence of Λ cdm cosmological parameters,” *Astrophys. J. Lett.* **773** (2013) L3, [arXiv:1303.5371 \[astro-ph.CO\]](#).
- [207] L. A. Anchordoqui, “Ultra-high-energy cosmic rays,” *Phys. Rept.* **801** (2019) 1–93, [arXiv:1807.09645 \[astro-ph.HE\]](#).
- [208] A. Moss, D. Scott, J. P. Zibin, and R. Battye, “Tilted physics: A cosmologically dipole-modulated sky,” *Phys. Rev. D* **84** (2011) 023014, [arXiv:1011.2990 \[astro-ph.CO\]](#).
- [209] A. Hajian and T. Souradeep, “Measuring statistical isotropy of the cmb anisotropy,” *Astrophys. J. Lett.* **597** (2003) L5–L8, [arXiv:astro-ph/0308001](#).
- [210] A. Hajian and T. Souradeep, “Testing global isotropy of three-year wilkinson microwave anisotropy probe (wmap) data: Temperature analysis,” *Phys. Rev. D* **74** (2006) 123521, [arXiv:astro-ph/0607153](#).
- [211] C.-G. Park, “Non-gaussian signatures in the temperature fluctuation observed by the wilkinson microwave anisotropy probe,” *Mon. Not. Roy. Astron. Soc.* **349** (2004) 313–320, [arXiv:astro-ph/0307469](#).
- [212] O. Buchmueller, C. Doglioni, and L. T. Wang, “Search for dark matter at colliders,” *Nature Phys.* **13** no. 3, (2017) 217–223, [arXiv:1912.12739 \[hep-ex\]](#).
- [213] J. M. Gaskins, “A review of indirect searches for particle dark matter,” *Contemp. Phys.* **57** no. 4, (2016) 496–525, [arXiv:1604.00014 \[astro-ph.HE\]](#).
- [214] T. Marrodán Undagoitia and L. Rauch, “Dark matter direct-detection experiments,” *J. Phys. G* **43** no. 1, (2016) 013001, [arXiv:1509.08767 \[physics.ins-det\]](#).
- [215] H. K. Eriksen, F. K. Hansen, A. J. Banday, K. M. Gorski, and P. B. Lilje, “Asymmetries in the cosmic microwave background anisotropy field,” *Astrophys. J.* **605** (2004) 14–20, [arXiv:astro-ph/0307507](#). [Erratum: *Astrophys.J.* 609, 1198 (2004)].
- [216] F. Villaescusa-Navarro *et al.*, “Ingredients for 21 cm intensity mapping,” *Astrophys. J.* **866** no. 2, (2018) 135, [arXiv:1804.09180 \[astro-ph.CO\]](#).
- [217] J. Wang *et al.*, “Hi intensity mapping with meerkat: calibration pipeline for multidish autocorrelation observations,” *Mon. Not. Roy. Astron. Soc.* **505** no. 3, (2021) 3698–3721, [arXiv:2011.13789 \[astro-ph.CO\]](#).
- [218] G. Papallo and H. S. Reall, “On the local well-posedness of lovelock and horndeski theories,” *Phys. Rev. D* **96** no. 4, (2017) 044019, [arXiv:1705.04370 \[gr-qc\]](#).
- [219] A. D. Kovács and H. S. Reall, “Well-posed formulation of lovelock and horndeski theories,” *Phys. Rev. D* **101** no. 12, (2020) 124003, [arXiv:2003.08398 \[gr-qc\]](#).
- [220] V. Faraoni, J. Côté, and A. Giusti, “Do solar system experiments constrain scalar–tensor gravity?,” *Eur. Phys. J. C* **80** no. 2, (2020) 132, [arXiv:1906.05957 \[gr-qc\]](#).
- [221] L. Bernard, L. Lehner, and R. Luna, “Challenges to global solutions in horndeski’s theory,” *Phys. Rev. D* **100** no. 2, (2019) 024011, [arXiv:1904.12866 \[gr-qc\]](#).
- [222] S. D. Matshawule, M. Spinelli, M. G. Santos, and S. Ngobese, “Hi intensity mapping with meerkat: primary beam effects on foreground cleaning,” *Mon. Not. Roy. Astron. Soc.* **506** no. 4, (2021) 5075–5092, [arXiv:2011.10815 \[astro-ph.CO\]](#).
- [223] L. Perivolaropoulos, “Ppn parameter gamma and solar system constraints of massive brans-dicke theories,” *Phys. Rev. D* **81** (2010) 047501, [arXiv:0911.3401 \[gr-qc\]](#).
- [224] Y. Li, M. G. Santos, K. Grainge, S. Harper, and J. Wang, “Hi intensity mapping with meerkat: 1/f noise analysis,” *Mon. Not. Roy. Astron. Soc.* **501** no. 3, (2021) 4344–4358, [arXiv:2007.01767 \[astro-ph.CO\]](#).

- [225] M. Novello and S. E. P. Bergliaffa, “Bouncing cosmologies,” *Phys. Rept.* **463** (2008) 127–213, [arXiv:0802.1634 \[astro-ph\]](#).
- [226] A. De Felice and S. Tsujikawa, “ $f(r)$ theories,” *Living Rev. Rel.* **13** (2010) 3, [arXiv:1002.4928 \[gr-qc\]](#).
- [227] F. A. Teppa Pannia and S. E. Perez Bergliaffa, “Constraining $f(r)$ theories with cosmography,” *JCAP* **08** (2013) 030, [arXiv:1301.6140 \[astro-ph.CO\]](#).
- [228] D. Crichton *et al.*, “The hydrogen intensity and real-time analysis experiment: 256-element array status and overview,” *J. Astron. Telesc. Instrum. Syst.* **8** (2022) 011019, [arXiv:2109.13755 \[astro-ph.IM\]](#).
- [229] A. A. Costa *et al.*, “The bingo project vii: Cosmological forecasts from 21cm intensity mapping,” (7, 2021) , [arXiv:2107.01639 \[astro-ph.CO\]](#).
- [230] C. Modi, M. White, E. Castorina, and A. Slosar, “Mind the gap: the power of combining photometric surveys with intensity mapping,” *JCAP* **10** (2021) 056, [arXiv:2102.08116 \[astro-ph.CO\]](#).
- [231] D. A. Riechers, A. Weiss, F. Walter, C. L. Carilli, P. Cox, R. Decarli, and R. Neri, “Microwave background temperature at a redshift of 6.34 from H_2O absorption,” *Nature* **602** no. 7895, (2022) 58–62, [arXiv:2202.00693 \[astro-ph.GA\]](#).
- [232] C. Guandalin, D. Alonso, and K. Moodley, “Clustering redshifts with the 21cm-galaxy cross-bispectrum,” (12, 2021) , [arXiv:2112.05034 \[astro-ph.CO\]](#).
- [233] M. Spinelli, I. P. Carucci, S. Cunnington, S. E. Harper, M. O. Irfan, J. Fonseca, A. Pourtsidou, and L. Wolz, “Skao hi intensity mapping: blind foreground subtraction challenge,” *Mon. Not. Roy. Astron. Soc.* **509** no. 2, (2021) 2048–2074, [arXiv:2107.10814 \[astro-ph.CO\]](#).
- [234] J. L. Feng *et al.*, “The forward physics facility at the high-luminosity lhc,” in *2022 Snowmass Summer Study*. 3, 2022. [arXiv:2203.05090 \[hep-ex\]](#).
- [235] R. Durrer, M. Jalilvand, R. Kothari, R. Maartens, and F. Montanari, “Full-sky bispectrum in redshift space for 21cm intensity maps,” *JCAP* **12** (2020) 003, [arXiv:2008.02266 \[astro-ph.CO\]](#).
- [236] S. Cunnington, C. Watkinson, and A. Pourtsidou, “The hi intensity mapping bispectrum including observational effects,” *Mon. Not. Roy. Astron. Soc.* **507** no. 2, (2021) 1623–1639, [arXiv:2102.11153 \[astro-ph.CO\]](#).
- [237] L. Wolz *et al.*, “Hi constraints from the cross-correlation of eboss galaxies and green bank telescope intensity maps,” *Mon. Not. Roy. Astron. Soc.* **510** no. 3, (2022) 3495–3511, [arXiv:2102.04946 \[astro-ph.CO\]](#).
- [238] A. Chakraborty *et al.*, “First multi-redshift limits on post-epoch of reionization 21 cm signal from $z = 1.96$ to 3.58 using ugmrt,” *Astrophys. J. Lett.* **907** no. 1, (2021) L7, [arXiv:2012.04674 \[astro-ph.CO\]](#).
- [239] **CHIME** Collaboration, M. Amiri *et al.*, “Detection of cosmological 21 cm emission with the canadian hydrogen intensity mapping experiment,” (2, 2022) , [arXiv:2202.01242 \[astro-ph.CO\]](#).
- [240] N. Arkani-Hamed and J. Maldacena, “Cosmological collider physics,” (3, 2015) , [arXiv:1503.08043 \[hep-th\]](#).
- [241] L. A. Anchordoqui *et al.*, “The forward physics facility: Sites, experiments, and physics potential,” (9, 2021) , [arXiv:2109.10905 \[hep-ph\]](#).
- [242] S. Cunnington, A. Pourtsidou, P. S. Soares, C. Blake, and D. Bacon, “Multipole expansion for hi intensity mapping experiments: simulations and modelling,” *Mon. Not. Roy. Astron. Soc.* **496** no. 1, (2020) 415–433, [arXiv:2002.05626 \[astro-ph.CO\]](#).
- [243] A. Witzemann, A. Pourtsidou, and M. G. Santos, “Prospects for cosmic magnification measurements using hi intensity mapping,” *Mon. Not. Roy. Astron. Soc.* **496** no. 2, (2020) 1959–1966, [arXiv:1907.00755 \[astro-ph.CO\]](#).

- [244] M. Jalilvand, E. Majerotto, C. Bonvin, F. Lacasa, M. Kunz, W. Naidoo, and K. Moodley, “New estimator for gravitational lensing using galaxy and intensity mapping surveys,” *Phys. Rev. Lett.* **124** no. 3, (2020) 031101, [arXiv:1907.00071 \[astro-ph.CO\]](#).
- [245] M. Ballardini and R. Maartens, “Constraining the neutrino mass using a multitracers combination of two galaxy surveys and cosmic microwave background lensing,” *Mon. Not. Roy. Astron. Soc.* **510** no. 3, (2022) 4295–4301, [arXiv:2109.03763 \[astro-ph.CO\]](#).
- [246] J.-A. Viljoen, J. Fonseca, and R. Maartens, “Multi-wavelength spectroscopic probes: prospects for primordial non-gaussianity and relativistic effects,” *JCAP* **11** (2021) 010, [arXiv:2107.14057 \[astro-ph.CO\]](#).
- [247] S. Jolicoeur, R. Maartens, E. M. De Weerd, O. Umeh, C. Clarkson, and S. Camera, “Detecting the relativistic bispectrum in 21cm intensity maps,” *JCAP* **06** (2021) 039, [arXiv:2009.06197 \[astro-ph.CO\]](#).
- [248] M. Ballardini, W. L. Matthewson, and R. Maartens, “Constraining primordial non-gaussianity using two galaxy surveys and cmb lensing,” *Mon. Not. Roy. Astron. Soc.* **489** no. 2, (2019) 1950–1956, [arXiv:1906.04730 \[astro-ph.CO\]](#).
- [249] D. Karagiannis, A. Slosar, and M. Liguori, “Forecasts on primordial non-gaussianity from 21 cm intensity mapping experiments,” *JCAP* **11** (2020) 052, [arXiv:1911.03964 \[astro-ph.CO\]](#).
- [250] **Cosmic Visions 21 cm** Collaboration, R. Ansari *et al.*, “Inflation and early dark energy with a stage ii hydrogen intensity mapping experiment,” (10, 2018) , [arXiv:1810.09572 \[astro-ph.CO\]](#).
- [251] N. Sailer, E. Castorina, S. Ferraro, and M. White, “Cosmology at high redshift – a probe of fundamental physics,” *JCAP* **12** no. 12, (2021) 049, [arXiv:2106.09713 \[astro-ph.CO\]](#).
- [252] E. Castorina and M. White, “Measuring the growth of structure with intensity mapping surveys,” *JCAP* **06** (2019) 025, [arXiv:1902.07147 \[astro-ph.CO\]](#).
- [253] F. Kennedy and P. Bull, “Statistical recovery of the bao scale from multipoles of the beam-convolved 21 cm correlation function,” *Mon. Not. Roy. Astron. Soc.* **506** no. 2, (2021) 2638–2658, [arXiv:2103.08568 \[astro-ph.CO\]](#).
- [254] **MeerKLASS** Collaboration, M. G. Santos *et al.*, “Meerklass: MeerKAT large area synoptic survey,” in *MeerKAT Science: On the Pathway to the SKA*. 9, 2017. [arXiv:1709.06099 \[astro-ph.CO\]](#).
- [255] P. Bull, P. G. Ferreira, P. Patel, and M. G. Santos, “Late-time cosmology with 21cm intensity mapping experiments,” *Astrophys. J.* **803** no. 1, (2015) 21, [arXiv:1405.1452 \[astro-ph.CO\]](#).
- [256] J. Fonseca, S. Camera, M. Santos, and R. Maartens, “Hunting down horizon-scale effects with multi-wavelength surveys,” *Astrophys. J. Lett.* **812** no. 2, (2015) L22, [arXiv:1507.04605 \[astro-ph.CO\]](#).
- [257] D. Alonso and P. G. Ferreira, “Constraining ultralarge-scale cosmology with multiple tracers in optical and radio surveys,” *Phys. Rev. D* **92** no. 6, (2015) 063525, [arXiv:1507.03550 \[astro-ph.CO\]](#).
- [258] E. R. Switzer *et al.*, “Determination of $z \sim 0.8$ neutral hydrogen fluctuations using the 21 cm intensity mapping auto-correlation,” *Mon. Not. Roy. Astron. Soc.* **434** (2013) L46, [arXiv:1304.3712 \[astro-ph.CO\]](#).
- [259] K. W. Masui *et al.*, “Measurement of 21 cm brightness fluctuations at $z \sim 0.8$ in cross-correlation,” *Astrophys. J. Lett.* **763** (2013) L20, [arXiv:1208.0331 \[astro-ph.CO\]](#).
- [260] T.-C. Chang, U.-L. Pen, K. Bandura, and J. B. Peterson, “Hydrogen 21-cm intensity mapping at redshift 0.8,” *Nature* **466** (2010) 463–465, [arXiv:1007.3709 \[astro-ph.CO\]](#).
- [261] S. Chatterjee, S. Bharadwaj, and V. R. Marthi, “Simulated predictions for hi at $z = 3.35$ with the ooty wide field array (owfa). ii. foreground avoidance,” *Mon. Not. Roy. Astron. Soc.* **500** no. 4, (2020) 4398–4413, [arXiv:1911.05372 \[astro-ph.CO\]](#).

- [262] D. Sarkar, S. Majumdar, and S. Bharadwaj, “Modelling the post-reionization neutral hydrogen (hi) 21-cm bispectrum,” *Mon. Not. Roy. Astron. Soc.* **490** no. 2, (2019) 2880–2889, [arXiv:1907.01819 \[astro-ph.CO\]](#).
- [263] S. Cunnington, M. O. Irfan, I. P. Carucci, A. Pourtsidou, and J. Bobin, “21-cm foregrounds and polarization leakage: cleaning and mitigation strategies,” *Mon. Not. Roy. Astron. Soc.* **504** no. 1, (2021) 208–227, [arXiv:2010.02907 \[astro-ph.CO\]](#).
- [264] H. K. Eriksen, A. J. Banday, K. M. Gorski, and P. B. Lilje, “The n-point correlation functions of the first-year wilkinson microwave anisotropy probe sky maps,” *Astrophys. J.* **622** (2005) 58–71, [arXiv:astro-ph/0407271](#).
- [265] H. K. Eriksen, D. I. Novikov, P. B. Lilje, A. J. Banday, and K. M. Gorski, “Testing for non-gaussianity in the wmap data: Minkowski functionals and the length of the skeleton,” *Astrophys. J.* **612** (2004) 64–80, [arXiv:astro-ph/0401276](#).
- [266] H. K. Eriksen, A. J. Banday, K. M. Gorski, F. K. Hansen, and P. B. Lilje, “Hemispherical power asymmetry in the three-year wilkinson microwave anisotropy probe sky maps,” *Astrophys. J. Lett.* **660** (2007) L81–L84, [arXiv:astro-ph/0701089](#).
- [267] J. Hoftuft, H. K. Eriksen, A. J. Banday, K. M. Gorski, F. K. Hansen, and P. B. Lilje, “Increasing evidence for hemispherical power asymmetry in the five-year wmap data,” *Astrophys. J.* **699** (2009) 985–989, [arXiv:0903.1229 \[astro-ph.CO\]](#).
- [268] C. Gordon, W. Hu, D. Huterer, and T. M. Crawford, “Spontaneous isotropy breaking: a mechanism for cmb multipole alignments,” *Phys. Rev. D* **72** (2005) 103002, [arXiv:astro-ph/0509301](#).
- [269] C. Rath, P. Schuecker, and A. J. Banday, “Model-independent test for scale-dependent non-gaussianities in the cosmic microwave background,” *Mon. Not. Roy. Astron. Soc.* **380** (2007) 466, [arXiv:astro-ph/0702163](#).
- [270] S. Bahamonde and C. G. Böhm, “Modified teleparallel theories of gravity: Gauss–bonnet and trace extensions,” *Eur. Phys. J. C* **76** no. 10, (2016) 578, [arXiv:1606.05557 \[gr-qc\]](#).
- [271] **Planck** Collaboration, Y. Akrami *et al.*, “Planck 2018 results. vii. isotropy and statistics of the cmb,” *Astron. Astrophys.* **641** (2020) A7, [arXiv:1906.02552 \[astro-ph.CO\]](#).
- [272] G. F. R. Ellis and J. E. Baldwin, “On the expected anisotropy of radio source counts,” *Mon. Not. Roy. Astron. Soc.* **206** (January, 1984) 377–381.
- [273] V. Sahni, A. Shafieloo, and A. A. Starobinsky, “Two new diagnostics of dark energy,” *Phys. Rev. D* **78** (2008) 103502, [arXiv:0807.3548 \[astro-ph\]](#).
- [274] M. Blomqvist *et al.*, “Baryon acoustic oscillations from the cross-correlation of $\text{Ly}\alpha$ absorption and quasars in eboss dr14,” *Astron. Astrophys.* **629** (2019) A86, [arXiv:1904.03430 \[astro-ph.CO\]](#).
- [275] V. de Sainte Agathe *et al.*, “Baryon acoustic oscillations at $z = 2.34$ from the correlations of $\text{Ly}\alpha$ absorption in eboss dr14,” *Astron. Astrophys.* **629** (2019) A85, [arXiv:1904.03400 \[astro-ph.CO\]](#).
- [276] **DESI** Collaboration, A. Aghamousa *et al.*, “The desi experiment part i: Science, targeting, and survey design,” (10, 2016) , [arXiv:1611.00036 \[astro-ph.IM\]](#).
- [277] A. Shafieloo and T. Souradeep, “Primordial power spectrum from wmap,” *Phys. Rev. D* **70** (2004) 043523, [arXiv:astro-ph/0312174](#).
- [278] A. Shafieloo, T. Souradeep, P. Manimaran, P. K. Panigrahi, and R. Rangarajan, “Features in the primordial spectrum from wmap: A wavelet analysis,” *Phys. Rev. D* **75** (2007) 123502, [arXiv:astro-ph/0611352](#).
- [279] G. Nicholson and C. R. Contaldi, “Reconstruction of the primordial power spectrum using temperature and polarisation data from multiple experiments,” *JCAP* **07** (2009) 011, [arXiv:0903.1106 \[astro-ph.CO\]](#).

- [280] D. K. Hazra, A. Shafieloo, and T. Souradeep, “Primordial power spectrum: a complete analysis with the wmap nine-year data,” *JCAP* **07** (2013) 031, [arXiv:1303.4143 \[astro-ph.CO\]](#).
- [281] D. K. Hazra, A. Shafieloo, and T. Souradeep, “Primordial power spectrum from planck,” *JCAP* **11** (2014) 011, [arXiv:1406.4827 \[astro-ph.CO\]](#).
- [282] M. Viel, G. D. Becker, J. S. Bolton, and M. G. Haehnelt, “Warm dark matter as a solution to the small scale crisis: New constraints from high redshift lyman- α forest data,” *Phys. Rev. D* **88** (2013) 043502, [arXiv:1306.2314 \[astro-ph.CO\]](#).
- [283] N. Palanque-Delabrouille *et al.*, “Neutrino masses and cosmology with lyman-alpha forest power spectrum,” *JCAP* **11** (2015) 011, [arXiv:1506.05976 \[astro-ph.CO\]](#).
- [284] D. Paoletti, M. Braglia, F. Finelli, M. Ballardini, and C. Umiltà, “Isocurvature fluctuations in the effective newton’s constant,” *Phys. Dark Univ.* **25** (2019) 100307, [arXiv:1809.03201 \[astro-ph.CO\]](#).
- [285] A. Avilez and C. Skordis, “Cosmological constraints on brans-dicke theory,” *Phys. Rev. Lett.* **113** no. 1, (2014) 011101, [arXiv:1303.4330 \[astro-ph.CO\]](#).
- [286] S. Joudaki, P. G. Ferreira, N. A. Lima, and H. A. Winther, “Testing gravity on cosmic scales: A case study of jordan-brans-dicke theory,” *Phys. Rev. D* **105** no. 4, (2022) 043522, [arXiv:2010.15278 \[astro-ph.CO\]](#).
- [287] M. Ballardini, F. Finelli, and D. Sapone, “Cosmological constraints on newton’s gravitational constant,” (11, 2021) , [arXiv:2111.09168 \[astro-ph.CO\]](#).
- [288] M. Ballardini and F. Finelli, “Type ia supernovae data with scalar-tensor gravity,” (12, 2021) , [arXiv:2112.15126 \[astro-ph.CO\]](#).
- [289] T. Abadi and E. D. Kovetz, “Can conformally coupled modified gravity solve the hubble tension?,” *Phys. Rev. D* **103** no. 2, (2021) 023530, [arXiv:2011.13853 \[astro-ph.CO\]](#).
- [290] N. Palanque-Delabrouille *et al.*, “Hints, neutrino bounds and wdm constraints from sdss dr14 lyman- α and planck full-survey data,” *JCAP* **04** (2020) 038, [arXiv:1911.09073 \[astro-ph.CO\]](#).
- [291] D. C. Hooper and M. Lucca, “Hints of dark matter-neutrino interactions in lyman- α data,” (10, 2021) , [arXiv:2110.04024 \[astro-ph.CO\]](#).
- [292] R. Murgia, A. Merle, M. Viel, M. Totzauer, and A. Schneider, ““non-cold” dark matter at small scales: a general approach,” *JCAP* **11** (2017) 046, [arXiv:1704.07838 \[astro-ph.CO\]](#).
- [293] D. Sapone, S. Nesseris, and C. A. P. Bengaly, “Is there any measurable redshift dependence on the sn ia absolute magnitude?,” *Phys. Dark Univ.* **32** (2021) 100814, [arXiv:2006.05461 \[astro-ph.CO\]](#).
- [294] P. Creminelli, G. D’Amico, J. Norena, and F. Vernizzi, “The effective theory of quintessence: the $w < -1$ side unveiled,” *JCAP* **02** (2009) 018, [arXiv:0811.0827 \[astro-ph\]](#).
- [295] M. M. Ivanov, “Cosmological constraints from the power spectrum of eboss emission line galaxies,” *Phys. Rev. D* **104** no. 10, (2021) 103514, [arXiv:2106.12580 \[astro-ph.CO\]](#).
- [296] N. I. Shakura and R. A. Sunyaev, “Black holes in binary systems. observational appearance,” *Astron. Astrophys.* **24** (1973) 337–355.
- [297] K. P. Rauch and R. D. Blandford, “Microlensing and the structure of active galactic nucleus accretion disks,” *Astrophys. J. Lett.* **381** (November, 1991) L39.
- [298] D. Brout *et al.*, “The pantheon+ analysis: Supercal-fragilistic cross calibration, retrained salt2 light curve model, and calibration systematic uncertainty,” (12, 2021) , [arXiv:2112.03864 \[astro-ph.CO\]](#).
- [299] D. Scolnic *et al.*, “The pantheon+ type ia supernova sample: The full dataset and light-curve release,” (12, 2021) , [arXiv:2112.03863 \[astro-ph.CO\]](#).

- [300] H. Netzer, “Continuum reverberation mapping and a new lag-luminosity relationship for agn,” *Mon. Not. Roy. Astron. Soc.* **509** no. 2, (January, 2022) 2637–2646, [arXiv:2110.05512 \[astro-ph.GA\]](#).
- [301] M. Zajaček *et al.*, “Time delay of mg ii emission response for the luminous quasar he 0435-4312: toward application of the high-accretor radius-luminosity relation in cosmology,” *Astrophys. J.* **912** no. 1, (May, 2021) 10, [arXiv:2012.12409 \[astro-ph.GA\]](#).
- [302] L. A. Anchordoqui, I. Antoniadis, D. Lüst, and J. F. Soriano, “S-dual inflation and the string swampland,” *Phys. Rev. D* **103** no. 12, (2021) 123537, [arXiv:2103.07982 \[hep-th\]](#).
- [303] N. Khadka, Z. Yu, M. Zajaček, M. L. Martinez-Aldama, B. Czerny, and B. Ratra, “Standardizing reverberation-measured mg ii time-lag quasars, by using the radius-luminosity relation, and constraining cosmological model parameters,” *Mon. Not. Roy. Astron. Soc.* **508** no. 4, (2021) 4722–4737, [arXiv:2106.11136 \[astro-ph.CO\]](#).
- [304] A. Heavens, Y. Fantaye, E. Sellentin, H. Eggers, Z. Hosenie, S. Kroon, and A. Mootoovaloo, “No evidence for extensions to the standard cosmological model,” *Phys. Rev. Lett.* **119** no. 10, (2017) 101301, [arXiv:1704.03467 \[astro-ph.CO\]](#).
- [305] R. Trotta, “Bayes in the sky: Bayesian inference and model selection in cosmology,” *Contemp. Phys.* **49** (2008) 71–104, [arXiv:0803.4089 \[astro-ph\]](#).
- [306] J. M. Dickey and B. P. Lientz, “The weighted likelihood ratio, sharp hypotheses about chances, the order of a markov chain,” *The Annals of Mathematical Statistics* **41** no. 1, (1970) 214–226. <http://www.jstor.org/stable/2239734>.
- [307] W. Handley and P. Lemos, “Quantifying dimensionality: Bayesian cosmological model complexities,” *Phys. Rev. D* **100** no. 2, (2019) 023512, [arXiv:1903.06682 \[astro-ph.CO\]](#).
- [308] S. Adhikari and D. Huterer, “A new measure of tension between experiments,” *JCAP* **01** (2019) 036, [arXiv:1806.04292 \[astro-ph.CO\]](#).
- [309] M. Kunz, R. Trotta, and D. Parkinson, “Measuring the effective complexity of cosmological models,” *Phys. Rev. D* **74** (2006) 023503, [arXiv:astro-ph/0602378](#).
- [310] S. Seehars, A. Amara, A. Refregier, A. Paranjape, and J. Akeret, “Information gains from cosmic microwave background experiments,” *Phys. Rev. D* **90** no. 2, (2014) 023533, [arXiv:1402.3593 \[astro-ph.CO\]](#).
- [311] W. Lin and M. Ishak, “A bayesian interpretation of inconsistency measures in cosmology,” *JCAP* **05** (2021) 009, [arXiv:1909.10991 \[astro-ph.CO\]](#).
- [312] W. Lin and M. Ishak, “Cosmological discordances ii: Hubble constant, planck and large-scale-structure data sets,” *Phys. Rev. D* **96** no. 8, (2017) 083532, [arXiv:1708.09813 \[astro-ph.CO\]](#).
- [313] A. Heavens, Y. Fantaye, A. Mootoovaloo, H. Eggers, Z. Hosenie, S. Kroon, and E. Sellentin, “Marginal likelihoods from monte carlo markov chains,” (4, 2017) , [arXiv:1704.03472 \[stat.CO\]](#).
- [314] W. Handley and P. Lemos, “Quantifying tensions in cosmological parameters: Interpreting the des evidence ratio,” *Phys. Rev. D* **100** no. 4, (2019) 043504, [arXiv:1902.04029 \[astro-ph.CO\]](#).
- [315] A. Lewis, A. Challinor, and A. Lasenby, “Efficient computation of cmb anisotropies in closed frw models,” *Astrophys. J.* **538** (2000) 473–476, [arXiv:astro-ph/9911177](#).
- [316] W. J. Handley, M. P. Hobson, and A. N. Lasenby, “Polychord: nested sampling for cosmology,” *Mon. Not. Roy. Astron. Soc.* **450** no. 1, (2015) L61–L65, [arXiv:1502.01856 \[astro-ph.CO\]](#).
- [317] F. Feroz, M. P. Hobson, E. Cameron, and A. N. Pettitt, “Importance nested sampling and the multinest algorithm,” *Open J. Astrophys.* **2** no. 1, (2019) 10, [arXiv:1306.2144 \[astro-ph.IM\]](#).
- [318] S. Grandis, D. Rapetti, A. Saro, J. J. Mohr, and J. P. Dietrich, “Quantifying tensions between cmb and distance data sets in models with free curvature or lensing amplitude,” *Mon. Not. Roy. Astron. Soc.* **463** no. 2, (2016) 1416–1430, [arXiv:1604.06463 \[astro-ph.CO\]](#).

- [319] A. Nicola, A. Amara, and A. Refregier, “Consistency tests in cosmology using relative entropy,” *JCAP* **01** (2019) 011, [arXiv:1809.07333 \[astro-ph.CO\]](#).
- [320] P. Lemos, F. Köhlinger, W. Handley, B. Joachimi, L. Whiteway, and O. Lahav, “Quantifying suspiciousness within correlated data sets,” *Mon. Not. Roy. Astron. Soc.* **496** no. 4, (2020) 4647–4653, [arXiv:1910.07820 \[astro-ph.CO\]](#).
- [321] J. Martin, C. Ringeval, R. Trotta, and V. Vennin, “The best inflationary models after planck,” *JCAP* **03** (2014) 039, [arXiv:1312.3529 \[astro-ph.CO\]](#).
- [322] C. R. Jenkins and J. A. Peacock, “The power of bayesian evidence in astronomy,” *Mon. Not. Roy. Astron. Soc.* **413** (2011) 2895, [arXiv:1101.4822 \[astro-ph.IM\]](#).
- [323] E. Sellentin, “A blinding solution for inference from astronomical data,” *Mon. Not. Roy. Astron. Soc.* **492** no. 3, (2020) 3396–3407, [arXiv:1910.08533 \[astro-ph.CO\]](#).
- [324] A. R. Khalifeh and R. Jimenez, “Using neutrino oscillations to measure h_0 ,” (11, 2021) , [arXiv:2111.15249 \[astro-ph.CO\]](#).
- [325] W. Liu, L. A. Anchordoqui, E. Di Valentino, S. Pan, Y. Wu, and W. Yang, “Constraints from high-precision measurements of the cosmic microwave background: the case of disintegrating dark matter with Λ or dynamical dark energy,” *JCAP* **02** no. 02, (2022) 012, [arXiv:2108.04188 \[astro-ph.CO\]](#).
- [326] K. L. Pandey, T. Karwal, and S. Das, “Alleviating the h_0 and σ_8 anomalies with a decaying dark matter model,” *JCAP* **07** (2020) 026, [arXiv:1902.10636 \[astro-ph.CO\]](#).
- [327] O. E. Bjælde, S. Das, and A. Moss, “Origin of δn_{eff} as a result of an interaction between dark radiation and dark matter,” *JCAP* **10** (2012) 017, [arXiv:1205.0553 \[astro-ph.CO\]](#).
- [328] R. Edelson *et al.*, “The first swift intensive agn accretion disk reverberation mapping survey,” *Astrophys. J.* **870** no. 2, (2019) 123, [arXiv:1811.07956 \[astro-ph.HE\]](#).
- [329] E. M. Cackett, C.-Y. Chiang, I. McHardy, R. Edelson, M. R. Goad, K. Horne, and K. T. Korista, “Accretion disk reverberation with hubble space telescope observations of ngc 4593: evidence for diffuse continuum lags,” *Astrophys. J.* **857** no. 1, (2018) 53, [arXiv:1712.04025 \[astro-ph.HE\]](#).
- [330] P. Hall, G. Sarrouh, and K. Horne, “Non-blackbody disks can help explain inferred agn accretion disk sizes,” *Astrophys. J.* **854** no. 2, (2018) 93, [arXiv:1705.05467 \[astro-ph.GA\]](#).
- [331] A. Kubota and C. Done, “A physical model of the broad-band continuum of agn and its implications for the uv/x relation and optical variability,” *Mon. Not. Roy. Astron. Soc.* **480** no. 1, (2018) 1247–1262, [arXiv:1804.00171 \[astro-ph.HE\]](#).
- [332] B. Czerny, M. Nikolajuk, A. Rozanska, A. M. Dumont, Z. Loska, and P. T. Zycki, “Universal spectral shape of high accretion rate agn,” *Astron. Astrophys.* **412** (2003) 317–329, [arXiv:astro-ph/0309242](#).
- [333] E. S. Kammoun, M. Dovciak, I. E. Papadakis, M. D. Caballero-Garcia, and V. Karas, “Uv/optical disk thermal reverberation in agn: an in-depth study with an analytic prescription for the time-lag spectra,” (11, 2020) , [arXiv:2011.08563 \[astro-ph.HE\]](#).
- [334] B.-H. Lee, W. Lee, E. O. Colgáin, M. M. Sheikh-Jabbari, and S. Thakur, “Is local h_0 at odds with dark energy eft?,” (2, 2022) , [arXiv:2202.03906 \[astro-ph.CO\]](#).
- [335] S. Collier, K. Horne, I. Wanders, and B. M. Peterson, “A new direct method for measuring the hubble constant from reverberating accretion discs in active galaxies,” *Mon. Not. Roy. Astron. Soc.* **302** (1999) 24, [arXiv:astro-ph/9811278](#).
- [336] D. Sapone, M. Kunz, and M. Kunz, “Fingerprinting dark energy,” *Phys. Rev. D* **80** (2009) 083519, [arXiv:0909.0007 \[astro-ph.CO\]](#).
- [337] L. R. Abramo, R. C. Batista, L. Liberato, and R. Rosenfeld, “Physical approximations for the nonlinear evolution of perturbations in inhomogeneous dark energy scenarios,” *Phys. Rev. D* **79** (2009) 023516, [arXiv:0806.3461 \[astro-ph\]](#).

- [338] M. Kunz, S. Nesseris, and I. Sawicki, “Using dark energy to suppress power at small scales,” *Phys. Rev. D* **92** no. 6, (2015) 063006, [arXiv:1507.01486 \[astro-ph.CO\]](#).
- [339] A. S. Bolton, S. Burles, L. V. E. Koopmans, T. Treu, R. Gavazzi, L. A. Moustakas, R. Wayth, and D. J. Schlegel, “The sloan lens acs survey. v. the full acs strong-lens sample,” *Astrophys. J.* **682** (2008) 964–984, [arXiv:0805.1931 \[astro-ph\]](#).
- [340] P. Zhang and A. Stebbins, “Confirmation of the copernican principle at gpc radial scale and above from the kinetic sunyaev zel’dovich effect power spectrum,” *Phys. Rev. Lett.* **107** (2011) 041301, [arXiv:1009.3967 \[astro-ph.CO\]](#).
- [341] D. Camarena, V. Marra, Z. Sakr, and C. Clarkson, “Coming soon,” *in preparation* (2021) .
- [342] D. Benisty, J. Mifsud, J. L. Said, and D. Staicova, “On the robustness of the constancy of the supernova absolute magnitude: Non-parametric reconstruction & bayesian approaches,” (2, 2022) , [arXiv:2202.04677 \[astro-ph.CO\]](#).
- [343] I. Odderskov, S. Hannestad, and J. Brandbyge, “The variance of the locally measured hubble parameter explained with different estimators,” *JCAP* **03** (2017) 022, [arXiv:1701.05391 \[astro-ph.CO\]](#).
- [344] L. Campanelli, P. Cea, and L. Tedesco, “Ellipsoidal universe can solve the cmb quadrupole problem,” *Phys. Rev. Lett.* **97** (2006) 131302, [arXiv:astro-ph/0606266](#). [Erratum: *Phys.Rev.Lett.* 97, 209903 (2006)].
- [345] D. Camarena, V. Marra, Z. Sakr, and C. Clarkson, “The copernican principle in light of the latest cosmological data,” *Mon. Not. Roy. Astron. Soc.* **509** (2022) 1291–1302, [arXiv:2107.02296 \[astro-ph.CO\]](#).
- [346] S.-S. Xue, “How universe evolves with cosmological and gravitational constants,” *Nucl. Phys. B* **897** (2015) 326–345, [arXiv:1410.6152 \[gr-qc\]](#).
- [347] L.-Y. Gao, Z.-W. Zhao, S.-S. Xue, and X. Zhang, “Relieving the h_0 tension with a new interacting dark energy model,” *JCAP* **07** (2021) 005, [arXiv:2101.10714 \[astro-ph.CO\]](#).
- [348] S. Weinberg, “Asymptotically safe inflation,” *Phys. Rev. D* **81** (2010) 083535, [arXiv:0911.3165 \[hep-th\]](#).
- [349] P. Cea, “The ellipsoidal universe and the hubble tension,” (1, 2022) , [arXiv:2201.04548 \[astro-ph.CO\]](#).
- [350] S. Weinberg, *Critical Phenomena for Field Theorists*, pp. 1–52. Springer US, Boston, MA, 1978. https://doi.org/10.1007/978-1-4684-0931-4_1.
- [351] D. Camarena and V. Marra, “Impact of the cosmic variance on h_0 on cosmological analyses,” *Phys. Rev. D* **98** no. 2, (2018) 023537, [arXiv:1805.09900 \[astro-ph.CO\]](#).
- [352] J. C. Hill *et al.*, “The atacama cosmology telescope: Constraints on pre-recombination early dark energy,” (9, 2021) , [arXiv:2109.04451 \[astro-ph.CO\]](#).
- [353] S. Banerjee, D. Benisty, and E. I. Guendelman, “Running dark energy and dark matter from dynamical spacetime,” *Bulg. J. Phys.* **48** no. 2, (2021) 117–137, [arXiv:1910.03933 \[gr-qc\]](#).
- [354] D. Benisty and D. Staicova, “Constraining the dark energy models using the bao data: An approach independent of $h_0 \cdot r_d$,” (7, 2021) , [arXiv:2107.14129 \[astro-ph.CO\]](#).
- [355] K. Asvesta, L. Kazantzidis, L. Perivolaropoulos, and C. G. Tsagas, “Observational constraints on the deceleration parameter in a tilted universe,” (2, 2022) , [arXiv:2202.00962 \[astro-ph.CO\]](#).
- [356] D. Staicova, “Hints of the $h_0 - r_d$ tension in uncorrelated baryon acoustic oscillations dataset,” in *16th Marcel Grossmann Meeting on Recent Developments in Theoretical and Experimental General Relativity, Astrophysics and Relativistic Field Theories*. 11, 2021. [arXiv:2111.07907 \[astro-ph.CO\]](#).

- [357] D. Benisty, “Decaying coupled fermions to curvature and the h_0 tension,” (12, 2019) , [arXiv:1912.11124 \[gr-qc\]](#).
- [358] W. Handley and P. Lemos, “Quantifying the global parameter tensions between act, spt and planck,” *Phys. Rev. D* **103** no. 6, (2021) 063529, [arXiv:2007.08496 \[astro-ph.CO\]](#).
- [359] D. J. E. Marsh and P. G. Ferreira, “Ultra-light scalar fields and the growth of structure in the universe,” *Phys. Rev. D* **82** (2010) 103528, [arXiv:1009.3501 \[hep-ph\]](#).
- [360] C. G. Tsagas and M. I. Kadiltzoglou, “Deceleration parameter in tilted friedmann universes,” *Phys. Rev. D* **92** no. 4, (2015) 043515, [arXiv:1507.04266 \[gr-qc\]](#).
- [361] P. Agrawal, F.-Y. Cyr-Racine, D. Pinner, and L. Randall, “Rock ‘n’ roll solutions to the hubble tension,” (4, 2019) , [arXiv:1904.01016 \[astro-ph.CO\]](#).
- [362] V. Poulin, T. L. Smith, and A. Bartlett, “Dark energy at early times and act data: A larger hubble constant without late-time priors,” *Phys. Rev. D* **104** no. 12, (2021) 123550, [arXiv:2109.06229 \[astro-ph.CO\]](#).
- [363] Y. Wen, E. Nesbit, D. Huterer, and S. Watson, “Misinterpreting modified gravity as dark energy: a quantitative study,” (11, 2021) , [arXiv:2111.02866 \[astro-ph.CO\]](#).
- [364] A. Pourtsidou and T. Tram, “Reconciling cmb and structure growth measurements with dark energy interactions,” *Phys. Rev. D* **94** no. 4, (2016) 043518, [arXiv:1604.04222 \[astro-ph.CO\]](#).
- [365] C. Howlett, K. Said, J. R. Lucey, M. Colless, F. Qin, Y. Lai, R. B. Tully, and T. M. Davis, “The sloan digital sky survey peculiar velocity catalogue,” (1, 2022) , [arXiv:2201.03112 \[astro-ph.CO\]](#).
- [366] M. Raveri, L. Pogosian, K. Koyama, M. Martinelli, A. Silvestri, G.-B. Zhao, J. Li, S. Peirone, and A. Zucca, “A joint reconstruction of dark energy and modified growth evolution,” (7, 2021) , [arXiv:2107.12990 \[astro-ph.CO\]](#).
- [367] L. Pogosian, M. Raveri, K. Koyama, M. Martinelli, A. Silvestri, and G.-B. Zhao, “Imprints of cosmological tensions in reconstructed gravity,” (7, 2021) , [arXiv:2107.12992 \[astro-ph.CO\]](#).
- [368] G.-B. Zhao *et al.*, “Dynamical dark energy in light of the latest observations,” *Nature Astron.* **1** no. 9, (2017) 627–632, [arXiv:1701.08165 \[astro-ph.CO\]](#).
- [369] Y. Wang, L. Pogosian, G.-B. Zhao, and A. Zucca, “Evolution of dark energy reconstructed from the latest observations,” *Astrophys. J. Lett.* **869** (2018) L8, [arXiv:1807.03772 \[astro-ph.CO\]](#).
- [370] S. Yeung and M.-C. Chu, “Directional variations of cosmological parameters from the planck cmb data,” (1, 2022) , [arXiv:2201.03799 \[astro-ph.CO\]](#).
- [371] R. G. Crittenden, G.-B. Zhao, L. Pogosian, L. Samushia, and X. Zhang, “Fables of reconstruction: controlling bias in the dark energy equation of state,” *JCAP* **02** (2012) 048, [arXiv:1112.1693 \[astro-ph.CO\]](#).
- [372] R. G. Crittenden, L. Pogosian, and G.-B. Zhao, “Investigating dark energy experiments with principal components,” *JCAP* **12** (2009) 025, [arXiv:astro-ph/0510293](#).
- [373] J. B. Jiménez, D. Bettoni, D. Figueruelo, F. A. Teppa Pannia, and S. Tsujikawa, “Probing elastic interactions in the dark sector and the role of s_8 ,” *Phys. Rev. D* **104** no. 10, (2021) 103503, [arXiv:2106.11222 \[astro-ph.CO\]](#).
- [374] **DES** Collaboration, A. Kovács *et al.*, “The des view of the eridanus supervoid and the cmb cold spot,” *Mon. Not. Roy. Astron. Soc.* **510** no. 1, (2022) 216–229, [arXiv:2112.07699 \[astro-ph.CO\]](#).
- [375] M. Lucca, “Dark energy–dark matter interactions as a solution to the s_8 tension,” *Phys. Dark Univ.* **34** (2021) 100899, [arXiv:2105.09249 \[astro-ph.CO\]](#).
- [376] E. Ó Colgáin and M. M. Sheikh-Jabbari, “Elucidating cosmological model dependence with h_0 ,” *Eur. Phys. J. C* **81** no. 10, (2021) 892, [arXiv:2101.08565 \[astro-ph.CO\]](#).

- [377] C. Krishnan, E. Ó Colgáin, M. M. Sheikh-Jabbari, and T. Yang, “Running hubble tension and a h_0 diagnostic,” *Phys. Rev. D* **103** no. 10, (2021) 103509, [arXiv:2011.02858 \[astro-ph.CO\]](#).
- [378] K. Jedamzik, L. Pogosian, and G.-B. Zhao, “Why reducing the cosmic sound horizon alone can not fully resolve the hubble tension,” *Commun. in Phys.* **4** (2021) 123, [arXiv:2010.04158 \[astro-ph.CO\]](#).
- [379] S. Vagnozzi, “Consistency tests of Λ cdm from the early integrated sachs-wolfe effect: Implications for early-time new physics and the hubble tension,” *Phys. Rev. D* **104** no. 6, (2021) 063524, [arXiv:2105.10425 \[astro-ph.CO\]](#).
- [380] P. Saha, C. Lobo, A. Iovino, D. Lazzati, and G. Chincarini, “Lensing degeneracies revisited,” *Astron. J.* **120** (2000) 1654, [arXiv:astro-ph/0006432](#).
- [381] T.-H. Yeh, K. A. Olive, and B. D. Fields, “The impact of new $d(p, \gamma)$ rates on big bang nucleosynthesis,” *JCAP* **03** (2021) 046, [arXiv:2011.13874 \[astro-ph.CO\]](#).
- [382] Y. Hoffman, D. Pomarede, R. Brent Tully, and H. Courtois, “The dipole repeller,” (2, 2017) , [arXiv:1702.02483 \[astro-ph.CO\]](#).
- [383] L. A. Anchordoqui, E. Di Valentino, S. Pan, and W. Yang, “Dissecting the h_0 and s_8 tensions with planck + bao + supernova type ia in multi-parameter cosmologies,” *JHEAp* **32** (2021) 28, [arXiv:2107.13932 \[astro-ph.CO\]](#).
- [384] J. K. Yadav, J. S. Bagla, and N. Khandai, “Fractal dimension as a measure of the scale of homogeneity,” *Mon. Not. Roy. Astron. Soc.* **405** (2010) 2009, [arXiv:1001.0617 \[astro-ph.CO\]](#).
- [385] E. Zuckerman and L. A. Anchordoqui, “Spatial curvature sensitivity to local h_0 from the cepheid distance ladder,” *JHEAp* **33** (2022) 10, [arXiv:2110.05346 \[astro-ph.CO\]](#).
- [386] J. R. Gott, III, M. Juric, D. Schlegel, F. Hoyle, M. Vogeley, M. Tegmark, N. A. Bahcall, and J. Brinkmann, “A map of the universe,” *Astrophys. J.* **624** (2005) 463, [arXiv:astro-ph/0310571](#).
- [387] L. Hart and J. Chluba, “Varying fundamental constants principal component analysis: additional hints about the hubble tension,” (7, 2021) , [arXiv:2107.12465 \[astro-ph.CO\]](#).
- [388] J. A. King, J. K. Webb, M. T. Murphy, V. V. Flambaum, R. F. Carswell, M. B. Bainbridge, M. R. Wilczynska, and F. E. Koch, “Spatial variation in the fine-structure constant – new results from vlt/uves,” *Mon. Not. Roy. Astron. Soc.* **422** (2012) 3370–3413, [arXiv:1202.4758 \[astro-ph.CO\]](#).
- [389] **DES** Collaboration, T. M. C. Abbott *et al.*, “Dark energy survey year 3 results: Cosmological constraints from galaxy clustering and weak lensing,” *Phys. Rev. D* **105** no. 2, (2022) 023520, [arXiv:2105.13549 \[astro-ph.CO\]](#).
- [390] **SPT-3G** Collaboration, D. Dutcher *et al.*, “Measurements of the e-mode polarization and temperature-e-mode correlation of the cmb from spt-3g 2018 data,” *Phys. Rev. D* **104** no. 2, (2021) 022003, [arXiv:2101.01684 \[astro-ph.CO\]](#).
- [391] **WMAP** Collaboration, D. N. Spergel *et al.*, “First year wilkinson microwave anisotropy probe (wmap) observations: Determination of cosmological parameters,” *Astrophys. J. Suppl.* **148** (2003) 175–194, [arXiv:astro-ph/0302209](#).
- [392] **WMAP** Collaboration, G. Hinshaw *et al.*, “First year wilkinson microwave anisotropy probe (wmap) observations: The angular power spectrum,” *Astrophys. J. Suppl.* **148** (2003) 135, [arXiv:astro-ph/0302217](#).
- [393] **WMAP** Collaboration, G. Hinshaw *et al.*, “Nine-year wilkinson microwave anisotropy probe (wmap) observations: Cosmological parameter results,” *Astrophys. J. Suppl.* **208** (2013) 19, [arXiv:1212.5226 \[astro-ph.CO\]](#).
- [394] B. Wang, C.-Y. Lin, and E. Abdalla, “Constraints on the interacting holographic dark energy model,” *Phys. Lett. B* **637** (2006) 357–361, [arXiv:hep-th/0509107](#).

- [395] M. R. Setare, “The holographic dark energy in non-flat brans-dicke cosmology,” *Phys. Lett. B* **644** (2007) 99–103, [arXiv:hep-th/0610190](#).
- [396] S. Wang, Y. Wang, and M. Li, “Holographic dark energy,” *Phys. Rept.* **696** (2017) 1–57, [arXiv:1612.00345 \[astro-ph.CO\]](#).
- [397] E. Ó Colgáin and M. M. Sheikh-Jabbari, “A critique of holographic dark energy,” *Class. Quant. Grav.* **38** no. 17, (2021) 177001, [arXiv:2102.09816 \[gr-qc\]](#).
- [398] S. Vagnozzi, F. Pacucci, and A. Loeb, “Implications for the hubble tension from the ages of the oldest astrophysical objects,” (5, 2021) , [arXiv:2105.10421 \[astro-ph.CO\]](#).
- [399] A. G. A. Brown, A. Vallenari, T. Prusti, J. H. J. de Bruijne, C. Babusiaux, M. Biermann, O. L. Creevey, D. W. Evans, L. Eyer, and et al., “Gaia early data release 3,” *Astron. Astrophys.* **649** (Apr, 2021) A1. <http://dx.doi.org/10.1051/0004-6361/202039657>.
- [400] A. G. Riess, S. Casertano, W. Yuan, J. B. Bowers, L. Macri, J. C. Zinn, and D. Scolnic, “Cosmic distances calibrated to 1% precision with gaiaedr3 parallaxes and hubble space telescope photometry of 75 milky way cepheids confirm tension with Λ cdm,” *Astrophys. J. Lett.* **908** no. 1, (2021) L6, [arXiv:2012.08534 \[astro-ph.CO\]](#).
- [401] W. L. Freedman, “Measurements of the hubble constant: Tensions in perspective,” *Astrophys. J.* **919** no. 1, (2021) 16, [arXiv:2106.15656 \[astro-ph.CO\]](#).
- [402] A. de Oliveira-Costa, M. Tegmark, M. Zaldarriaga, and A. Hamilton, “The significance of the largest scale cmb fluctuations in wmap,” *Phys. Rev. D* **69** (2004) 063516, [arXiv:astro-ph/0307282](#).
- [403] K. Land and J. Magueijo, “Is the universe odd?,” *Phys. Rev. D* **72** (2005) 101302, [arXiv:astro-ph/0507289](#).
- [404] D. J. Schwarz, G. D. Starkman, D. Huterer, and C. J. Copi, “Is the low-l microwave background cosmic?,” *Phys. Rev. Lett.* **93** (2004) 221301, [arXiv:astro-ph/0403353](#).
- [405] P. Naselsky, W. Zhao, J. Kim, and S. Chen, “Is the cmb asymmetry due to the kinematic dipole?,” *Astrophys. J.* **749** (2012) 31, [arXiv:1108.4376 \[astro-ph.CO\]](#).
- [406] C. Blake and J. Wall, “Detection of the velocity dipole in the radio galaxies of the nrao vla sky survey,” *Nature* **416** (2002) 150–152, [arXiv:astro-ph/0203385](#).
- [407] A. K. Singal, “Large peculiar motion of the solar system from the dipole anisotropy in sky brightness due to distant radio sources,” *Astrophys. J. Lett.* **742** (2011) L23, [arXiv:1110.6260 \[astro-ph.CO\]](#).
- [408] C. Gibelyou and D. Huterer, “Dipoles in the sky,” *Mon. Not. Roy. Astron. Soc.* **427** (2012) 1994–2021, [arXiv:1205.6476 \[astro-ph.CO\]](#).
- [409] M. Rubart and D. J. Schwarz, “Cosmic radio dipole from nvss and wenss,” *Astron. Astrophys.* **555** (2013) A117, [arXiv:1301.5559 \[astro-ph.CO\]](#).
- [410] P. Tiwari and A. Nusser, “Revisiting the nvss number count dipole,” *JCAP* **03** (2016) 062, [arXiv:1509.02532 \[astro-ph.CO\]](#).
- [411] J. Colin, R. Mohayaee, M. Rameez, and S. Sarkar, “High redshift radio galaxies and divergence from the cmb dipole,” *Mon. Not. Roy. Astron. Soc.* **471** no. 1, (2017) 1045–1055, [arXiv:1703.09376 \[astro-ph.CO\]](#).
- [412] P. d. S. Ferreira and M. Quartin, “First constraints on the intrinsic cmb dipole and our velocity with doppler and aberration,” *Phys. Rev. Lett.* **127** no. 10, (2021) 101301, [arXiv:2011.08385 \[astro-ph.CO\]](#).
- [413] M. Demianski, E. Lusso, M. Paolillo, E. Piedipalumbo, and G. Risaliti, “Investigating dark energy equation of state with high redshift hubble diagram,” *Front. Astron. Space Sci.* **7** (2020) 69, [arXiv:2010.05289 \[astro-ph.CO\]](#).

- [414] D. Watson, K. D. Denney, M. Vestergaard, and T. M. Davis, “A new cosmological distance measure using agn,” *Astrophys. J. Lett.* **740** (2011) L49, [arXiv:1109.4632 \[astro-ph.CO\]](#).
- [415] G. Bargiacchi, M. Benetti, S. Capozziello, E. Lusso, G. Risaliti, and M. Signorini, “Quasar cosmology: dark energy evolution and spatial curvature,” (11, 2021) , [arXiv:2111.02420 \[astro-ph.CO\]](#).
- [416] B. Paczynski and T. Piran, “A dipole moment of the microwave background as a cosmological effect,” *Astrophys. J.* **364** (December, 1990) 341.
- [417] T. R. Lauer and M. Postman, “The motion of the local group with respect to the 15,000 kilometer per second abell cluster inertial frame,” *Astrophys. J.* **425** (April, 1994) 418.
- [418] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck intermediate results. xiii. constraints on peculiar velocities,” *Astron. Astrophys.* **561** (2014) A97, [arXiv:1303.5090 \[astro-ph.CO\]](#).
- [419] F. Atrio-Barandela, A. Kashlinsky, H. Ebeling, D. J. Fixsen, and D. Kocevski, “Probing the dark flow signal in wmap 9 -year and planck cosmic microwave background maps,” *Astrophys. J.* **810** no. 2, (2015) 143, [arXiv:1411.4180 \[astro-ph.CO\]](#).
- [420] A. Kashlinsky, F. Atrio-Barandela, H. Ebeling, A. Edge, and D. Kocevski, “A new measurement of the bulk flow of x-ray luminous clusters of galaxies,” *Astrophys. J. Lett.* **712** (2010) L81–L85, [arXiv:0910.4958 \[astro-ph.CO\]](#).
- [421] K. Migkas and T. H. Reiprich, “Anisotropy of the galaxy cluster x-ray luminosity–temperature relation,” *Astron. Astrophys.* **611** (2018) A50, [arXiv:1711.02539 \[astro-ph.CO\]](#).
- [422] M. J. Hudson, R. J. Smith, J. R. Lucey, and E. Branchini, “Streaming motions of galaxy clusters within 12000 km s^{−1}. v. the peculiar velocity field,” *Mon. Not. Roy. Astron. Soc.* **352** (2004) 61, [arXiv:astro-ph/0404386](#).
- [423] A. Kashlinsky, F. Atrio-Barandela, D. Kocevski, and H. Ebeling, “A measurement of large-scale peculiar velocities of clusters of galaxies: results and cosmological implications,” *Astrophys. J. Lett.* **686** (2009) L49–L52, [arXiv:0809.3734 \[astro-ph\]](#).
- [424] A. Challinor and F. van Leeuwen, “Peculiar velocity effects in high resolution microwave background experiments,” *Phys. Rev. D* **65** (2002) 103001, [arXiv:astro-ph/0112457](#).
- [425] A. K. Singal, “Peculiar motion of solar system from the hubble diagram of supernovae ia and its implications for cosmology,” (6, 2021) , [arXiv:2106.11968 \[astro-ph.CO\]](#).
- [426] A. K. Singal, “Solar system peculiar motion from the hubble diagram of quasars and testing the cosmological principle,” *Mon. Not. Roy. Astron. Soc.* **511** no. 2, (2022) 1819–1829, [arXiv:2107.09390 \[astro-ph.CO\]](#).
- [427] R. E. Kass and A. E. Raftery, “Bayes factors,” *J. Am. Statist. Assoc.* **90** no. 430, (1995) 773–795.
- [428] A. R. Liddle, “Information criteria for astrophysical model selection,” *Mon. Not. Roy. Astron. Soc.* **377** (2007) L74–L78, [arXiv:astro-ph/0701113](#).
- [429] H. Jeffreys, *The Theory of Probability*. Oxford Classic Texts in the Physical Sciences. Oxford University Press, 1939.
- [430] I. Ben-Dayan, R. Durrer, G. Marozzi, and D. J. Schwarz, “The value of h_0 in the inhomogeneous universe,” *Phys. Rev. Lett.* **112** (2014) 221301, [arXiv:1401.7973 \[astro-ph.CO\]](#).
- [431] S. Saha, S. Shaikh, S. Mukherjee, T. Souradeep, and B. D. Wandelt, “Bayesian estimation of our local motion from the planck-2018 cmb temperature map,” *JCAP* **10** (2021) 072, [arXiv:2106.07666 \[astro-ph.CO\]](#).
- [432] S. Mukherjee and T. Souradeep, “Litmus test for cosmic hemispherical asymmetry in the cosmic microwave background b-mode polarization,” *Phys. Rev. Lett.* **116** no. 22, (2016) 221301, [arXiv:1509.06736 \[astro-ph.CO\]](#).

- [433] I. Horvath, Z. Bagoly, J. Hakkila, and L. V. Toth, “New data support the existence of the hercules-corona borealis great wall,” *Astron. Astrophys.* **584** (2015) A48, [arXiv:1510.01933 \[astro-ph.HE\]](#).
- [434] C. Park, Y.-Y. Choi, J. Kim, J. R. Gott, III, S. S. Kim, and K.-S. Kim, “The challenge of the largest structures in the universe to cosmology,” *Astrophys. J. Lett.* **759** (2012) L7, [arXiv:1209.5659 \[astro-ph.CO\]](#).
- [435] S. Nadathur, “Seeing patterns in noise: Gigaparsec-scale ‘structures’ that do not violate homogeneity,” *Mon. Not. Roy. Astron. Soc.* **434** (2013) 398–406, [arXiv:1306.1700 \[astro-ph.CO\]](#).
- [436] T. N. Ukwatta and P. R. Wozniak, “Investigation of redshift- and duration-dependent clustering of gamma-ray bursts,” *Mon. Not. Roy. Astron. Soc.* **455** no. 1, (2016) 703–711, [arXiv:1507.07117 \[astro-ph.HE\]](#).
- [437] S. Christian, “Re-examining the evidence of the hercules-corona-borealis great wall,” *Mon. Not. Roy. Astron. Soc.* **495** (7, 2020) 4291—4296, [arXiv:2006.00141 \[astro-ph.CO\]](#).
<https://doi.org/10.1093/mnras/staa1448>.
- [438] D. Hutsemekers and H. Lamy, “Confirmation of the existence of coherent orientations of quasar polarization vectors on cosmological scales,” *Astron. Astrophys.* **367** (2001) 381–387, [arXiv:astro-ph/0012182](#).
- [439] D. Hutsemekers, R. Cabanac, H. Lamy, and D. Sluse, “Mapping extreme-scale alignments of quasar polarization vectors,” *Astron. Astrophys.* **441** (2005) 915–930, [arXiv:astro-ph/0507274](#).
- [440] C. Krishnan, R. Mohayaee, E. Ó Colgáin, M. M. Sheikh-Jabbari, and L. Yin, “Does hubble tension signal a breakdown in flrw cosmology?,” *Class. Quant. Grav.* **38** no. 18, (2021) 184001, [arXiv:2105.09790 \[astro-ph.CO\]](#).
- [441] S. Mukherjee, A. De, and T. Souradeep, “Statistical isotropy violation of cmb polarization sky due to lorentz boost,” *Phys. Rev. D* **89** no. 8, (2014) 083005, [arXiv:1309.3800 \[astro-ph.CO\]](#).
- [442] L. Amati, C. Guidorzi, F. Frontera, M. Della Valle, F. Finelli, R. Landi, and E. Montanari, “Measuring the cosmological parameters with the ep,i-eiso correlation of gamma-ray bursts,” *Mon. Not. Roy. Astron. Soc.* **391** (2008) 577–584, [arXiv:0805.0377 \[astro-ph\]](#).
- [443] K. Migkas, G. Schellenberger, T. H. Reiprich, F. Pacaud, M. E. Ramos-Ceja, and L. Lovisari, “Probing cosmic isotropy with a new x-ray galaxy cluster sample through the $l_x - t$ scaling relation,” *Astron. Astrophys.* **636** (2020) A15, [arXiv:2004.03305 \[astro-ph.CO\]](#).
- [444] N. Kaiser, “Evolution and clustering of rich clusters,” *Mon. Not. Roy. Astron. Soc.* **222** (1986) 323–345. https://ui.adsabs.harvard.edu/link_gateway/1986MNRAS.222..323K/doi:10.1093/mnras/222.2.323.
- [445] K. Migkas, F. Pacaud, G. Schellenberger, J. Erler, N. T. Nguyen-Dang, T. H. Reiprich, M. E. Ramos-Ceja, and L. Lovisari, “Cosmological implications of the anisotropy of ten galaxy cluster scaling relations,” *Astron. Astrophys.* **649** (2021) A151, [arXiv:2103.13904 \[astro-ph.CO\]](#).
- [446] S. Mukherjee, “Hemispherical asymmetry from an isotropy violating stochastic gravitational wave background,” *Phys. Rev. D* **91** no. 6, (2015) 062002, [arXiv:1412.2491 \[astro-ph.CO\]](#).
- [447] M. Millon *et al.*, “Tdcosmo. i. an exploration of systematic uncertainties in the inference of h_0 from time-delay cosmography,” *Astron. Astrophys.* **639** (2020) A101, [arXiv:1912.08027 \[astro-ph.CO\]](#).
- [448] E. Lusso *et al.*, “Quasars as standard candles iii. validation of a new sample for cosmological studies,” *Astron. Astrophys.* **642** (2020) A150, [arXiv:2008.08586 \[astro-ph.GA\]](#).
- [449] O. Luongo, M. Muccino, E. Ó Colgáin, M. M. Sheikh-Jabbari, and L. Yin, “On larger h_0 values in the cmb dipole direction,” (8, 2021) , [arXiv:2108.13228 \[astro-ph.CO\]](#).
- [450] M. Muccino, L. Izzo, O. Luongo, K. Boshkayev, L. Amati, M. Della Valle, G. B. Pisani, and E. Zaninoni, “Tracing dark energy history with gamma ray bursts,” *Astrophys. J.* **908** no. 2, (2021) 181, [arXiv:2012.03392 \[astro-ph.CO\]](#).

- [451] C. Krishnan, R. Mohayaee, E. O. Colgáin, M. M. Sheikh-Jabbari, and L. Yin, “Hints of flrw breakdown from supernovae,” *Phys. Rev. D* **105** no. 6, (2022) 063514, [arXiv:2106.02532 \[astro-ph.CO\]](#).
- [452] R. G. Clowes, K. A. Harris, S. Raghunathan, L. E. Campusano, I. K. Soechting, and M. J. Graham, “A structure in the early universe at $z \sim 1.3$ that exceeds the homogeneity scale of the r-w concordance cosmology,” *Mon. Not. Roy. Astron. Soc.* **429** (2013) 2910–2916, [arXiv:1211.6256 \[astro-ph.CO\]](#).
- [453] J. I. Cayuso and M. C. Johnson, “Towards testing cmb anomalies using the kinetic and polarized sunyaev-zel’dovich effects,” *Phys. Rev. D* **101** no. 12, (2020) 123508, [arXiv:1904.10981 \[astro-ph.CO\]](#).
- [454] **HST** Collaboration, W. L. Freedman *et al.*, “Final results from the hubble space telescope key project to measure the hubble constant,” *Astrophys. J.* **553** (2001) 47–72, [arXiv:astro-ph/0012376](#).
- [455] S. Mukherjee, P. K. Aluri, S. Das, S. Shaikh, and T. Souradeep, “Direction dependence of cosmological parameters due to cosmic hemispherical asymmetry,” *JCAP* **06** (2016) 042, [arXiv:1510.00154 \[astro-ph.CO\]](#).
- [456] S. Mukherjee and B. D. Wandelt, “Making maps of cosmological parameters,” *JCAP* **01** (2018) 042, [arXiv:1712.01986 \[astro-ph.CO\]](#).
- [457] M. L. McClure and C. C. Dyer, “Anisotropy in the hubble constant as observed in the hst extragalactic distance scale key project results,” *New Astron.* **12** (2007) 533–543, [arXiv:astro-ph/0703556](#).
- [458] I. L. Shapiro and J. Sola, “On the scaling behavior of the cosmological constant and the possible existence of new forces and new light degrees of freedom,” *Phys. Lett. B* **475** (2000) 236–246, [arXiv:hep-ph/9910462](#).
- [459] I. L. Shapiro and J. Sola, “Scaling behavior of the cosmological constant: Interface between quantum field theory and cosmology,” *JHEP* **02** (2002) 006, [arXiv:hep-th/0012227](#).
- [460] M. V. Gorenstein, E. E. Falco, and I. I. Shapiro, “Degeneracies in parameter estimates for models of gravitational lens systems,” *Astrophys. J.* **327** (April, 1988) 693.
- [461] S. Mukherjee and T. Souradeep, “Statistically anisotropic gaussian simulations of the cmb temperature field,” *Phys. Rev. D* **89** no. 6, (2014) 063013, [arXiv:1311.5837 \[astro-ph.CO\]](#).
- [462] E. E. Falco, M. V. Gorenstein, and I. I. Shapiro, “On model-dependent bounds on $h(0)$ from gravitational images : application to q 0957+561 a, b,” *Astrophys. J. Lett.* **289** (February, 1985) L1–L4.
- [463] D. A. Goldstein, P. E. Nugent, D. N. Kasen, and T. E. Collett, “Precise time delays from strongly gravitationally lensed type ia supernovae with chromatically microlensed images,” *Astrophys. J.* **855** no. 1, (2018) 22, [arXiv:1708.00003 \[astro-ph.CO\]](#).
- [464] D. A. Goldstein and P. E. Nugent, “How to find gravitationally lensed type ia supernovae,” *Astrophys. J. Lett.* **834** no. 1, (2017) L5, [arXiv:1611.09459 \[astro-ph.IM\]](#).
- [465] D. A. Goldstein, P. E. Nugent, and A. Goobar, “Rates and properties of supernovae strongly gravitationally lensed by elliptical galaxies in time-domain imaging surveys,” *Astrophys. J. Suppl.* **243** no. 1, (2019) 6, [arXiv:1809.10147 \[astro-ph.GA\]](#).
- [466] S. Mukherjee, J. Silk, and B. D. Wandelt, “Fsd: Frequency space differential measurement of cmb spectral distortions,” *Mon. Not. Roy. Astron. Soc.* **477** no. 4, (2018) 4473–4482, [arXiv:1801.05120 \[astro-ph.CO\]](#).
- [467] S. Mukherjee, J. Silk, and B. D. Wandelt, “How to measure cmb spectral distortions with an imaging telescope,” *Phys. Rev. D* **100** no. 10, (2019) 103508, [arXiv:1910.02132 \[astro-ph.CO\]](#).
- [468] D. D. Xu, S. Mao, A. Cooper, L. Gao, C. Frenk, R. Angulo, and J. Helly, “On the effects of line-of-sight structures on lensing flux-ratio anomalies in a lcdm universe,” *Mon. Not. Roy. Astron. Soc.* **421** (2012) 2553, [arXiv:1110.1185 \[astro-ph.CO\]](#).

- [469] E. Di Valentino, O. Mena, S. Pan, L. Visinelli, W. Yang, A. Melchiorri, D. F. Mota, A. G. Riess, and J. Silk, “In the realm of the hubble tension—a review of solutions,” *Class. Quant. Grav.* **38** no. 15, (2021) 153001, [arXiv:2103.01183 \[astro-ph.CO\]](#).
- [470] P. Shah, P. Lemos, and O. Lahav, “A buyer’s guide to the hubble constant,” *Astron. Astrophys. Rev.* **29** no. 1, (2021) 9, [arXiv:2109.01161 \[astro-ph.CO\]](#).
- [471] **ACT** Collaboration, S. Aiola *et al.*, “The atacama cosmology telescope: Dr4 maps and cosmological parameters,” *JCAP* **12** (2020) 047, [arXiv:2007.07288 \[astro-ph.CO\]](#).
- [472] **SPT-3G** Collaboration, L. Balkenhol *et al.*, “Constraints on Λ cdm extensions from the spt-3g 2018 ee and te power spectra,” *Phys. Rev. D* **104** no. 8, (2021) 083509, [arXiv:2103.13618 \[astro-ph.CO\]](#).
- [473] H. B. Benaoum, W. Yang, S. Pan, and E. Di Valentino, “Modified emergent dark energy and its astronomical constraints,” (8, 2020) , [arXiv:2008.09098 \[gr-qc\]](#).
- [474] W. Yang, E. Di Valentino, S. Pan, A. Shafieloo, and X. Li, “Generalized emergent dark energy model and the hubble constant tension,” *Phys. Rev. D* **104** no. 6, (2021) 063521, [arXiv:2103.03815 \[astro-ph.CO\]](#).
- [475] J. P. Blakeslee, J. B. Jensen, C.-P. Ma, P. A. Milne, and J. E. Greene, “The hubble constant from infrared surface brightness fluctuation distances,” *Astrophys. J.* **911** no. 1, (2021) 65, [arXiv:2101.02221 \[astro-ph.CO\]](#).
- [476] W. J. C. da Silva and R. Silva, “Growth of matter perturbations in the extended viscous dark energy models,” *Eur. Phys. J. C* **81** no. 5, (2021) 403, [arXiv:2011.09516 \[astro-ph.CO\]](#).
- [477] M. Oguri and P. J. Marshall, “Gravitationally lensed quasars and supernovae in future wide-field optical imaging surveys,” *Mon. Not. Roy. Astron. Soc.* **405** (2010) 2579–2593, [arXiv:1001.2037 \[astro-ph.CO\]](#).
- [478] J. D. R. Pierel, S. Rodney, G. Vernardos, M. Oguri, R. Kessler, and T. Anguita, “Projected cosmological constraints from strongly lensed supernovae with the roman space telescope,” *Astrophys. J.* **908** no. 2, (2021) 190, [arXiv:2010.12399 \[astro-ph.CO\]](#).
- [479] J. Green *et al.*, “Wide-field infrared survey telescope (wfirst) final report,” (8, 2012) , [arXiv:1208.4012 \[astro-ph.IM\]](#).
- [480] R. Wojtak, J. Hjorth, and C. Gall, “Magnified or multiply imaged? – search strategies for gravitationally lensed supernovae in wide-field surveys,” *Mon. Not. Roy. Astron. Soc.* **487** no. 3, (2019) 3342–3355, [arXiv:1903.07687 \[astro-ph.CO\]](#).
- [481] Z. Cano, J. Selsing, J. Hjorth, A. de Ugarte Postigo, L. Christensen, C. Gall, and D. A. Kann, “A spectroscopic look at the gravitationally lensed type ia supernova 2016geu at $z = 0.409$,” *Mon. Not. Roy. Astron. Soc.* **473** no. 3, (2018) 4257–4267, [arXiv:1708.05534 \[astro-ph.HE\]](#).
- [482] A. Goobar *et al.*, “iptf16geu: A multiply imaged, gravitationally lensed type ia supernova,” *Science* **356** (2017) 291–295, [arXiv:1611.00014 \[astro-ph.CO\]](#).
- [483] C. Grillo *et al.*, “Measuring the value of the hubble constant ”à la refsdal”,” *Astrophys. J.* **860** no. 2, (2018) 94, [arXiv:1802.01584 \[astro-ph.CO\]](#).
- [484] L. A. Anchordoqui, V. Barger, D. Marfatia, and J. F. Soriano, “Decay of multiple dark matter particles to dark radiation in different epochs does not alleviate the hubble tension,” (3, 2022) , [arXiv:2203.04818 \[astro-ph.CO\]](#).
- [485] P. L. Kelly *et al.*, “Deja vu all over again: The reappearance of supernova refsdal,” *Astrophys. J. Lett.* **819** no. 1, (2016) L8, [arXiv:1512.04654 \[astro-ph.CO\]](#).
- [486] P. L. Kelly *et al.*, “Multiple images of a highly magnified supernova formed by an early-type cluster galaxy lens,” *Science* **347** (2015) 1123, [arXiv:1411.6009 \[astro-ph.CO\]](#).

- [487] R. M. Quimby, M. Oguri, A. More, S. More, T. J. Moriya, M. C. Werner, M. Tanaka, G. Folatelli, M. C. Bersten, and K. Nomoto, “Detection of the gravitational lens magnifying a type ia supernova,” *Science* **344** no. 6, (2014) 396–399, [arXiv:1404.6014 \[astro-ph.CO\]](#).
- [488] S. Refsdal, “On the possibility of determining hubble’s parameter and the masses of galaxies from the gravitational lens effect,” *Mon. Not. Roy. Astron. Soc.* **128** (January, 1964) 307.
- [489] E. Abdalla and A. Marins, “The dark sector cosmology,” *Int. J. Mod. Phys. D* **29** no. 14, (2020) 2030014, [arXiv:2010.08528 \[gr-qc\]](#).
- [490] C. Vafa, “The string landscape and the swampland,” [arXiv:hep-th/0509212](#).
- [491] W. H. Kinney, S. Vagnozzi, and L. Visinelli, “The zoo plot meets the swampland: mutual (in)consistency of single-field inflation, string conjectures, and cosmological data,” *Class. Quant. Grav.* **36** no. 11, (2019) 117001, [arXiv:1808.06424 \[astro-ph.CO\]](#).
- [492] Y. Akrami, R. Kallosh, A. Linde, and V. Vardanyan, “The landscape, the swampland and the era of precision cosmology,” *Fortsch. Phys.* **67** no. 1-2, (2019) 1800075, [arXiv:1808.09440 \[hep-th\]](#).
- [493] U. Danielsson, “The quantum swampland,” *JHEP* **04** (2019) 095, [arXiv:1809.04512 \[hep-th\]](#).
- [494] F. Renzi and A. Silvestri, “A look at the hubble speed from first principles,” [arXiv:2011.10559 \[astro-ph.CO\]](#).
- [495] S. Mukherjee, B. D. Wandelt, and J. Silk, “Probing the theory of gravity with gravitational lensing of gravitational waves and galaxy surveys,” *Mon. Not. Roy. Astron. Soc.* **494** no. 2, (2020) 1956–1970, [arXiv:1908.08951 \[astro-ph.CO\]](#).
- [496] F. B. Abdalla and S. Rawlings, “Probing dark energy with baryonic oscillations and future radio surveys of neutral hydrogen,” *Mon. Not. Roy. Astron. Soc.* **360** (2005) 27–40, [arXiv:astro-ph/0411342](#).
- [497] E. Abdalla *et al.*, “The bingo project i: Baryon acoustic oscillations from integrated neutral gas observations,” [arXiv:2107.01633 \[astro-ph.CO\]](#).
- [498] A. Costa *et al.*, “J-pas: forecasts on interacting dark energy from baryon acoustic oscillations and redshift-space distortions,” *Mon. Not. Roy. Astron. Soc.* **488** no. 1, (2019) 78–88, [arXiv:1901.02540 \[astro-ph.CO\]](#).
- [499] R. R. Bachega, A. A. Costa, E. Abdalla, and K. Fornazier, “Forecasting the interaction in dark matter-dark energy models with standard sirens from the einstein telescope,” *JCAP* **05** (2020) 021, [arXiv:1906.08909 \[astro-ph.CO\]](#).
- [500] C. A. Wuensche *et al.*, “The bingo project ii: Instrument description,” [arXiv:2107.01634 \[astro-ph.IM\]](#).
- [501] K. S. F. Fornazier *et al.*, “The bingo project v: Further steps in component separation and bispectrum analysis,” (7, 2021) , [arXiv:2107.01637 \[astro-ph.CO\]](#).
- [502] R.-G. Cai and T. Yang, “Estimating cosmological parameters by the simulated data of gravitational waves from the einstein telescope,” *Phys. Rev. D* **95** no. 4, (2017) 044024, [arXiv:1608.08008 \[astro-ph.CO\]](#).
- [503] B. Wang, E. Abdalla, F. Atrio-Barandela, and D. Pavon, “Dark matter and dark energy interactions: Theoretical challenges, cosmological implications and observational signatures,” *Rept. Prog. Phys.* **79** no. 9, (2016) 096901, [arXiv:1603.08299 \[astro-ph.CO\]](#).
- [504] L. Wolz, F. Abdalla, C. Blake, J. Shaw, E. Chapman, and S. Rawlings, “The effect of foreground subtraction on cosmological measurements from intensity mapping,” *Mon. Not. Roy. Astron. Soc.* **441** no. 4, (2014) 3271–3283, [arXiv:1310.8144 \[astro-ph.CO\]](#).
- [505] T. Kite, A. Ravenni, S. P. Patil, and J. Chluba, “Bridging the gap: spectral distortions meet gravitational waves,” *Mon. Not. Roy. Astron. Soc.* **505** no. 3, (2021) 4396, [arXiv:2010.00040 \[astro-ph.CO\]](#).

- [506] J. Chluba, L. Dai, D. Grin, M. Amin, and M. Kamionkowski, “Spectral distortions from the dissipation of tensor perturbations,” *Mon. Not. Roy. Astron. Soc.* **446** (2015) 2871–2886, [arXiv:1407.3653 \[astro-ph.CO\]](#).
- [507] N. Schöneberg, M. Lucca, and D. C. Hooper, “Constraining the inflationary potential with spectral distortions,” *JCAP* **03** (2021) 036, [arXiv:2010.07814 \[astro-ph.CO\]](#).
- [508] L. Hart, A. Rotti, and J. Chluba, “Sensitivity forecasts for the cosmological recombination radiation in the presence of foregrounds,” *Mon. Not. Roy. Astron. Soc.* **497** no. 4, (2020) 4535–4548, [arXiv:2006.04826 \[astro-ph.CO\]](#).
- [509] J. Chluba and Y. Ali-Haïmoud, “Cosmospec: Fast and detailed computation of the cosmological recombination radiation from hydrogen and helium,” *Mon. Not. Roy. Astron. Soc.* **456** no. 4, (2016) 3494–3508, [arXiv:1510.03877 \[astro-ph.CO\]](#).
- [510] J. Chluba, “Which spectral distortions does Λ cdm actually predict?,” *Mon. Not. Roy. Astron. Soc.* **460** no. 1, (2016) 227–239, [arXiv:1603.02496 \[astro-ph.CO\]](#).
- [511] J. Chluba, “Distinguishing different scenarios of early energy release with spectral distortions of the cosmic microwave background,” *Mon. Not. Roy. Astron. Soc.* **436** (2013) 2232–2243, [arXiv:1304.6121 \[astro-ph.CO\]](#).
- [512] J. Chluba, R. Khatri, and R. A. Sunyaev, “Cmb at 2x2 order: The dissipation of primordial acoustic waves and the observable part of the associated energy release,” *Mon. Not. Roy. Astron. Soc.* **425** (2012) 1129–1169, [arXiv:1202.0057 \[astro-ph.CO\]](#).
- [513] K. Jedamzik and A. Saveliev, “Stringent limit on primordial magnetic fields from the cosmic microwave background radiation,” *Phys. Rev. Lett.* **123** no. 2, (2019) 021301, [arXiv:1804.06115 \[astro-ph.CO\]](#).
- [514] K. E. Kunze and E. Komatsu, “Constraining primordial magnetic fields with distortions of the black-body spectrum of the cosmic microwave background: pre- and post-decoupling contributions,” *JCAP* **01** (2014) 009, [arXiv:1309.7994 \[astro-ph.CO\]](#).
- [515] D. B  gu  , C. Stahl, and S.-S. Xue, “A model of interacting dark fluids tested with supernovae and baryon acoustic oscillations data,” *Nucl. Phys. B* **940** (2019) 312–320, [arXiv:1702.03185 \[astro-ph.CO\]](#).
- [516] S. J. Osborne, D. S. Y. Mak, S. E. Church, and E. Pierpaoli, “Measuring the galaxy cluster bulk flow from wmap data,” *Astrophys. J.* **737** (2011) 98, [arXiv:1011.2781 \[astro-ph.CO\]](#).
- [517] K. Jedamzik, V. Katalinic, and A. V. Olinto, “A limit on primordial small scale magnetic fields from cmb distortions,” *Phys. Rev. Lett.* **85** (2000) 700–703, [arXiv:astro-ph/9911100](#).
- [518] S. K. Acharya and R. Khatri, “Cmb and bbn constraints on evaporating primordial black holes revisited,” *JCAP* **06** (2020) 018, [arXiv:2002.00898 \[astro-ph.CO\]](#).
- [519] S. Mukherjee, D. N. Spergel, R. Khatri, and B. D. Wandelt, “A new probe of axion-like particles: Cmb polarization distortions due to cluster magnetic fields,” *JCAP* **02** (2020) 032, [arXiv:1908.07534 \[astro-ph.CO\]](#).
- [520] J. Colin, R. Mohayaee, S. Sarkar, and A. Shafieloo, “Probing the anisotropic local universe and beyond with sne ia data,” *Mon. Not. Roy. Astron. Soc.* **414** (2011) 264–271, [arXiv:1011.6292 \[astro-ph.CO\]](#).
- [521] D.-C. Dai, W. H. Kinney, and D. Stojkovic, “Measuring the cosmological bulk flow using the peculiar velocities of supernovae,” *JCAP* **04** (2011) 015, [arXiv:1102.0800 \[astro-ph.CO\]](#).
- [522] S. Mukherjee, R. Khatri, and B. D. Wandelt, “Polarized anisotropic spectral distortions of the cmb: Galactic and extragalactic constraints on photon-axion conversion,” *JCAP* **04** (2018) 045, [arXiv:1801.09701 \[astro-ph.CO\]](#).
- [523] H. Tashiro and N. Sugiyama, “Constraints on primordial black holes by distortions of cosmic microwave background,” *Phys. Rev. D* **78** (2008) 023004, [arXiv:0801.3172 \[astro-ph\]](#).

- [524] M. Demianski, E. Piedipalumbo, D. Sawant, and L. Amati, “Cosmology with gamma-ray bursts: I. the hubble diagram through the calibrated $e_{p,i} - e_{iso}$ correlation,” *Astron. Astrophys.* **598** (2017) A112, [arXiv:1610.00854 \[astro-ph.CO\]](#).
- [525] M. Demianski, E. Piedipalumbo, D. Sawant, and L. Amati, “Cosmology with gamma-ray bursts: II cosmography challenges and cosmological scenarios for the accelerated universe,” *Astron. Astrophys.* **598** (2017) A113, [arXiv:1609.09631 \[astro-ph.CO\]](#).
- [526] J. Ripa and A. Shafieloo, “Testing the isotropic universe using the gamma-ray burst data of fermi/gbm,” *Astrophys. J.* **851** no. 1, (2017) 15, [arXiv:1706.03556 \[astro-ph.HE\]](#).
- [527] J. Řípa and A. Shafieloo, “Update on testing the isotropy of the properties of gamma-ray bursts,” *Mon. Not. Roy. Astron. Soc.* **486** no. 3, (2019) 3027–3040, [arXiv:1809.03973 \[astro-ph.HE\]](#).
- [528] J. K. Bloomfield, E. E. Flanagan, M. Park, and S. Watson, “Dark energy or modified gravity? an effective field theory approach,” *JCAP* **08** (2013) 010, [arXiv:1211.7054 \[astro-ph.CO\]](#).
- [529] G. Gubitosi, F. Piazza, and F. Vernizzi, “The effective field theory of dark energy,” *JCAP* **02** (2013) 032, [arXiv:1210.0201 \[hep-th\]](#).
- [530] M. Park, K. M. Zurek, and S. Watson, “A unified approach to cosmic acceleration,” *Phys. Rev. D* **81** (2010) 124008, [arXiv:1003.1722 \[hep-th\]](#).
- [531] S. Appleby, A. Shafieloo, and A. Johnson, “Probing bulk flow with nearby sne ia data,” *Astrophys. J.* **801** no. 2, (2015) 76, [arXiv:1410.5562 \[astro-ph.CO\]](#).
- [532] V. Pelgrims and D. Hutsemékers, “Evidence for the alignment of quasar radio polarizations with large quasar group axes,” *Astron. Astrophys.* **590** (2016) A53, [arXiv:1604.03937 \[astro-ph.GA\]](#).
- [533] S. J. Turnbull, M. J. Hudson, H. A. Feldman, M. Hicken, R. P. Kirshner, and R. Watkins, “Cosmic flows in the nearby universe from type ia supernovae,” *Mon. Not. Roy. Astron. Soc.* **420** (2012) 447–454, [arXiv:1111.0631 \[astro-ph.CO\]](#).
- [534] SDSS Collaboration, D. P. Schneider *et al.*, “The sloan digital sky survey quasar catalog v. seventh data release,” *Astron. J.* **139** (2010) 2360–2373, [arXiv:1004.1167 \[astro-ph.CO\]](#).
- [535] R. G. Clowes and L. E. Campusano, “A 100-200 mpc group of quasars,” *Mon. Not. Roy. Astron. Soc.* **249** (March, 1991) 218–226.
- [536] T. R. Slatyer and C.-L. Wu, “Early-universe constraints on dark matter-baryon scattering and their implications for a global 21 cm signal,” *Phys. Rev. D* **98** no. 2, (2018) 023013, [arXiv:1803.09734 \[astro-ph.CO\]](#).
- [537] Y. Ali-Haïmoud, J. Chluba, and M. Kamionkowski, “Constraints on dark matter interactions with standard model particles from cosmic microwave background spectral distortions,” *Phys. Rev. Lett.* **115** no. 7, (2015) 071304, [arXiv:1506.04745 \[astro-ph.CO\]](#).
- [538] W. Hu and J. Silk, “Thermalization constraints and spectral distortions for massive unstable relic particles,” *Phys. Rev. Lett.* **70** (1993) 2661–2664.
- [539] H. Fu, M. Lucca, S. Galli, E. S. Battistelli, D. C. Hooper, J. Lesgourgues, and N. Schöneberg, “Unlocking the synergy between cmb spectral distortions and anisotropies,” *JCAP* **12** no. 12, (2021) 050, [arXiv:2006.12886 \[astro-ph.CO\]](#).
- [540] J. Chluba and R. Sunyaev, “The evolution of cmb spectral distortions in the early universe,” *Mon. Not. Roy. Astron. Soc.* **419** (2012) 1294–1314, [arXiv:1109.6552 \[astro-ph.CO\]](#).
- [541] PRISM Collaboration, P. André *et al.*, “Prism (polarized radiation imaging and spectroscopy mission): An extended white paper,” *JCAP* **02** (2014) 006, [arXiv:1310.1554 \[astro-ph.CO\]](#).
- [542] J. Chluba and D. Jeong, “Teasing bits of information out of the cmb energy spectrum,” *Mon. Not. Roy. Astron. Soc.* **438** no. 3, (2014) 2065–2082, [arXiv:1306.5751 \[astro-ph.CO\]](#).

- [543] R. A. Sunyaev and Y. B. Zeldovich, “The interaction of matter and radiation in the hot model of the universe,” *Astrophys. Space Sci.* **7** (1970) 20–30.
- [544] C. Burigana, L. Danese, and G. de Zotti, “Formation and evolution of early distortions of the microwave background spectrum - a numerical study,” *Astron. Astrophys.* **246** no. 1, (June, 1991) 49–58.
- [545] W. Hu and J. Silk, “Thermalization and spectral distortions of the cosmic background radiation,” *Phys. Rev. D* **48** (1993) 485–502.
- [546] W. T. Hu, “Wandering in the background: A cmb explorer,” other thesis, University of California Berkeley, 8, 1995.
- [547] K. Aylor, M. Joy, L. Knox, M. Millea, S. Raghunathan, and W. K. Wu, “Sounds discordant: Classical distance ladder & Λ cdm -based determinations of the cosmological sound horizon,” *Astrophys. J.* **874** no. 1, (2019) 4, [arXiv:1811.00537 \[astro-ph.CO\]](#).
- [548] V. Poulin, K. K. Boddy, S. Bird, and M. Kamionkowski, “Implications of an extended dark energy cosmology with massive neutrinos for cosmological tensions,” *Phys. Rev. D* **97** no. 12, (2018) 123504, [arXiv:1803.02474 \[astro-ph.CO\]](#).
- [549] C. Krishnan, E. Ó Colgáin, Ruchika, A. A. Sen, M. Sheikh-Jabbari, and T. Yang, “Is there an early universe solution to hubble tension?,” *Phys. Rev. D* **102** no. 10, (2020) 103525, [arXiv:2002.06044 \[astro-ph.CO\]](#).
- [550] K. C. Wong *et al.*, “H0licow – xiii. a 2.4 per cent measurement of h_0 from lensed quasars: 5.3σ tension between early- and late-universe probes,” *Mon. Not. Roy. Astron. Soc.* **498** no. 1, (2020) 1420–1439, [arXiv:1907.04869 \[astro-ph.CO\]](#).
- [551] E. D. Kovetz, V. Poulin, V. Gluscevic, K. K. Boddy, R. Barkana, and M. Kamionkowski, “Tighter limits on dark matter explanations of the anomalous edges 21 cm signal,” *Phys. Rev. D* **98** no. 10, (2018) 103529, [arXiv:1807.11482 \[astro-ph.CO\]](#).
- [552] J. Stadler and C. Boehm, “Constraints on γ -cdm interactions matching the planck data precision,” *JCAP* **10** (2018) 009, [arXiv:1802.06589 \[astro-ph.CO\]](#).
- [553] N. Becker, D. C. Hooper, F. Kahlhoefer, J. Lesgourgues, and N. Schöneberg, “Cosmological constraints on multi-interacting dark matter,” *JCAP* **02** (2021) 019, [arXiv:2010.04074 \[astro-ph.CO\]](#).
- [554] S. Camera, I. Harrison, A. Bonaldi, and M. L. Brown, “Ska weak lensing – iii. added value of multiwavelength synergies for the mitigation of systematics,” *Mon. Not. Roy. Astron. Soc.* **464** no. 4, (2017) 4747–4760, [arXiv:1606.03451 \[astro-ph.CO\]](#).
- [555] M. Raveri and W. Hu, “Concordance and discordance in cosmology,” *Phys. Rev. D* **99** no. 4, (2019) 043506, [arXiv:1806.04649 \[astro-ph.CO\]](#).
- [556] **DES** Collaboration, J. Muir *et al.*, “Blinding multiprobe cosmological experiments,” *Mon. Not. Roy. Astron. Soc.* **494** no. 3, (2020) 4454–4470, [arXiv:1911.05929 \[astro-ph.CO\]](#).
- [557] D. Camarena and V. Marra, “Local determination of the hubble constant and the deceleration parameter,” *Phys. Rev. Res.* **2** no. 1, (2020) 013028, [arXiv:1906.11814 \[astro-ph.CO\]](#).
- [558] G. S. Anand, R. B. Tully, L. Rizzi, A. G. Riess, and W. Yuan, “Comparing tip of the red giant branch distance scales: An independent reduction of the carnegie-chicago hubble program and the value of the hubble constant,” [arXiv:2108.00007 \[astro-ph.CO\]](#).
- [559] Y. Avni and H. Tananbaum, “X-ray properties of optically selected qos,” *Astrophys. J.* **305** (June, 1986) 83.
- [560] N. Khadka and B. Ratra, “Quasar x-ray and uv flux, baryon acoustic oscillation, and hubble parameter measurement constraints on cosmological model parameters,” *Mon. Not. Roy. Astron. Soc.* **492** no. 3, (2020) 4456–4468, [arXiv:1909.01400 \[astro-ph.CO\]](#).

- [561] G. Risaliti and E. Lusso, “A hubble diagram for quasars,” *Astrophys. J.* **815** (2015) 33, [arXiv:1505.07118 \[astro-ph.CO\]](#).
- [562] E. Lusso, E. Piedipalumbo, G. Risaliti, M. Paolillo, S. Bisogni, E. Nardini, and L. Amati, “Tension with the flat λ cdm model from a high-redshift hubble diagram of supernovae, quasars, and gamma-ray bursts,” *Astron. Astrophys.* **628** (2019) L4, [arXiv:1907.07692 \[astro-ph.CO\]](#).
- [563] S. Collaboration, “Skypy,” October, 2020. <https://doi.org/10.5281/zenodo.4071945>. AA and PS supported by the Royal Society Wolfson Fellowship, JPC acknowledges support granted by Agencia Nacional de Investigación y Desarrollo (ANID) DOCTORADO BECAS CHILE/2016 - 72170279.
- [564] D. Alonso, P. G. Ferreira, M. J. Jarvis, and K. Moodley, “Calibrating photometric redshifts with intensity mapping observations,” *Phys. Rev. D* **96** no. 4, (2017) 043515, [arXiv:1704.01941 \[astro-ph.CO\]](#).
- [565] S. Dhawan, S. W. Jha, and B. Leibundgut, “Measuring the hubble constant with type ia supernovae as near-infrared standard candles,” *Astron. Astrophys.* **609** (2018) A72, [arXiv:1707.00715 \[astro-ph.CO\]](#).
- [566] S. Cunnington, I. Harrison, A. Pourtsidou, and D. Bacon, “Hi intensity mapping for clustering-based redshift estimation,” *Mon. Not. Roy. Astron. Soc.* **482** no. 3, (2019) 3341–3355, [arXiv:1805.04498 \[astro-ph.CO\]](#).
- [567] B. Follin and L. Knox, “Insensitivity of the distance ladder hubble constant determination to cepheid calibration modelling choices,” *Mon. Not. Roy. Astron. Soc.* **477** no. 4, (2018) 4534–4542, [arXiv:1707.01175 \[astro-ph.CO\]](#).
- [568] A. Bonaldi, I. Harrison, S. Camera, and M. L. Brown, “Ska weak lensing– ii. simulated performance and survey design considerations,” *Mon. Not. Roy. Astron. Soc.* **463** no. 4, (2016) 3686–3698, [arXiv:1601.03948 \[astro-ph.CO\]](#).
- [569] I. Harrison, S. Camera, J. Zuntz, and M. L. Brown, “Ska weak lensing – i. cosmological forecasts and the power of radio-optical cross-correlations,” *Mon. Not. Roy. Astron. Soc.* **463** no. 4, (2016) 3674–3685, [arXiv:1601.03947 \[astro-ph.CO\]](#).
- [570] **SKA** Collaboration, D. J. Bacon *et al.*, “Cosmology with phase 1 of the square kilometre array: Red book 2018: Technical specifications and performance forecasts,” *Publ. Astron. Soc. Austral.* **37** (2020) e007, [arXiv:1811.02743 \[astro-ph.CO\]](#).
- [571] M. M. Ivanov, Y. Ali-Haïmoud, and J. Lesgourgues, “ h_0 tension or t_0 tension?,” *Phys. Rev. D* **102** no. 6, (2020) 063515, [arXiv:2005.10656 \[astro-ph.CO\]](#).
- [572] M. Gavela, D. Hernandez, L. Lopez Honorez, O. Mena, and S. Rigolin, “Dark coupling,” *JCAP* **07** (2009) 034, [arXiv:0901.1611 \[astro-ph.CO\]](#). [Erratum: JCAP 05, E01 (2010)].
- [573] I. S. Jang and M. G. Lee, “The tip of the red giant branch distances to type ia supernova host galaxies. v. ngc 3021, ngc 3370, and ngc 1309 and the value of the hubble constant,” *Astrophys. J.* **836** no. 1, (2017) 74, [arXiv:1702.01118 \[astro-ph.CO\]](#).
- [574] J. Chluba *et al.*, “Spectral Distortions of the CMB as a Probe of Inflation, Recombination, Structure Formation and Particle Physics: Astro2020 Science White Paper,” *Bull. Am. Astron. Soc.* **51** no. 3, (2019) 184, [arXiv:1903.04218 \[astro-ph.CO\]](#). <https://baas.aas.org/pub/2020n3i184>.
- [575] J. Chluba *et al.*, “New horizons in cosmology with spectral distortions of the cosmic microwave background,” *Exper. Astron.* **51** no. 3, (2021) 1515–1554, [arXiv:1909.01593 \[astro-ph.CO\]](#).
- [576] A. Kogut, M. Abitbol, J. Chluba, J. Delabrouille, D. Fixsen, J. Hill, S. Patil, and A. Rotti, “Cmb spectral distortions: Status and prospects,” [arXiv:1907.13195 \[astro-ph.CO\]](#).
- [577] M. H. Abitbol, J. C. Hill, and J. Chluba, “Measuring the hubble constant from the cooling of the cmb monopole,” (10, 2019) , [arXiv:1910.09881 \[astro-ph.CO\]](#).

- [578] M. Lucca, “The role of cmb spectral distortions in the hubble tension: a proof of principle,” *Phys. Lett. B* **810** (2020) 135791, [arXiv:2008.01115 \[astro-ph.CO\]](#).
- [579] M. Lucca and D. C. Hooper, “Shedding light on dark matter-dark energy interactions,” *Phys. Rev. D* **102** no. 12, (2020) 123502, [arXiv:2002.06127 \[astro-ph.CO\]](#).
- [580] M. Lucca, N. Schöneberg, D. C. Hooper, J. Lesgourgues, and J. Chluba, “The synergy between cmb spectral distortions and anisotropies,” *JCAP* **02** (2020) 026, [arXiv:1910.04619 \[astro-ph.CO\]](#).
- [581] K. Jedamzik and L. Pogosian, “Relieving the hubble tension with primordial magnetic fields,” *Phys. Rev. Lett.* **125** no. 18, (2020) 181302, [arXiv:2004.09487 \[astro-ph.CO\]](#).
- [582] D. K. Hazra, A. Shafieloo, and T. Souradeep, “Parameter discordance in planck cmb and low-redshift measurements: projection in the primordial power spectrum,” *JCAP* **04** (2019) 036, [arXiv:1810.08101 \[astro-ph.CO\]](#).
- [583] D. K. Hazra, A. Antony, and A. Shafieloo, “One spectrum to cure them all: Signature from early universe solves major anomalies and tensions in cosmology,” (1, 2022) , [arXiv:2201.12000 \[astro-ph.CO\]](#).
- [584] R. E. Keeley, A. Shafieloo, D. K. Hazra, and T. Souradeep, “Inflation wars: A new hope,” *JCAP* **09** (2020) 055, [arXiv:2006.12710 \[astro-ph.CO\]](#).
- [585] M. Braglia, M. Ballardini, W. T. Emond, F. Finelli, A. E. Gumrukcuoglu, K. Koyama, and D. Paoletti, “Larger value for h_0 by an evolving gravitational constant,” *Phys. Rev. D* **102** no. 2, (2020) 023529, [arXiv:2004.11161 \[astro-ph.CO\]](#).
- [586] M. Braglia, M. Ballardini, F. Finelli, and K. Koyama, “Early modified gravity in light of the h_0 tension and lss data,” *Phys. Rev. D* **103** no. 4, (2021) 043528, [arXiv:2011.12934 \[astro-ph.CO\]](#).
- [587] M. Braglia, W. T. Emond, F. Finelli, A. E. Gumrukcuoglu, and K. Koyama, “Unified framework for early dark energy from α -attractors,” *Phys. Rev. D* **102** no. 8, (2020) 083513, [arXiv:2005.14053 \[astro-ph.CO\]](#).
- [588] W. L. K. Wu, P. Motloch, W. Hu, and M. Raveri, “Hubble constant difference between cmb lensing and bao measurements,” *Phys. Rev. D* **102** no. 2, (2020) 023510, [arXiv:2004.10207 \[astro-ph.CO\]](#).
- [589] L. Hart and J. Chluba, “New constraints on time-dependent variations of fundamental constants using planck data,” *Mon. Not. Roy. Astron. Soc.* **474** no. 2, (2018) 1850–1861, [arXiv:1705.03925 \[astro-ph.CO\]](#).
- [590] C.-T. Chiang and A. z. Slosar, “Inferences of h_0 in presence of a non-standard recombination,” [arXiv:1811.03624 \[astro-ph.CO\]](#).
- [591] F. W. Hehl, P. von der Heyde, G. D. Kerlick, and J. M. Nester, “General relativity with spin and torsion: Foundations and prospects,” *Rev. Mod. Phys.* **48** (Jul, 1976) 393–416. <https://link.aps.org/doi/10.1103/RevModPhys.48.393>.
- [592] J. M. Ezquiaga and M. Zumalacárregui, “Dark energy after gw170817: Dead ends and the road ahead,” *Phys. Rev. Lett.* **119** no. 25, (2017) 251304, [arXiv:1710.05901 \[astro-ph.CO\]](#).
- [593] A. Nishizawa, “Generalized framework for testing gravity with gravitational-wave propagation. i. formulation,” *Phys. Rev. D* **97** no. 10, (2018) 104037, [arXiv:1710.04825 \[gr-qc\]](#).
- [594] C. Li, Y. Cai, Y.-F. Cai, and E. N. Saridakis, “The effective field theory approach of teleparallel gravity, $f(t)$ gravity and beyond,” *JCAP* **10** (2018) 001, [arXiv:1803.09818 \[gr-qc\]](#).
- [595] J. M.-a. Ezquiaga and M. ZumalacÁrregui, “Dark energy in light of multi-messenger gravitational-wave astronomy,” *Front. Astron. Space Sci.* **5** (2018) 44, [arXiv:1807.09241 \[astro-ph.CO\]](#).
- [596] I. D. Saltas, I. Sawicki, L. Amendola, and M. Kunz, “Anisotropic stress as a signature of nonstandard propagation of gravitational waves,” *Phys. Rev. Lett.* **113** no. 19, (2014) 191101, [arXiv:1406.7139 \[astro-ph.CO\]](#).

- [597] R. C. Nunes, M. E. S. Alves, and J. C. N. de Araujo, “Forecast constraints on $f(t)$ gravity with gravitational waves from compact binary coalescences,” *Phys. Rev.* **D100** no. 6, (2019) 064012, [arXiv:1905.03237 \[gr-qc\]](#).
- [598] Y.-F. Cai, S. Capozziello, M. De Laurentis, and E. N. Saridakis, “ $f(t)$ teleparallel gravity and cosmology,” *Rept. Prog. Phys.* **79** no. 10, (2016) 106901, [arXiv:1511.07586 \[gr-qc\]](#).
- [599] G. Farrugia, J. Levi Said, and A. Finch, “Gravitoelectromagnetism, solar system test and weak-field solutions in $f(t, b)$ gravity with observational constraints,” *Universe* **6** (2020) 34, [arXiv:2002.08183 \[gr-qc\]](#).
- [600] J. D. Bekenstein, “The relation between physical and gravitational geometry,” *Phys. Rev.* **D48** (1993) 3641–3647, [arXiv:gr-qc/9211017 \[gr-qc\]](#).
- [601] B. Mostaghel, H. Moshafi, and S. M. S. Movahed, “Non-minimal derivative coupling scalar field and bulk viscous dark energy,” *Eur. Phys. J. C* **77** no. 8, (2017) 541, [arXiv:1611.08196 \[astro-ph.CO\]](#).
- [602] C. Tsallis and L. J. L. Cirto, “Black hole thermodynamical entropy,” *Eur. Phys. J. C* **73** (2013) 2487, [arXiv:1202.2154 \[cond-mat.stat-mech\]](#).
- [603] J. D. Barrow, “The area of a rough black hole,” *Phys. Lett. B* **808** (2020) 135643, [arXiv:2004.09444 \[gr-qc\]](#).
- [604] W. J. C. da Silva and R. Silva, “Cosmological perturbations in the tsallis holographic dark energy scenarios,” *Eur. Phys. J. Plus* **136** no. 5, (2021) 543, [arXiv:2011.09520 \[astro-ph.CO\]](#).
- [605] E. Elizalde, M. Khurshudyan, S. D. Odintsov, and R. Myrzakulov, “Analysis of the h_0 tension problem in the universe with viscous dark fluid,” *Phys. Rev. D* **102** no. 12, (2020) 123501, [arXiv:2006.01879 \[gr-qc\]](#).
- [606] I. H. Brevik and O. Gorbunova, “Dark energy and viscous cosmology,” *Gen. Rel. Grav.* **37** (2005) 2039–2045, [arXiv:gr-qc/0504001](#).
- [607] B. Mostaghel, H. Moshafi, and S. M. S. Movahed, “The integrated sachs–wolfe effect in the bulk viscous dark energy model,” *Mon. Not. Roy. Astron. Soc.* **481** no. 2, (2018) 1799–1808, [arXiv:1810.04856 \[astro-ph.CO\]](#).
- [608] H. Velten and D. Schwarz, “Dissipation of dark matter,” *Phys. Rev. D* **86** (2012) 083501, [arXiv:1206.0986 \[astro-ph.CO\]](#).
- [609] D. Wang, Y.-J. Yan, and X.-H. Meng, “A new pressure-parametrization unified dark fluid model,” *Eur. Phys. J. C* **77** no. 4, (2017) 263, [arXiv:1701.03362 \[astro-ph.CO\]](#).
- [610] P. Wu and H. W. Yu, “Observational constraints on $f(t)$ theory,” *Phys. Lett.* **B693** (2010) 415–420, [arXiv:1006.0674 \[gr-qc\]](#).
- [611] K. A. Olive and M. Pospelov, “Evolution of the fine structure constant driven by dark matter and the cosmological constant,” *Phys. Rev. D* **65** (2002) 085044, [arXiv:hep-ph/0110377](#).
- [612] O. Minazzoli, “Conservation laws in theories with universal gravity/matter coupling,” *Phys. Rev. D* **88** (2013) 027506, [arXiv:1307.1590 \[gr-qc\]](#).
- [613] O. Minazzoli and A. Hees, “Dilatons with intrinsic decouplings,” *Phys. Rev.* **D94** no. 6, (2016) 064038, [arXiv:1512.05232 \[gr-qc\]](#).
- [614] O. Minazzoli and A. Hees, “Late-time cosmology of a scalar-tensor theory with a universal multiplicative coupling between the scalar field and the matter lagrangian,” *Phys. Rev. D* **90** (2014) 023017, [arXiv:1404.4266 \[gr-qc\]](#).
- [615] A. Hees, O. Minazzoli, and J. Larena, “Breaking of the equivalence principle in the electromagnetic sector and its cosmological signatures,” *Phys. Rev.* **D90** (2014) 124064, [arXiv:1406.6187 \[astro-ph.CO\]](#).

- [616] T. Damour, F. Piazza, and G. Veneziano, “Runaway dilaton and equivalence principle violations,” *Phys. Rev. Lett.* **89** (2002) 081601, [arXiv:gr-qc/0204094](#) [gr-qc].
- [617] P. Brax, A.-C. Davis, B. Li, and H. A. Winther, “A unified description of screened modified gravity,” *Phys. Rev.* **D86** (2012) 044015, [arXiv:1203.4812](#) [astro-ph.CO].
- [618] P. Brax, C. Burrage, A.-C. Davis, D. Seery, and A. Weltman, “Anomalous coupling of scalars to gauge fields,” *Phys. Lett.* **B699** (2011) 5–9, [arXiv:1010.4536](#) [hep-th].
- [619] S. Capozziello, M. Capriolo, and L. Caso, “Weak field limit and gravitational waves in $f(t, b)$ teleparallel gravity,” *Eur. Phys. J.* **C80** no. 2, (2020) 156, [arXiv:1912.12469](#) [gr-qc].
- [620] A. Riess, “Shoes-supernovae, ho, for the equation of state of dark energy.” Hst proposal, July, 2006.
- [621] E. J. Copeland, N. J. Nunes, and M. Pospelov, “Models of quintessence coupled to the electromagnetic field and the cosmological evolution of α ,” *Phys. Rev.* **D69** (2004) 023501, [arXiv:hep-ph/0307299](#) [hep-ph].
- [622] S. Lee, K. A. Olive, and M. Pospelov, “Quintessence models and the cosmological evolution of α ,” *Phys. Rev.* **D70** (2004) 083503, [arXiv:astro-ph/0406039](#) [astro-ph].
- [623] A. Hees, O. Minazzoli, and J. Larena, “Observables in theories with a varying fine structure constant,” *Gen. Rel. Grav.* **47** no. 2, (2015) 9, [arXiv:1409.7273](#) [gr-qc].
- [624] T. Damour, F. Piazza, and G. Veneziano, “Violations of the equivalence principle in a dilaton runaway scenario,” *Phys. Rev.* **D66** (2002) 046007, [arXiv:hep-th/0205111](#) [hep-th].
- [625] C. Wetterich, “Crossover quintessence and cosmological history of fundamental ‘constants’,” *Phys. Lett.* **B561** (2003) 10–16, [arXiv:hep-ph/0301261](#) [hep-ph].
- [626] V. I. Sabla and R. R. Caldwell, “No h_0 assistance from assisted quintessence,” *Phys. Rev. D* **103** no. 10, (2021) 103506, [arXiv:2103.04999](#) [astro-ph.CO].
- [627] A. Bonilla, R. D’Agostino, R. C. Nunes, and J. C. N. de Araujo, “Forecasts on the speed of gravitational waves at high z ,” *JCAP* **03** (2020) 015, [arXiv:1910.05631](#) [gr-qc].
- [628] A. Finke, S. Foffa, F. Iacovelli, M. Maggiore, and M. Mancarella, “Probing modified gravitational wave propagation with strongly lensed coalescing binaries,” *Phys. Rev. D* **104** no. 8, (2021) 084057, [arXiv:2107.05046](#) [gr-qc].
- [629] C. van de Bruck, J. Mifsud, and N. J. Nunes, “The variation of the fine-structure constant from disformal couplings,” *JCAP* **1512** no. 12, (2015) 018, [arXiv:1510.00200](#) [astro-ph.CO].
- [630] S. Carloni, E. Elizalde, and S. Odintsov, “Conformal transformations in cosmology of modified gravity: The covariant approach perspective,” *Gen. Rel. Grav.* **42** (2010) 1667–1705, [arXiv:0907.3941](#) [gr-qc].
- [631] K.-i. Maeda, “Towards the einstein-hilbert action via conformal transformation,” *Phys. Rev. D* **39** (May, 1989) 3159–3162. <https://link.aps.org/doi/10.1103/PhysRevD.39.3159>.
- [632] P. J. E. Peebles, *Principles of physical cosmology*. Princeton University Press, 1993.
- [633] H. Abedi and S. Capozziello, “Gravitational waves in modified teleparallel theories of gravity,” *Eur. Phys. J.* **C78** no. 6, (2018) 474, [arXiv:1712.05933](#) [gr-qc].
- [634] LISA Collaboration, P. Amaro-Seoane *et al.*, “Laser interferometer space antenna,” [arXiv:1702.00786](#) [astro-ph.IM].
- [635] W. L. Freedman *et al.*, “The carnegie-chicago hubble program. viii. an independent determination of the hubble constant based on the tip of the red giant branch,” (7, 2019) , [arXiv:1907.05922](#) [astro-ph.CO].

- [636] **LIGO Scientific, Virgo, 1M2H, Dark Energy Camera GW-E, DES, DLT40, Las Cumbres Observatory, VINROUGE, MASTER** Collaboration, B. P. Abbott *et al.*, “A gravitational-wave standard siren measurement of the hubble constant,” *Nature* **551** no. 7678, (2017) 85–88, [arXiv:1710.05835 \[astro-ph.CO\]](#).
- [637] L. L. Graef, M. Benetti, and J. S. Alcaniz, “Primordial gravitational waves and the h_0 -tension problem,” *Phys.Rev.D* **99** no. 4, (2019) 043519, [arXiv:1809.04501 \[astro-ph.CO\]](#).
- [638] J. Baker *et al.*, “The laser interferometer space antenna: Unveiling the millihertz gravitational wave sky,” [arXiv:1907.06482 \[astro-ph.IM\]](#).
- [639] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2015 results. xiii. cosmological parameters,” *Astron. Astrophys.* **594** (2016) A13, [arXiv:1502.01589 \[astro-ph.CO\]](#).
- [640] G. Farrugia, J. Levi Said, V. Gakis, and E. N. Saridakis, “Gravitational waves in modified teleparallel theories,” *Phys. Rev.* **D97** no. 12, (2018) 124064, [arXiv:1804.07365 \[gr-qc\]](#).
- [641] D. Lovelock, “The einstein tensor and its generalizations,” *J. Math. Phys.* **12** (1971) 498–501.
- [642] P. A. Gonzalez and Y. Vasquez, “Teleparallel equivalent of lovelock gravity,” *Phys. Rev.* **D92** no. 12, (2015) 124023, [arXiv:1508.01174 \[hep-th\]](#).
- [643] D. Blixt, M. Hohmann, and C. Pfeifer, “Hamiltonian and primary constraints of new general relativity,” *Phys.Rev.D* **99** no. 8, (2019) 084025, [arXiv:1811.11137 \[gr-qc\]](#).
- [644] X.-M. Deng, “Probing $f(t)$ gravity with gravitational time advancement,” *Class.Quant.Grav.* **35** no. 17, (2018) 175013.
- [645] A. Finch and J. L. Said, “Galactic rotation dynamics in $f(t)$ gravity,” *Eur.Phys.J.C* **78** no. 7, (2018) 560, [arXiv:1806.09677 \[astro-ph.GA\]](#).
- [646] S. Nojiri and S. D. Odintsov, “Introduction to modified gravity and gravitational alternative for dark energy,” *eConf* **C0602061** (2006) 06, [arXiv:hep-th/0601213](#).
- [647] R. Aldrovandi, J. Pereira, and K. Vu, “Doing without the equivalence principle,” in *10th Marcel Grossmann Meeting on Recent Developments in Theoretical and Experimental General Relativity, Gravitation and Relativistic Field Theories (MG X MMIII)*, pp. 1505–1512. 10, 2004. [arXiv:gr-qc/0410042](#).
- [648] D. Blixt, M. Hohmann, and C. Pfeifer, “On the gauge fixing in the hamiltonian analysis of general teleparallel theories,” *Universe* **5** no. 6, (2019) 143, [arXiv:1905.01048 \[gr-qc\]](#).
- [649] S. Bahamonde, K. F. Dialektopoulos, and J. Levi Said, “Can horndeski theory be recast using teleparallel gravity?,” *Phys. Rev.* **D100** no. 6, (2019) 064018, [arXiv:1904.10791 \[gr-qc\]](#).
- [650] M. Krssak, R. J. van den Hoogen, J. G. Pereira, C. G. Böhrer, and A. A. Coley, “Teleparallel theories of gravity: illuminating a fully invariant approach,” *Class. Quant. Grav.* **36** no. 18, (2019) 183001, [arXiv:1810.12932 \[gr-qc\]](#).
- [651] R. Ferraro and F. Fiorini, “On born-infeld gravity in weitzenbock spacetime,” *Phys. Rev.* **D78** (2008) 124019, [arXiv:0812.1981 \[gr-qc\]](#).
- [652] R. Ferraro and F. Fiorini, “Modified teleparallel gravity: Inflation without inflaton,” *Phys. Rev.* **D75** (2007) 084031, [arXiv:gr-qc/0610067 \[gr-qc\]](#).
- [653] H. T. Intema, P. Jagannathan, K. P. Mooley, and D. A. Frail, “The gmrt 150 mhz all-sky radio survey: First alternative data release tgss adr1,” *Astron. Astrophys.* **598** (2017) A78, [arXiv:1603.04368 \[astro-ph.CO\]](#).
- [654] J. Peacock, *Cosmological Physics*. Cambridge Astrophysics. Cambridge University Press, 1999. <https://books.google.com.mt/books?id=t80-yy1U0j0C>.

- [655] J. A. Tyson, G. P. Kochanski, and I. P. Dell’Antonio, “Detailed mass map of cl0024+1654 from strong lensing,” *Astrophys. J.* **498** (1998) L107, [arXiv:astro-ph/9801193](#) [astro-ph].
- [656] R. B. Rengelink, Y. Tang, A. G. de Bruyn, G. K. Miley, M. N. Bremer, H. J. A. Roettgering, and M. A. R. Bremer, “The westerbork northern sky survey (wenss), i. a 570 square degree mini-survey around the north ecliptic pole,” *Astron. Astrophys.* **124** (August, 1997) 259–280.
- [657] J. J. Condon, W. D. Cotton, E. W. Greisen, Q. F. Yin, R. A. Perley, G. B. Taylor, and J. J. Broderick, “The nrao vla sky survey,” *Astron. J.* **115** (1998) 1693–1716.
- [658] T. Mauch, T. Murphy, H. J. Buttery, J. Curran, R. W. Hunstead, B. Piestrzynski, J. G. Robertson, and E. M. Sadler, “Sumss: A wide-field radio imaging survey of the southern sky. 2. the source catalogue,” *Mon. Not. Roy. Astron. Soc.* **342** (2003) 1117, [arXiv:astro-ph/0303188](#).
- [659] M. Rubart, D. Bacon, and D. J. Schwarz, “Impact of local structure on the cosmic radio dipole,” *Astron. Astrophys.* **565** (2014) A111, [arXiv:1402.0376](#) [astro-ph.CO].
- [660] M. Bartelmann and P. Schneider, “Weak gravitational lensing,” *Phys. Rept.* **340** (2001) 291–472, [arXiv:astro-ph/9912508](#) [astro-ph].
- [661] S. Dodelson, *Modern Cosmology*. Academic Press, 2003.
<https://books.google.com.mt/books?id=3oPRxdXJexcC>.
- [662] A. Goldstein *et al.*, “An ordinary short gamma-ray burst with extraordinary implications: Fermi-gbm detection of grb 170817a,” *Astrophys. J.* **848** no. 2, (2017) L14, [arXiv:1710.05446](#) [astro-ph.HE].
- [663] C. M. Will, *Theory and Experiment in Gravitational Physics*. Cambridge University Press, 2 ed., 2018.
- [664] T. M. Davis, S. R. Hinton, C. Howlett, and J. Calcino, “Can redshift errors bias measurements of the hubble constant?,” *Mon. Not. Roy. Astron. Soc.* **490** no. 2, (2019) 2948–2957, [arXiv:1907.12639](#) [astro-ph.CO].
- [665] C. de Rham, J. T. Deskins, A. J. Tolley, and S.-Y. Zhou, “Graviton mass bounds,” *Rev. Mod. Phys.* **89** no. 2, (2017) 025004, [arXiv:1606.08462](#) [astro-ph.CO].
- [666] J. Calcino and T. Davis, “The need for accurate redshifts in supernova cosmology,” *JCAP* **01** (2017) 038, [arXiv:1610.07695](#) [astro-ph.CO].
- [667] **LIGO Scientific, Virgo Collaboration**, B. P. Abbott *et al.*, “Observation of gravitational waves from a binary black hole merger,” *Phys. Rev. Lett.* **116** no. 6, (2016) 061102, [arXiv:1602.03837](#) [gr-qc].
- [668] N. Khadka and B. Ratra, “Do quasar x-ray and uv flux measurements provide a useful test of cosmological models?,” *Mon. Not. Roy. Astron. Soc.* **510** no. 2, (2022) 2772, [arXiv:2107.07600](#) [astro-ph.CO].
- [669] **LIGO Scientific, Virgo Collaboration**, B. P. Abbott *et al.*, “Gw170817: Observation of gravitational waves from a binary neutron star inspiral,” *Phys. Rev. Lett.* **119** no. 16, (2017) 161101, [arXiv:1710.05832](#) [gr-qc].
- [670] J. Colin, R. Mohayaee, M. Rameez, and S. Sarkar, “Evidence for anisotropy of cosmic acceleration,” *Astron. Astrophys.* **631** (2019) L13, [arXiv:1808.04597](#) [astro-ph.CO].
- [671] **Supernova Cosmology Project Collaboration**, S. Perlmutter *et al.*, “Measurements of ω and λ from 42 high redshift supernovae,” *Astrophys. J.* **517** (1999) 565–586, [arXiv:astro-ph/9812133](#).
- [672] W. Rahman, R. Trotta, S. S. Boruah, M. J. Hudson, and D. A. van Dyk, “New constraints on anisotropic expansion from supernovae type ia,” (8, 2021) , [arXiv:2108.12497](#) [astro-ph.CO].
- [673] N. Khadka and B. Ratra, “Determining the range of validity of quasar x-ray and uv flux measurements for constraining cosmological model parameters,” *Mon. Not. Roy. Astron. Soc.* **502** no. 4, (2021) 6140–6156, [arXiv:2012.09291](#) [astro-ph.CO].

- [674] A. G. Riess, S. Casertano, W. Yuan, L. M. Macri, and D. Scolnic, “Large magellanic cloud cepheid standards provide a 1% foundation for the determination of the hubble constant and stronger evidence for physics beyond Λ cdm,” *Astrophys. J.* **876** no. 1, (2019) 85, [arXiv:1903.07603](#) [astro-ph.CO].
- [675] E. J. Copeland, M. Sami, and S. Tsujikawa, “Dynamics of dark energy,” *Int. J. Mod. Phys. D* **15** (2006) 1753–1936, [arXiv:hep-th/0603057](#) [hep-th].
- [676] **BOSS Collaboration**, T. Delubac *et al.*, “Baryon acoustic oscillations in the $\text{Ly}\alpha$ forest of boss dr11 quasars,” *Astron. Astrophys.* **574** (2015) A59, [arXiv:1404.1801](#) [astro-ph.CO].
- [677] E. Aubourg *et al.*, “Cosmological implications of baryon acoustic oscillation measurements,” *Phys. Rev. D* **92** no. 12, (2015) 123516, [arXiv:1411.1074](#) [astro-ph.CO].
- [678] M. Rameez, “Concerns about the reliability of publicly available sne ia data,” (5, 2019) , [arXiv:1905.00221](#) [astro-ph.CO].
- [679] **Supernova Search Team Collaboration**, A. G. Riess *et al.*, “Observational evidence from supernovae for an accelerating universe and a cosmological constant,” *Astron. J.* **116** (1998) 1009–1038, [arXiv:astro-ph/9805201](#).
- [680] S. Bahamonde, “Generalised nonminimally gravity-matter coupled theory,” *Eur. Phys. J. C* **78** no. 4, (2018) 326, [arXiv:1709.05319](#) [gr-qc].
- [681] D. Rubin and J. Heitlauf, “Is the expansion of the universe accelerating? all signs still point to yes a local dipole anisotropy cannot explain dark energy,” *Astrophys. J.* **894** no. 1, (2020) 68, [arXiv:1912.02191](#) [astro-ph.CO].
- [682] H. du Mas des Bourboux *et al.*, “The completed sdss-iv extended baryon oscillation spectroscopic survey: Baryon acoustic oscillations with $\text{Ly}\alpha$ forests,” *Astrophys. J.* **901** no. 2, (2020) 153, [arXiv:2007.08995](#) [astro-ph.CO].
- [683] T. Harko, F. S. N. Lobo, G. Otalora, and E. N. Saridakis, “ $f(t, \mathcal{T})$ gravity and cosmology,” *JCAP* **1412** (2014) 021, [arXiv:1405.0519](#) [gr-qc].
- [684] M. Rameez and S. Sarkar, “Is there really a hubble tension?,” *Class. Quant. Grav.* **38** no. 15, (2021) 154005, [arXiv:1911.06456](#) [astro-ph.CO].
- [685] M. Pace and J. L. Said, “Quark stars in $f(t, \mathcal{T})$ -gravity,” *Eur. Phys. J. C* **77** no. 2, (2017) 62, [arXiv:1701.04761](#) [gr-qc].
- [686] G. Farrugia and J. Levi Said, “Growth factor in $f(t, \mathcal{T})$ gravity,” *Phys. Rev. D* **94** no. 12, (2016) 124004, [arXiv:1612.00974](#) [gr-qc].
- [687] C. L. Steinhardt, A. Sneppen, and B. Sen, “Effects of supernova redshift uncertainties on the determination of cosmological parameters,” *Astrophys. J.* **902** no. 1, (2020) 14, [arXiv:2005.07707](#) [astro-ph.CO].
- [688] E. Cartan, “Sur les variétés à connexion affine et la théorie de la relativité généralisée. (première partie),” *Annales Sci. Ecole Norm. Sup.* **40** (1923) 325–412.
- [689] R. D. Hecht, J. Lemke, and R. P. Wallner, “Can poincaré gauge theory be saved?,” *Phys. Rev. D* **44** (Oct, 1991) 2442–2451. <https://link.aps.org/doi/10.1103/PhysRevD.44.2442>.
- [690] R. D. Hecht, J. M. Nester, and V. V. Zhytnikov, “Some poincare gauge theory lagrangians with well posed initial value problems,” *Phys. Lett. A* **222** (1996) 37–42.
- [691] E. Cartan, “Sur les variétés à connexion affine et la théorie de la relativité généralisée. (première partie) (suite).,” *Annales Sci. Ecole Norm. Sup.* **41** (1924) 1–25.
- [692] N. J. Secrest, R. P. Dudik, B. N. Dorland, N. Zacharias, V. Makarov, A. Fey, J. Frouard, and C. Finch, “Identification of 1.4 million active galactic nuclei in the mid-infrared using wise data,” *The Astrophysical Journal Supplement Series* **221** no. 1, (November, 2015) 12, [arXiv:1509.07289](#) [astro-ph.GA].

- [693] D. W. Sciama, “The physical structure of general relativity,” *Rev. Mod. Phys.* **36** (1964) 463–469. [Erratum: *Rev. Mod. Phys.* 36,1103(1964)].
- [694] T. W. B. Kibble, “Lorentz invariance and the gravitational field,” *J. Math. Phys.* **2** (1961) 212–221. [,168(1961)].
- [695] A. Okolów, “Adm-like hamiltonian formulation of gravity in the teleparallel geometry,” *Gen. Rel. Grav.* **45** (2013) 2569–2610, [arXiv:1111.5498 \[gr-qc\]](#).
- [696] A. Okolów, “Adm-like hamiltonian formulation of gravity in the teleparallel geometry: derivation of constraint algebra,” *Gen. Rel. Grav.* **46** (2014) 1636, [arXiv:1309.4685 \[gr-qc\]](#).
- [697] Y. Kucukakca, “Scalar tensor teleparallel dark gravity via noether symmetry,” *Eur. Phys. J.* **C73** no. 2, (2013) 2327, [arXiv:1404.7315 \[gr-qc\]](#).
- [698] P. V. Tretyakov, “Dynamical stability of extended teleparallel gravity,” *Mod. Phys. Lett.* **A31** no. 14, (2016) 1650085, [arXiv:1602.01287 \[gr-qc\]](#).
- [699] N. Sk, “Noether symmetry in $f(t)$ teleparallel gravity,” *Phys. Lett.* **B775** (2017) 100–104, [arXiv:1706.00537 \[gr-qc\]](#).
- [700] A. Aslam, M. Jamil, D. Momeni, and R. Myrzakulov, “Noether gauge symmetry of modified teleparallel gravity minimally coupled with a canonical scalar field,” *Can. J. Phys.* **91** (2013) 93–97, [arXiv:1212.6022 \[astro-ph.CO\]](#).
- [701] M. Jamil, D. Momeni, and R. Myrzakulov, “Noether symmetry of $f(t)$ cosmology with quintessence and phantom scalar fields,” *Eur. Phys. J.* **C72** (2012) 2137, [arXiv:1210.0001 \[physics.gen-ph\]](#).
- [702] J. L. Anderson and P. G. Bergmann, “Constraints in covariant field theories,” *Phys. Rev.* **83** (1951) 1018–1025.
- [703] P. Dirac, *Lectures on Quantum Mechanics*. Belfer Graduate School of Science Monographs Series. Belfer Graduate School of Science, Yeshiva University, 1964. <https://books.google.com.mt/books?id=oQNRAAAAMAAJ>.
- [704] K. Sundermeyer, “Constrained dynamics with applications to yang-mills theory, general relativity, classical spin, dual string model,” *Lect. Notes Phys.* **169** (1982) 1–318.
- [705] H. Friedrich and A. D. Rendall, “The cauchy problem for the einstein equations,” *Lect. Notes Phys.* **540** (2000) 127–224, [arXiv:gr-qc/0002074 \[gr-qc\]](#). [,127(2000)].
- [706] R. Wojtak and A. Agnello, “The hubble–lemaître constant and sound horizon from low-redshift probes,” *Mon. Not. Roy. Astron. Soc.* **486** no. 4, (2019) 5046–5051, [arXiv:1908.02401 \[astro-ph.CO\]](#).
- [707] P. A. M. Dirac, “Generalized hamiltonian dynamics,” *Proceedings of the Royal Society of London A: Mathematical, Physical and Engineering Sciences* **246** no. 1246, (1958) 326–332. <http://rspa.royalsocietypublishing.org/content/246/1246/326>.
- [708] P. A. M. Dirac, “Fixation of coordinates in the hamiltonian theory of gravitation,” *Phys. Rev.* **114** (1959) 924–930.
- [709] A. W. Wipf, “Hamilton’s formalism for systems with constraints,” [arXiv:hep-th/9312078 \[hep-th\]](#). [Lect. Notes Phys.434,22(1994)].
- [710] A. Awad and G. Nashed, “Generalized teleparallel cosmology and initial singularity crossing,” *JCAP* **1702** no. 02, (2017) 046, [arXiv:1701.06899 \[gr-qc\]](#).
- [711] B. S. DeWitt, “Quantum theory of gravity. 1. the canonical theory,” *Phys. Rev.* **160** (1967) 1113–1148.
- [712] R. A. Remillard and J. E. McClintock, “X-ray properties of black-hole binaries,” *Ann. Rev. Astron. Astrophys.* **44** (2006) 49–92, [arXiv:astro-ph/0606352 \[astro-ph\]](#).

- [713] R. L. Arnowitt, S. Deser, and C. W. Misner, “Dynamical structure and definition of energy in general relativity,” *Phys. Rev.* **116** (1959) 1322–1330.
- [714] R. Aldrovandi, P. B. Barros, and J. G. Pereira, “Spin and anholonomy in general relativity,” [arXiv:gr-qc/0402022 \[gr-qc\]](#).
- [715] R. Aldrovandi and J. Pereira, *An Introduction to Geometrical Physics*. World Scientific, 1995. <https://books.google.com.mt/books?id=w8hBT4DV1vkC>.
- [716] R. Aldrovandi and J. G. Pereira, *Teleparallel Gravity*, vol. 173. Springer, Dordrecht, 2013.
- [717] M. Nakahara, *Geometry, Topology and Physics, Second Edition*. Graduate student series in physics. Taylor & Francis, 2003. <https://books.google.com.mt/books?id=cH-XQB0Ex5wC>.
- [718] D. Bleecker, *Gauge theory and variational principles*. Global analysis, pure and applied. Addison-Wesley Pub. Co., Advanced Book Program/World Science Division, 1981. <https://books.google.com.mt/books?id=tsrvAAAAMAAJ>.
- [719] T. Ortín, *Gravity and Strings*. Cambridge Monographs on Mathematical Physics. Cambridge University Press, 2004. <https://books.google.com.mt/books?id=sRlHoXdAVNwC>.
- [720] V. Fock and D. Ivanenko, “Géometrie quantique linéaire et déplacement parallèle,” *Compt. Rend. Acad. Sci.* **188** no. 1470, (1929) .
- [721] D. Ivanenko and G. Sardanashvily, “The gauge treatment of gravity,” *Phys. Rept.* **94** (1983) 1–45.
- [722] L. Baudis, “Dark matter detection,” *J. Phys.* **G43** no. 4, (2016) 044001.
- [723] J. L. Feng, “Dark matter candidates from particle physics and methods of detection,” *Ann. Rev. Astron. Astrophys.* **48** (2010) 495–545, [arXiv:1003.0904 \[astro-ph.CO\]](#).
- [724] L. Visinelli, “Light axion-like dark matter must be present during inflation,” *Phys. Rev. D* **96** no. 2, (2017) 023013, [arXiv:1703.08798 \[astro-ph.CO\]](#).
- [725] **LUX** Collaboration, D. S. Akerib *et al.*, “First results from the lux dark matter experiment at the sanford underground research facility,” *Phys. Rev. Lett.* **112** (2014) 091303, [arXiv:1310.8214 \[astro-ph.CO\]](#).
- [726] G. Bertone, D. Hooper, and J. Silk, “Particle dark matter: Evidence, candidates and constraints,” *Phys. Rept.* **405** (2005) 279–390, [arXiv:hep-ph/0404175 \[hep-ph\]](#).
- [727] R. C. Nunes and E. Di Valentino, “Dark sector interaction and the supernova absolute magnitude tension,” *Phys. Rev. D* **104** no. 6, (2021) 063529, [arXiv:2107.09151 \[astro-ph.CO\]](#).
- [728] A. Lewis and A. Challinor, “Weak gravitational lensing of the cmb,” *Phys. Rept.* **429** (2006) 1–65, [arXiv:astro-ph/0601594 \[astro-ph\]](#).
- [729] V. C. Rubin and W. K. Ford, Jr., “Rotation of the andromeda nebula from a spectroscopic survey of emission regions,” *Astrophys. J.* **159** (1970) 379–403.
- [730] R. Myrzakulov, “F(t) gravity and k-essence,” *Gen. Rel. Grav.* **44** (2012) 3059–3080, [arXiv:1008.4486 \[physics.gen-ph\]](#).
- [731] P. Motloch and W. Hu, “Tensions between direct measurements of the lens power spectrum from planck data,” *Phys. Rev. D* **97** no. 10, (2018) 103536, [arXiv:1803.11526 \[astro-ph.CO\]](#).
- [732] **Planck** Collaboration, N. Aghanim *et al.*, “Planck 2018 results. vi. cosmological parameters,” *Astron. Astrophys.* **641** (2020) A6, [arXiv:1807.06209 \[astro-ph.CO\]](#). [Erratum: *Astron. Astrophys.* 652, C4 (2021)].
- [733] F. Zwicky, “On the masses of nebulae and of clusters of nebulae,” *Astrophys. J.* **86** (October, 1937) 217.

- [734] M. Raveri, B. Hu, N. Frusciante, and A. Silvestri, “Effective field theory of cosmic acceleration: constraining dark energy with cmb data,” *Phys. Rev. D* **90** no. 4, (2014) 043513, [arXiv:1405.1022 \[astro-ph.CO\]](#).
- [735] P. J. E. Peebles, “The void phenomenon,” *Astrophys. J.* **557** (2001) 495–504, [arXiv:astro-ph/0101127 \[astro-ph\]](#).
- [736] N. Frusciante, M. Raveri, and A. Silvestri, “Effective field theory of dark energy: a dynamical analysis,” *JCAP* **02** (2014) 026, [arXiv:1310.6026 \[astro-ph.CO\]](#).
- [737] P. J. E. Peebles and B. Ratra, “The cosmological constant and dark energy,” *Rev. Mod. Phys.* **75** (2003) 559–606, [arXiv:astro-ph/0207347 \[astro-ph\]](#). [,592(2002)].
- [738] SDSS Collaboration, W. J. Percival *et al.*, “Baryon acoustic oscillations in the sloan digital sky survey data release 7 galaxy sample,” *Mon. Not. Roy. Astron. Soc.* **401** (2010) 2148–2168, [arXiv:0907.1660 \[astro-ph.CO\]](#).
- [739] S. Bridle and L. King, “Dark energy constraints from cosmic shear power spectra: impact of intrinsic alignments on photometric redshift requirements,” *New J. Phys.* **9** (2007) 444, [arXiv:0705.0166 \[astro-ph\]](#).
- [740] SDSS Collaboration, M. Tegmark *et al.*, “Cosmological parameters from sdss and wmap,” *Phys. Rev. D* **69** (2004) 103501, [arXiv:astro-ph/0310723 \[astro-ph\]](#).
- [741] SDSS Collaboration, M. Tegmark *et al.*, “Cosmological constraints from the sdss luminous red galaxies,” *Phys. Rev. D* **74** (2006) 123507, [arXiv:astro-ph/0608632 \[astro-ph\]](#).
- [742] S. Weinberg, “The cosmological constant problem,” *Rev. Mod. Phys.* **61** (1989) 1–23.
- [743] V. F. Mukhanov, H. A. Feldman, and R. H. Brandenberger, “Theory of cosmological perturbations. part 1. classical perturbations. part 2. quantum theory of perturbations. part 3. extensions,” *Phys. Rept.* **215** (1992) 203–333.
- [744] A. D. Linde, “A new inflationary universe scenario: A possible solution of the horizon, flatness, homogeneity, isotropy and primordial monopole problems,” *Phys. Lett.* **108B** (1982) 389–393.
- [745] A. H. Guth, “The inflationary universe: A possible solution to the horizon and flatness problems,” *Phys. Rev. D* **23** (1981) 347–356.
- [746] A. Einstein, “Kosmologische betrachtungen zur allgemeinen relativitätstheorie, 8 feb 1917. cosmological considerations in the general theory of relativity, 8 feb 1917,”. <http://cds.cern.ch/record/632340>.
- [747] T. Clifton, P. G. Ferreira, A. Padilla, and C. Skordis, “Modified gravity and cosmology,” *Phys. Rept.* **513** (2012) 1–189, [arXiv:1106.2476 \[astro-ph.CO\]](#).
- [748] A. Ashtekar and J. Lewandowski, “Background independent quantum gravity: A status report,” *Class. Quant. Grav.* **21** (2004) R53, [arXiv:gr-qc/0404018 \[gr-qc\]](#).
- [749] P. D. Mannheim, “Alternatives to dark matter and dark energy,” *Prog. Part. Nucl. Phys.* **56** (2006) 340–445, [arXiv:astro-ph/0505266 \[astro-ph\]](#).
- [750] V. Faraoni, “f(r) gravity: Successes and challenges,” in *18th SIGRAV Conference*. 10, 2008. [arXiv:0810.2602 \[gr-qc\]](#).
- [751] S. Capozziello and M. De Laurentis, “Extended theories of gravity,” *Phys. Rept.* **509** (2011) 167–321, [arXiv:1108.6266 \[gr-qc\]](#).
- [752] T. P. Sotiriou and V. Faraoni, “f(r) theories of gravity,” *Rev. Mod. Phys.* **82** (2010) 451–497, [arXiv:0805.1726 \[gr-qc\]](#).
- [753] J. Jackson, *Classical Electrodynamics*. Wiley, 2012. <https://books.google.com.mt/books?id=8qHCZjJHRUgC>.

- [754] T. Koivisto, M. Hohmann, and L. Marzola, “Axiomatic derivation of coincident general relativity and its premetric extension,” *Phys. Rev. D* **103** no. 6, (2021) 064041, [arXiv:1909.10415 \[gr-qc\]](#).
- [755] R. Aldrovandi, J. G. Pereira, and K. H. Vu, “Gravitation without the equivalence principle,” *Gen. Rel. Grav.* **36** (2004) 101–110, [arXiv:gr-qc/0304106 \[gr-qc\]](#).
- [756] V. C. de Andrade and J. G. Pereira, “Gravitational lorentz force and the description of the gravitational interaction,” *Phys. Rev.* **D56** (1997) 4689–4695, [arXiv:gr-qc/9703059 \[gr-qc\]](#).
- [757] K. Hayashi and T. Shirafuji, “New general relativity,” *Phys. Rev.* **D19** (1979) 3524–3553. [,409(1979)].
- [758] K. Hayashi and T. Nakano, “Extended translation invariance and associated gauge fields,” *Prog. Theor. Phys.* **38** (1967) 491–507.
- [759] R. Weitzenböck, ‘*Invariantentheorie*’. Noordhoff, Gronningen, 1923.
- [760] K. Pasmatsiou, C. G. Tsagas, and J. D. Barrow, “Kinematics of einstein-cartan universes,” *Phys. Rev.* **D95** no. 10, (2017) 104007, [arXiv:1611.07878 \[gr-qc\]](#).
- [761] H. I. Arcos and J. G. Pereira, “Torsion gravity: A reappraisal,” *Int. J. Mod. Phys.* **D13** (2004) 2193–2240, [arXiv:gr-qc/0501017 \[gr-qc\]](#).
- [762] A. A. Sousa and J. W. Maluf, “Gravitomagnetic effect and spin torsion coupling,” *Gen. Rel. Grav.* **36** (2004) 967–982, [arXiv:gr-qc/0310131 \[gr-qc\]](#).
- [763] Yu. N. Obukhov and J. G. Pereira, “Teleparallel origin of the fierz picture for spin-2 particle,” *Phys. Rev.* **D67** (2003) 044008, [arXiv:gr-qc/0212078 \[gr-qc\]](#).
- [764] M. Krššák and J. G. Pereira, “Spin connection and renormalization of teleparallel action,” *Eur. Phys. J.* **C75** no. 11, (2015) 519, [arXiv:1504.07683 \[gr-qc\]](#).
- [765] J. W. Maluf, “The teleparallel equivalent of general relativity,” *Annalen Phys.* **525** (2013) 339–357, [arXiv:1303.3897 \[gr-qc\]](#).
- [766] R. Aldrovandi and J. G. Pereira, “Gravitation: In search of the missing torsion,” [arXiv:0801.4148 \[gr-qc\]](#).
- [767] S. Capozziello and R. de Ritis, “Noether’s symmetries and exact solutions in flat nonminimally coupled cosmological models,” *Class. Quant. Grav.* **11** (1994) 107–117.
- [768] R. Ferraro and M.-a. J. Guzmán, “Hamiltonian formulation of teleparallel gravity,” *Phys. Rev.* **D94** no. 10, (2016) 104045, [arXiv:1609.06766 \[gr-qc\]](#).
- [769] Y. C. Ong and J. M. Nester, “Counting components in the lagrange multiplier formulation of teleparallel theories,” *Eur. Phys. J. C* **78** no. 7, (2018) 568, [arXiv:1709.00068 \[gr-qc\]](#).
- [770] J. W. Maluf and J. F. da Rocha-Neto, “General relativity on a null surface: Hamiltonian formulation in the teleparallel geometry,” *Gen. Rel. Grav.* **31** (1999) 173–185, [arXiv:gr-qc/9808001 \[gr-qc\]](#).
- [771] M. Blagojevic and I. A. Nikolic, “Hamiltonian structure of the teleparallel formulation of gr,” *Phys. Rev.* **D62** (2000) 024021, [arXiv:hep-th/0002022 \[hep-th\]](#).
- [772] J. W. Maluf and J. F. da Rocha-Neto, “Hamiltonian formulation of general relativity in the teleparallel geometry,” *Phys. Rev. D* **64** (Sep, 2001) 084014.
<https://link.aps.org/doi/10.1103/PhysRevD.64.084014>.
- [773] J. M. Nester, F.-H. Ho, and C.-M. Chen, “Quasilocal center-of-mass for teleparallel gravity,” in *On recent developments in theoretical and experimental general relativity, gravitation, and relativistic field theories. Proceedings, 10th Marcel Grossmann Meeting, MG10, Rio de Janeiro, Brazil, July 20-26, 2003. Pt. A-C*, pp. 1483–1494. 2004. [arXiv:gr-qc/0403101 \[gr-qc\]](#).
- [774] A. Einstein, *Hamiltonisches prinzip und allgemeine relativitätstheorie Das Relativitätsprinzip*. Berlin: Verlag der Akademie der Wissenschaften, 1923.

- [775] A. Einstein, *Sitzungsberichte der Königlich Preußischen Akademie der Wissenschaften*. Berlin: Verlag der Akademie der Wissenschaften, 1918.
- [776] V. C. de Andrade, L. C. T. Guillen, and J. G. Pereira, “Gravitational energy momentum density in teleparallel gravity,” *Phys. Rev. Lett.* **84** (2000) 4533–4536, [arXiv:gr-qc/0003100](#) [gr-qc].
- [777] J. W. Maluf, E. F. Martins, and A. Kneip, “Gravitational energy of rotating black holes,” *J. Math. Phys.* **37** (1996) 6302–6310, [arXiv:gr-qc/9608049](#) [gr-qc].
- [778] J. D. Brown and J. W. York, Jr., “Quasilocal energy and conserved charges derived from the gravitational action,” *Phys. Rev.* **D47** (1993) 1407–1419, [arXiv:gr-qc/9209012](#) [gr-qc].
- [779] L. B. Szabados, “Quasi-local energy-momentum and angular momentum in gr: A review article,” *Living Rev. Rel.* **7** (2004) 4.
- [780] L. Landau and L. Landau, *The Classical Theory of Fields*. Course of theoretical physics. Butterworth-Heinemann, 1975. <https://books.google.com.mt/books?id=X18PF4oKyrUC>.
- [781] L. B. Szabados, “Quasi-local energy-momentum and angular momentum in general relativity,” *Living Reviews in Relativity* **12** no. 1, (Jun, 2009) 4. <https://doi.org/10.12942/lrr-2009-4>.
- [782] G. Acquaviva, D. Kofroň, and M. Scholtz, “A gravitational energy–momentum and the thermodynamic description of gravity,” *Class. Quant. Grav.* **35** no. 9, (2018) 095001, [arXiv:1802.09208](#) [gr-qc].
- [783] P. A. M. Dirac, *General Theory of Relativity*. Princeton Landmarks in Physics, Princeton University Press, Princeton, N. J., 1996.
- [784] J. W. Maluf, S. C. Ulhoa, and J. F. da Rocha-Neto, “Gravitational pressure on event horizons and thermodynamics in the teleparallel framework,” *Phys. Rev.* **D85** (2012) 044050, [arXiv:1202.4995](#) [gr-qc].
- [785] J. Beltran Jimenez, L. Heisenberg, G. J. Olmo, and D. Rubiera-Garcia, “Born–infeld inspired modifications of gravity,” *Phys. Rept.* **727** (2018) 1–129, [arXiv:1704.03351](#) [gr-qc].
- [786] J. W. Maluf and S. C. Ulhoa, “The energy-momentum of plane-fronted gravitational waves in the teleparallel equivalent of gr,” *Phys. Rev.* **D78** (2008) 047502, [arXiv:0807.0255](#) [gr-qc]. [Erratum: *Phys. Rev.* **D78**, 069901(2008)].
- [787] S. C. Ulhoa, J. F. da Rocha Neto, and J. W. Maluf, “The gravitational energy problem for cosmological models in teleparallel gravity,” *Int. J. Mod. Phys.* **D19** (2010) 1925–1935, [arXiv:1010.3235](#) [gr-qc].
- [788] J. F. da Rocha-Neto and J. W. Maluf, “The angular momentum of plane-fronted gravitational waves in the teleparallel equivalent of general relativity,” *Gen. Rel. Grav.* **46** (2014) 1667, [arXiv:1402.5344](#) [gr-qc].
- [789] J. W. Maluf, “Sparling two forms, the conformal factor and the gravitational energy density of the teleparallel equivalent of general relativity,” *Gen. Rel. Grav.* **30** (1998) 413–423, [arXiv:gr-qc/9710124](#) [gr-qc].
- [790] J. W. Maluf and J. F. da Rocha-Neto, “The vacuum energy density in the teleparallel equivalent of general relativity,” in *On recent developments in theoretical and experimental general relativity, gravitation, and relativistic field theories. Proceedings, 10th Marcel Grossmann Meeting, MG10, Rio de Janeiro, Brazil, July 20-26, 2003. Pt. A-C*. 2003. [arXiv:gr-qc/0308084](#) [gr-qc].
- [791] J. W. Maluf, M. V. O. Veiga, and J. F. da Rocha-Neto, “Regularized expression for the gravitational energy-momentum in teleparallel gravity and the principle of equivalence,” *Gen. Rel. Grav.* **39** (2007) 227–240, [arXiv:gr-qc/0507122](#) [gr-qc].
- [792] J. W. Maluf, J. F. da Rocha-Neto, T. M. L. Toribio, and K. H. Castello-Branco, “Energy momentum of the gravitational field in the teleparallel geometry,” in *Recent developments in theoretical and experimental general relativity, gravitation and relativistic field theories. Proceedings, 9th Marcel Grossmann Meeting, MG’9, Rome, Italy, July 2-8, 2000. Pts. A-C*, pp. 1043–1044. 2000. [arXiv:gr-qc/0008073](#) [gr-qc].

- [793] J. W. Maluf, J. F. da Rocha-Neto, T. M. L. Toribio, and K. H. Castello-Branco, “Energy and angular momentum of the gravitational field in the teleparallel geometry,” *Phys. Rev.* **D65** (2002) 124001, [arXiv:gr-qc/0204035 \[gr-qc\]](#).
- [794] W. El Hanafy and G. G. L. Nashed, “Exact teleparallel gravity of binary black holes,” *Astrophys. Space Sci.* **361** no. 2, (2016) 68, [arXiv:1507.07377 \[gr-qc\]](#).
- [795] J. W. Maluf and J. F. da Rocha-Neto, “Static bondi energy in the teleparallel equivalent of general relativity,” *J. Math. Phys.* **40** (1999) 1490–1503, [arXiv:gr-qc/9812020 \[gr-qc\]](#).
- [796] J. F. da Rocha-Neto and B. R. Morais, “Gravitational pressure, apparent horizon and thermodynamics of flrw universe in the teleparallel gravity,” [arXiv:1802.06062 \[gr-qc\]](#).
- [797] J. W. Maluf and A. Goya, “Space-time defects and teleparallelism,” *Class. Quant. Grav.* **18** (2001) 5143–5154, [arXiv:gr-qc/0110107 \[gr-qc\]](#).
- [798] A. S. Fernandes, S. C. Ulhoa, and R. G. G. Amorim, “On quantum cosmology in teleparallel gravity,” *J. Phys. Conf. Ser.* **965** no. 1, (2018) 012014, [arXiv:1802.08087 \[gr-qc\]](#).
- [799] E. L. B. Junior, M. E. Rodrigues, and M. J. S. Houndjo, “Born-infeld and charged black holes with non-linear source in $f(t)$ gravity,” *JCAP* **1506** no. 06, (2015) 037, [arXiv:1503.07427 \[gr-qc\]](#).
- [800] A. Behboodi and K. Nozari, “Braneworld cosmological perturbations in teleparallel gravity,” *Phys. Lett.* **B750** (2015) 601–608, [arXiv:1505.06572 \[gr-qc\]](#).
- [801] S. Jana, “Cosmology in a reduced born-infeld $f(t)$ theory of gravity,” *Phys. Rev.* **D90** (2014) 124007, [arXiv:1410.7117 \[gr-qc\]](#).
- [802] M. Sharif and S. Rani, “K-essence models and cosmic acceleration in generalized teleparallel gravity,” *Phys. Scripta* **84** (2011) 055005, [arXiv:1111.3599 \[physics.gen-ph\]](#).
- [803] R. Ferraro and F. Fiorini, “Cosmological frames for theories with absolute parallelism,” *Int. J. Mod. Phys. Conf. Ser.* **3** (2011) 227–237, [arXiv:1106.6349 \[gr-qc\]](#).
- [804] F. Fiorini and R. Ferraro, “A type of born-infeld regular gravity and its cosmological consequences,” *Int. J. Mod. Phys.* **A24** (2009) 1686–1689, [arXiv:0904.1767 \[gr-qc\]](#).
- [805] H. Weyl, “Gravitation und electrizität,” *Sitz. Ber. Preuss. Ak. Wiss.* **465** (1918) .
- [806] R. J. Riegert, “Birkhoff’s theorem in conformal gravity,” *Phys. Rev. Lett.* **53** (1984) 315–318.
- [807] P. D. Mannheim, “Making the case for conformal gravity,” *Found. Phys.* **42** (2012) 388–420, [arXiv:1101.2186 \[hep-th\]](#).
- [808] P. D. Mannheim and D. Kazanas, “Exact vacuum solution to conformal weyl gravity and galactic rotation curves,” *Astrophys. J.* **342** (1989) 635–638.
- [809] V. Mossa *et al.*, “The baryon density of the universe from an improved rate of deuterium burning,” *Nature* **587** no. 7833, (2020) 210–213.
- [810] J. G. O’Brien, T. L. Chiarelli, J. Dentico, M. Stulge, B. Stefanski, R. Moss, and S. Chaykov, “Alternative gravity rotation curves for the little things survey,” *Astrophys. J.* **852** no. 1, (2018) 6, [arXiv:1705.01252 \[gr-qc\]](#).
- [811] P. D. Mannheim, “Cosmic acceleration as the solution to the cosmological constant problem,” *Astrophys. J.* **561** (2001) 1–12, [arXiv:astro-ph/9910093 \[astro-ph\]](#).
- [812] S. W. Hawking, T. Hertog, and H. S. Reall, “Trace anomaly driven inflation,” *Phys. Rev.* **D63** (2001) 083504, [arXiv:hep-th/0010232 \[hep-th\]](#).
- [813] S. Capozziello and A. De Felice, “ $f(r)$ cosmology by noether’s symmetry,” *JCAP* **08** (2008) 016, [arXiv:0804.2163 \[gr-qc\]](#).

- [814] S. Nojiri and S. D. Odintsov, “Brane world inflation induced by quantum effects,” *Phys. Lett.* **B484** (2000) 119–123, [arXiv:hep-th/0004097](#) [hep-th].
- [815] R. Armillis, A. Monin, and M. Shaposhnikov, “Spontaneously broken conformal symmetry: Dealing with the trace anomaly,” *JHEP* **10** (2013) 030, [arXiv:1302.5619](#) [hep-th].
- [816] R. Kallosh and A. Linde, “Universality class in conformal inflation,” *JCAP* **1307** (2013) 002, [arXiv:1306.5220](#) [hep-th].
- [817] J. W. Maluf and F. F. Faria, “Conformally invariant teleparallel theories of gravity,” *Phys. Rev.* **D85** (2012) 027502, [arXiv:1110.3095](#) [gr-qc].
- [818] J. W. Maluf and F. F. Faria, “Teleparallel gauge theory of gravity,” *Annalen Phys.* **524** (2012) 366–370, [arXiv:1203.0040](#) [gr-qc].
- [819] J. T. Wheeler, “Weyl geometry,” *Gen. Rel. Grav.* **50** no. 7, (2018) 80, [arXiv:1801.03178](#) [gr-qc].
- [820] R.-J. Yang, “Conformal transformation in $f(t)$ theories,” *EPL* **93** no. 6, (2011) 60001, [arXiv:1010.1376](#) [gr-qc].
- [821] D. Momeni and R. Myrzakulov, “Conformal invariant teleparallel cosmology,” *Eur. Phys. J. Plus* **129** (2014) 137, [arXiv:1404.0778](#) [gr-qc].
- [822] M. Hohmann, “Disformal transformations in scalar-torsion gravity,” *Universe* **5** (2019) 167, [arXiv:1905.00451](#) [gr-qc].
- [823] A. Golovnev and M. J. Guzman, “Disformal transformations in modified teleparallel gravity,” *Symmetry* **12** (2020) 152, [arXiv:1912.04604](#) [gr-qc].
- [824] M. Wright, “Conformal transformations in modified teleparallel theories of gravity revisited,” *Phys. Rev.* **D93** no. 10, (2016) 103002, [arXiv:1602.05764](#) [gr-qc].
- [825] K. Bamba, S. D. Odintsov, and D. Sáez-Gómez, “Conformal symmetry and accelerating cosmology in teleparallel gravity,” *Phys. Rev. D* **88** (2013) 084042, [arXiv:1308.5789](#) [gr-qc].
- [826] K.-F. Shie, J. M. Nester, and H.-J. Yo, “Torsion cosmology and the accelerating universe,” *Phys. Rev.* **D78** (2008) 023522, [arXiv:0805.3834](#) [gr-qc].
- [827] H.-J. Yo and J. M. Nester, “Dynamic scalar torsion and an oscillating universe,” *Mod. Phys. Lett.* **A22** (2007) 2057–2069, [arXiv:astro-ph/0612738](#) [astro-ph].
- [828] S. Capozziello, M. De Laurentis, and R. Myrzakulov, “Noether symmetry approach for teleparallel-curvature cosmology,” *Int. J. Geom. Meth. Mod. Phys.* **12** no. 09, (2015) 1550095, [arXiv:1412.1471](#) [gr-qc].
- [829] A. de la Cruz Dombriz, “Towards new constraints in extended theories of gravity: Cosmography and gravitational-wave signals from neutron stars,” *Galaxies* **6** no. 1, (2018) 28.
- [830] S. Capozziello, M. Capriolo, and M. Transirico, “The gravitational energy-momentum pseudotensor: the cases of $f(r)$ and $f(t)$ gravity,” *Int. J. Geom. Meth. Mod. Phys.* **15** (2018) 1850164, [arXiv:1804.08530](#) [gr-qc].
- [831] H. J. Hortúa, R. Volpi, D. Marinelli, and L. Malagó, “Parameter estimation for the cosmic microwave background with bayesian neural networks,” *Phys. Rev. D* **102** no. 10, (2020) 103509, [arXiv:1911.08508](#) [astro-ph.IM].
- [832] H. Dong, Y.-b. Wang, and X.-h. Meng, “Extended birkhoff’s theorem in the $f(t)$ gravity,” *Eur. Phys. J.* **C72** (2012) 2002, [arXiv:1203.5890](#) [gr-qc].
- [833] M. H. Daouda, M. E. Rodrigues, and M. J. S. Houndjo, “Anisotropic fluid for a set of non-diagonal tetrads in $f(t)$ gravity,” *Phys. Lett.* **B715** (2012) 241–245, [arXiv:1202.1147](#) [gr-qc].

- [834] G. G. L. Nashed, “Schwarzschild solution in extended teleparallel gravity,” *EPL* **105** no. 1, (2014) 10001, [arXiv:1501.00974 \[gr-qc\]](#).
- [835] C. Deliduman and B. Yapiskan, “Absence of relativistic stars in $f(t)$ gravity,” [arXiv:1103.2225 \[gr-qc\]](#).
- [836] P. A. Gonzalez, E. N. Saridakis, and Y. Vasquez, “Circularly symmetric solutions in three-dimensional teleparallel, $f(t)$ and maxwell- $f(t)$ gravity,” *JHEP* **07** (2012) 053, [arXiv:1110.4024 \[gr-qc\]](#).
- [837] S. Mukherjee, A. Krolewski, B. D. Wandelt, and J. Silk, “Cross-correlating dark sirens and galaxies: measurement of h_0 from gwtc-3 of ligo-virgo-kagra,” [arXiv:2203.03643 \[astro-ph.CO\]](#).
- [838] L. Iorio and E. N. Saridakis, “Solar system constraints on $f(t)$ gravity,” *Mon. Not. Roy. Astron. Soc.* **427** (2012) 1555, [arXiv:1203.5781 \[gr-qc\]](#).
- [839] R. Ferraro and F. Fiorini, “Spherically symmetric static spacetimes in vacuum $f(t)$ gravity,” *Phys. Rev.* **D84** (2011) 083518, [arXiv:1109.4209 \[gr-qc\]](#).
- [840] L. Barack *et al.*, “Black holes, gravitational waves and fundamental physics: a roadmap,” *Class. Quant. Grav.* **36** no. 14, (2019) 143001, [arXiv:1806.05195 \[gr-qc\]](#).
- [841] N. Tamanini, C. Caprini, E. Barausse, A. Sesana, A. Klein, and A. Petiteau, “Science with the space-based interferometer elisa. iii: Probing the expansion of the universe using gravitational wave standard sirens,” *JCAP* **04** (2016) 002, [arXiv:1601.07112 \[astro-ph.CO\]](#).
- [842] C. G. Boehmer, A. Mussa, and N. Tamanini, “Existence of relativistic stars in $f(t)$ gravity,” *Class. Quant. Grav.* **28** (2011) 245020, [arXiv:1107.4455 \[gr-qc\]](#).
- [843] M. J. S. Houndjo, D. Momeni, R. Myrzakulov, and M. E. Rodrigues, “Evaporation phenomena in $f(t)$ gravity,” *Can. J. Phys.* **93** (2015) 377–383, [arXiv:1304.1147 \[physics.gen-ph\]](#).
- [844] M. L. Ruggiero and N. Radicella, “Weak-field spherically symmetric solutions in $f(t)$ gravity,” *Phys. Rev.* **D91** (2015) 104014, [arXiv:1501.02198 \[gr-qc\]](#).
- [845] M. Jamil, D. Momeni, and R. Myrzakulov, “Resolution of dark matter problem in $f(t)$ gravity,” *Eur. Phys. J.* **C72** (2012) 2122, [arXiv:1209.1298 \[gr-qc\]](#).
- [846] S. Capozziello, P. A. Gonzalez, E. N. Saridakis, and Y. Vasquez, “Exact charged black-hole solutions in d -dimensional $f(t)$ gravity: torsion vs curvature analysis,” *JHEP* **02** (2013) 039, [arXiv:1210.1098 \[hep-th\]](#).
- [847] M. E. Rodrigues, M. J. S. Houndjo, J. Tossa, D. Momeni, and R. Myrzakulov, “Charged black holes in generalized teleparallel gravity,” *JCAP* **1311** (2013) 024, [arXiv:1306.2280 \[gr-qc\]](#).
- [848] A. Paliathanasis, S. Basilakos, E. N. Saridakis, S. Capozziello, K. Atazadeh, F. Darabi, and M. Tsamparlis, “New schwarzschild-like solutions in $f(t)$ gravity through noether symmetries,” *Phys. Rev.* **D89** (2014) 104042, [arXiv:1402.5935 \[gr-qc\]](#).
- [849] C. Bejarano, R. Ferraro, and M.-a. J. Guzmán, “Kerr geometry in $f(t)$ gravity,” *Eur. Phys. J.* **C75** (2015) 77, [arXiv:1412.0641 \[gr-qc\]](#).
- [850] G. Farrugia, J. L. Said, and M. L. Ruggiero, “Solar system tests in $f(t)$ gravity,” *Phys. Rev.* **D93** no. 10, (2016) 104034, [arXiv:1605.07614 \[gr-qc\]](#).
- [851] G. G. L. Nashed, “Schwarzschild-nut solution in modified teleparallel gravity theory,” *Astrophys. Space Sci.* **350** no. 2, (2014) 791–797.
- [852] G. G. L. Nashed, “Spherically symmetric geometries in and gravitational theories,” *Adv. High Energy Phys.* **2015** (2015) 821519.
- [853] G. G. L. Nashed and W. El Hanafy, “Analytic rotating black hole solutions in n -dimensional $f(t)$ gravity,” *Eur. Phys. J.* **C77** no. 2, (2017) 90, [arXiv:1612.05106 \[gr-qc\]](#).

- [854] D. Momeni, G. Abbas, S. Qaisar, Z. Zaz, and R. Myrzakulov, “Modelling of a compact anisotropic star as an anisotropic fluid sphere in $f(t)$ gravity,” *Can. J. Phys.* **96** no. 12, (2018) 1295–1303, [arXiv:1611.03727 \[gr-qc\]](#).
- [855] A. M. Awad, S. Capozziello, and G. G. L. Nashed, “ d -dimensional charged anti-de-sitter black holes in $f(t)$ gravity,” *JHEP* **07** (2017) 136, [arXiv:1706.01773 \[gr-qc\]](#).
- [856] A. K. Ahmed, M. Azreg-Aïnou, S. Bahamonde, S. Capozziello, and M. Jamil, “Astrophysical flows near $f(t)$ gravity black holes,” *Eur. Phys. J. C* **76** no. 5, (2016) 269, [arXiv:1602.03523 \[gr-qc\]](#).
- [857] C. L. MacLeod *et al.*, “A description of quasar variability measured using repeated sdss and poss imaging,” *Astrophys. J.* **753** (2012) 106, [arXiv:1112.0679 \[astro-ph.CO\]](#).
- [858] A. V. Kpadonou, M. J. S. Houndjo, and M. E. Rodrigues, “Tolman-oppenheimer-volkoff equations and their implications for the structures of relativistic stars in $f(t)$ gravity,” *Astrophys. Space Sci.* **361** no. 7, (2016) 244, [arXiv:1509.08771 \[gr-qc\]](#).
- [859] L. Iorio, N. Radicella, and M. L. Ruggiero, “Constraining $f(t)$ gravity in the solar system,” *JCAP* **1508** no. 08, (2015) 021, [arXiv:1505.06996 \[gr-qc\]](#).
- [860] C. Bejarano, R. Ferraro, and M.-a. J. Guzmán, “McVittie solution in $f(t)$ gravity,” *Eur. Phys. J. C* **77** no. 12, (2017) 825, [arXiv:1707.06637 \[gr-qc\]](#).
- [861] S. Chakrabarti, J. L. Said, and G. Farrugia, “Some aspects of reconstruction using a scalar field in $f(t)$ gravity,” *Eur. Phys. J. C* **77** no. 12, (2017) 815, [arXiv:1711.04423 \[gr-qc\]](#).
- [862] G. G. L. Nashed and S. Capozziello, “Charged anti-de sitter btz black holes in maxwell- $f(t)$ gravity,” *Int. J. Mod. Phys. A* **33** no. 13, (2018) 1850076, [arXiv:1710.06620 \[gr-qc\]](#).
- [863] A. Behboodi, S. Akhshabi, and K. Nozari, “Scalar perturbation potentials in a homogeneous and isotropic weitzenböck geometry,” *Int. J. Mod. Phys. D* **25** no. 07, (2016) 1650087, [arXiv:1507.08419 \[gr-qc\]](#).
- [864] K. Bamba, M. Jamil, D. Momeni, and R. Myrzakulov, “Generalized second law of thermodynamics in $f(t)$ gravity with entropy corrections,” *Astrophys. Space Sci.* **344** (2013) 259–267, [arXiv:1202.6114 \[physics.gen-ph\]](#).
- [865] H. Wei, “Dynamics of teleparallel dark energy,” *Phys. Lett. B* **712** (2012) 430–436, [arXiv:1109.6107 \[gr-qc\]](#).
- [866] R. Myrzakulov, “Accelerating universe from $f(t)$ gravity,” *Eur. Phys. J. C* **71** (2011) 1752, [arXiv:1006.1120 \[gr-qc\]](#).
- [867] U. Debnath, “Reconstructing $f(r)$, $f(g)$, $f(t)$, and einstein-aether gravities from entropy-corrected (m, n) type pilgrim dark energy,” *Astrophys. Space Sci.* **355** (2015) 405–411.
- [868] M. Hohmann, L. Jarv, and U. Ualikhanova, “Dynamical systems approach and generic properties of $f(t)$ cosmology,” *Phys. Rev. D* **96** no. 4, (2017) 043508, [arXiv:1706.02376 \[gr-qc\]](#).
- [869] W. El Hanafy and G. L. Nashed, “Reconstruction of $f(t)$ -gravity in the absence of matter,” *Astrophys. Space Sci.* **361** no. 6, (2016) 197, [arXiv:1410.2467 \[hep-th\]](#).
- [870] S. Capozziello, R. D’Agostino, and O. Luongo, “Model-independent reconstruction of $f(t)$ teleparallel cosmology,” *Gen. Rel. Grav.* **49** no. 11, (2017) 141, [arXiv:1706.02962 \[gr-qc\]](#).
- [871] A. Aviles, A. Bravetti, S. Capozziello, and O. Luongo, “Cosmographic reconstruction of $f(\mathcal{T})$ cosmology,” *Phys. Rev. D* **87** no. 6, (2013) 064025, [arXiv:1302.4871 \[gr-qc\]](#).
- [872] G. G. L. Nashed, W. El Hanafy, and S. K. Ibrahim, “Graceful exit inflation in $f(t)$ gravity,” [arXiv:1411.3293 \[gr-qc\]](#).
- [873] K. Bamba, S. Nojiri, and S. D. Odintsov, “Effective $f(t)$ gravity from the higher-dimensional kaluza-klein and randall-sundrum theories,” *Phys. Lett. B* **725** (2013) 368–371, [arXiv:1304.6191 \[gr-qc\]](#).

- [874] M. E. Rodrigues, M. H. Daouda, M. J. S. Houndjo, R. Myrzakulov, and M. Sharif, “Inhomogeneous universe in $f(t)$ theory,” *Grav. Cosmol.* **20** no. 2, (2014) 80–89, [arXiv:1205.0565 \[gr-qc\]](#).
- [875] K. K. Yerzhanov, S. R. Myrzakul, I. I. Kulnazarov, and R. Myrzakulov, “Accelerating cosmology in $f(t)$ gravity with scalar field,” [arXiv:1006.3879 \[gr-qc\]](#).
- [876] S.-H. Chen, J. B. Dent, S. Dutta, and E. N. Saridakis, “Cosmological perturbations in $f(t)$ gravity,” *Phys. Rev.* **D83** (2011) 023508, [arXiv:1008.1250 \[astro-ph.CO\]](#).
- [877] P. Wu and H. W. Yu, “ $f(t)$ models with phantom divide line crossing,” *Eur. Phys. J.* **C71** (2011) 1552, [arXiv:1008.3669 \[gr-qc\]](#).
- [878] V. F. Cardone, N. Radicella, and S. Camera, “Accelerating $f(t)$ gravity models constrained by recent cosmological data,” *Phys. Rev.* **D85** (2012) 124007, [arXiv:1204.5294 \[astro-ph.CO\]](#).
- [879] M. Jamil, K. Yesmakhanova, D. Momeni, and R. Myrzakulov, “Phase space analysis of interacting dark energy in $f(t)$ cosmology,” *Central Eur. J. Phys.* **10** (2012) 1065–1071, [arXiv:1207.2735 \[gr-qc\]](#).
- [880] K. Bamba, C.-Q. Geng, and L.-W. Luo, “Large-scale magnetic fields from inflation in teleparallel gravity,” *JPS Conf. Proc.* **1** (2014) 013123, [arXiv:1307.7448 \[astro-ph.CO\]](#).
- [881] M. U. Farooq, M. Jamil, D. Momeni, and R. Myrzakulov, “Reconstruction of $f(t)$ and $f(r)$ gravity according to (m, n) -type holographic dark energy,” *Can. J. Phys.* **91** (2013) 703–708, [arXiv:1306.1637 \[astro-ph.CO\]](#).
- [882] E. N. Saridakis and S. V. Sushkov, “Quintessence and phantom cosmology with non-minimal derivative coupling,” *Phys. Rev. D* **81** (2010) 083510, [arXiv:1002.3478 \[gr-qc\]](#).
- [883] I. G. Salako, M. E. Rodrigues, A. V. Kpadonou, M. J. S. Houndjo, and J. Tossa, “ λ cdm model in $f(t)$ gravity: Reconstruction, thermodynamics and stability,” *JCAP* **1311** (2013) 060, [arXiv:1307.0730 \[gr-qc\]](#).
- [884] A. Awad, W. El Hanafy, G. G. L. Nashed, S. D. Odintsov, and V. K. Oikonomou, “Constant-roll inflation in $f(t)$ teleparallel gravity,” *JCAP* **07** (2018) 026, [arXiv:1710.00682 \[gr-qc\]](#).
- [885] W. El Hanafy and G. G. L. Nashed, “The hidden flat like universe ii: Quasi inverse power law inflation by $f(t)$ gravity,” *Astrophys. Space Sci.* **361** no. 8, (2016) 266, [arXiv:1510.02337 \[gr-qc\]](#).
- [886] W. El Hanafy and G. G. L. Nashed, “Lorenz gauge fixing of $f(t)$ teleparallel cosmology,” *Int. J. Mod. Phys.* **D26** no. 14, (2017) 1750154, [arXiv:1707.01802 \[gr-qc\]](#).
- [887] J. D. Barrow, “Graduated inflationary universes,” *Phys. Lett. B* **235** (1990) 40–43.
- [888] A. Paliathanasis, J. L. Said, and J. D. Barrow, “Stability of the kasner universe in $f(t)$ gravity,” *Phys. Rev.* **D97** no. 4, (2018) 044008, [arXiv:1709.03432 \[gr-qc\]](#).
- [889] S. Capozziello, O. Luongo, and E. N. Saridakis, “Transition redshift in $f(t)$ cosmology and observational constraints,” *Phys. Rev.* **D91** no. 12, (2015) 124037, [arXiv:1503.02832 \[gr-qc\]](#).
- [890] H. Johnston *et al.*, “Kids+gama: Intrinsic alignment model constraints for current and future weak lensing cosmology,” *Astron. Astrophys.* **624** (2019) A30, [arXiv:1811.09598 \[astro-ph.CO\]](#).
- [891] C. M. Hirata and U. Seljak, “Intrinsic alignment-lensing interference as a contaminant of cosmic shear,” *Phys. Rev. D* **70** (2004) 063526, [arXiv:astro-ph/0406275](#). [Erratum: *Phys.Rev.D* 82, 049901 (2010)].
- [892] M. C. Fortuna, H. Hoekstra, B. Joachimi, H. Johnston, N. E. Chisari, C. Georgiou, and C. Mahony, “The halo model as a versatile tool to predict intrinsic alignments,” *Mon. Not. Roy. Astron. Soc.* **501** no. 2, (2021) 2983–3002, [arXiv:2003.02700 \[astro-ph.CO\]](#).
- [893] S. Samuroff, R. Mandelbaum, and J. Blazek, “Advances in constraining intrinsic alignment models with hydrodynamic simulations,” *Mon. Not. Roy. Astron. Soc.* **508** no. 1, (2021) 637–664, [arXiv:2009.10735 \[astro-ph.CO\]](#).

- [894] N. E. Chisari, S. Codis, C. Laigle, Y. Dubois, C. Pichon, J. Devriendt, A. Slyz, L. Miller, R. Gavazzi, and K. Benabed, “Intrinsic alignments of galaxies in the horizon-agn cosmological hydrodynamical simulation,” *Mon. Not. Roy. Astron. Soc.* **454** no. 3, (2015) 2736–2753, [arXiv:1507.07843 \[astro-ph.CO\]](#).
- [895] B. Joachimi, E. Semboloni, S. Hilbert, P. E. Bett, J. Hartlap, H. Hoekstra, and P. Schneider, “Intrinsic galaxy shapes and alignments ii: Modelling the intrinsic alignment contamination of weak lensing surveys,” *Mon. Not. Roy. Astron. Soc.* **436** (2013) 819, [arXiv:1305.5791 \[astro-ph.CO\]](#).
- [896] D. Kirk, A. Rassat, O. Host, and S. Bridle, “The cosmological impact of intrinsic alignment model choice for cosmic shear,” *Mon. Not. Roy. Astron. Soc.* **424** (2012) 1647, [arXiv:1112.4752 \[astro-ph.CO\]](#).
- [897] D. Kirk, S. Bridle, and M. Schneider, “The impact of intrinsic alignments: Cosmological constraints from a joint analysis of cosmic shear and galaxy survey data,” *Mon. Not. Roy. Astron. Soc.* **408** (2010) 1502–1515, [arXiv:1001.3787 \[astro-ph.CO\]](#).
- [898] Z. Vlah, N. E. Chisari, and F. Schmidt, “An eft description of galaxy intrinsic alignments,” *JCAP* **01** (2020) 025, [arXiv:1910.08085 \[astro-ph.CO\]](#).
- [899] J. Blazek, M. McQuinn, and U. Seljak, “Testing the tidal alignment model of galaxy intrinsic alignment,” *JCAP* **05** (2011) 010, [arXiv:1101.4017 \[astro-ph.CO\]](#).
- [900] **LSST Dark Energy Science** Collaboration, C. D. Leonard and R. Mandelbaum, “Measuring the scale dependence of intrinsic alignments using multiple shear estimates,” *Mon. Not. Roy. Astron. Soc.* **479** no. 1, (2018) 1412–1426, [arXiv:1802.08263 \[astro-ph.CO\]](#).
- [901] J. Blazek, Z. Vlah, and U. Seljak, “Tidal alignment of galaxies,” *JCAP* **08** (2015) 015, [arXiv:1504.02510 \[astro-ph.CO\]](#).
- [902] J. Blazek, N. MacCrann, M. A. Troxel, and X. Fang, “Beyond linear galaxy alignments,” *Phys. Rev. D* **100** no. 10, (2019) 103506, [arXiv:1708.09247 \[astro-ph.CO\]](#).
- [903] E. Krause, T. Eifler, and J. Blazek, “The impact of intrinsic alignment on current and future cosmic shear surveys,” *Mon. Not. Roy. Astron. Soc.* **456** no. 1, (2016) 207–222, [arXiv:1506.08730 \[astro-ph.CO\]](#).
- [904] K. Bamba, “Cosmological issues in $f(t)$ gravity theory,” in *Proceedings, International Conference on Relativistic Astrophysics : Celebrating 100 Years of Einstein’s Theory of General Relativity: Lahore, Pakistan, 10-14 Feb 2015*, pp. 39–47. 2015. [arXiv:1504.04457 \[gr-qc\]](#).
<https://inspirehep.net/record/1361889/files/arXiv:1504.04457.pdf>.
- [905] R. C. Nunes, “Structure formation in $f(t)$ gravity and a solution for h_0 tension,” *JCAP* **05** (2018) 052, [arXiv:1802.02281 \[gr-qc\]](#).
- [906] A. Aslam, M. Jamil, and R. Myrzakulov, “Noether gauge symmetry for the bianchi type i model in $f(t)$ gravity,” *Phys. Scripta* **88** (2013) 025003, [arXiv:1308.0325 \[gr-qc\]](#).
- [907] D. Milaković, *Fundamental physics and cosmology using astronomical laser frequency combs*. PhD thesis, Ludwig Maximilian University of Munich, September, 2020.
- [908] M. Jamil, D. Momeni, R. Myrzakulov, and P. Rudra, “Statefinder analysis of $f(t)$ cosmology,” *J. Phys. Soc. Jap.* **81** (2012) 114004, [arXiv:1211.0018 \[physics.gen-ph\]](#).
- [909] S. Nesseris, S. Basilakos, E. N. Saridakis, and L. Perivolaropoulos, “Viable $f(t)$ models are practically indistinguishable from λ cdm,” *Phys. Rev.* **D88** (2013) 103010, [arXiv:1308.6142 \[astro-ph.CO\]](#).
- [910] M. Jamil, D. Momeni, and R. Myrzakulov, “Warm intermediate inflation in $f(t)$ gravity,” *Int. J. Theor. Phys.* **54** no. 4, (2015) 1098–1112, [arXiv:1309.3269 \[gr-qc\]](#).
- [911] K. Bamba, G. G. L. Nashed, W. El Hanafy, and S. K. Ibraheem, “Bounce inflation in $f(t)$ cosmology: A unified inflaton-quintessence field,” *Phys. Rev.* **D94** no. 8, (2016) 083513, [arXiv:1604.07604 \[gr-qc\]](#).
- [912] S. B. Nassur, C. Ainamon, M. J. S. Houndjo, and J. Tossa, “Unimodular $f(t)$ gravity,” *Eur. Phys. J. Plus* **131** no. 12, (2016) 420, [arXiv:1602.03172 \[gr-qc\]](#).

- [913] K. Bamba, S. D. Odintsov, and E. N. Saridakis, “Inflationary cosmology in unimodular $f(t)$ gravity,” *Mod. Phys. Lett. A* **32** no. 21, (2017) 1750114, [arXiv:1605.02461 \[gr-qc\]](#).
- [914] M. E. Rodrigues, M. J. S. Houndjo, D. Saez-Gomez, and F. Rahaman, “Anisotropic universe models in $f(t)$ gravity,” *Phys. Rev. D* **86** (2012) 104059, [arXiv:1209.4859 \[gr-qc\]](#).
- [915] R. Zheng and Q.-G. Huang, “Growth factor in $f(t)$ gravity,” *JCAP* **1103** (2011) 002, [arXiv:1010.3512 \[gr-qc\]](#).
- [916] J. B. Dent, S. Dutta, and E. N. Saridakis, “ $f(t)$ gravity mimicking dynamical dark energy. background and perturbation analysis,” *JCAP* **1101** (2011) 009, [arXiv:1010.2215 \[astro-ph.CO\]](#).
- [917] J. L. Said, “Reconstruction from scalar–tensor theory and the inhomogeneous equation of state in $f(t)$ gravity,” *Eur. Phys. J. C* **77** no. 12, (2017) 883, [arXiv:1712.07592 \[gr-qc\]](#).
- [918] A. Awad, W. El Hanafy, G. G. L. Nashed, and E. N. Saridakis, “Phase portraits of general $f(t)$ cosmology,” *JCAP* **1802** no. 02, (2018) 052, [arXiv:1710.10194 \[gr-qc\]](#).
- [919] E. Güdekli, A. Myrzakul, and R. Myrzakulov, “Teleparallelism by inhomogeneous dark fluid,” *Astrophys. Space Sci.* **359** no. 2, (2015) 64, [arXiv:1312.1112 \[gr-qc\]](#).
- [920] R. Myrzakulov, D. Saez-Gomez, and P. Tsyba, “Cosmological solutions in $f(t)$ gravity with the presence of spinor fields,” *Int. J. Geom. Meth. Mod. Phys.* **12** no. 02, (2014) 1550023, [arXiv:1311.5261 \[gr-qc\]](#).
- [921] K. Bamba, C.-Q. Geng, C.-C. Lee, and L.-W. Luo, “Equation of state for dark energy in $f(t)$ gravity,” *JCAP* **1101** (2011) 021, [arXiv:1011.0508 \[astro-ph.CO\]](#).
- [922] K. Bamba, J. de Haro, and S. D. Odintsov, “Future singularities and teleparallelism in loop quantum cosmology,” *JCAP* **1302** (2013) 008, [arXiv:1211.2968 \[gr-qc\]](#).
- [923] S. Capozziello, V. F. Cardone, H. Farajollahi, and A. Ravanpak, “Cosmography in $f(t)$ -gravity,” *Phys. Rev. D* **84** (2011) 043527, [arXiv:1108.2789 \[astro-ph.CO\]](#).
- [924] Y.-P. Wu and C.-Q. Geng, “Matter density perturbations in modified teleparallel theories,” *JHEP* **11** (2012) 142, [arXiv:1211.1778 \[gr-qc\]](#).
- [925] Y.-F. Cai, S.-H. Chen, J. B. Dent, S. Dutta, and E. N. Saridakis, “Matter bounce cosmology with the $f(t)$ gravity,” *Class. Quant. Grav.* **28** (2011) 215011, [arXiv:1104.4349 \[astro-ph.CO\]](#).
- [926] V. K. Oikonomou and E. N. Saridakis, “ $f(t)$ gravitational baryogenesis,” *Phys. Rev. D* **94** no. 12, (2016) 124005, [arXiv:1607.08561 \[gr-qc\]](#).
- [927] S. Basilakos, S. Capozziello, M. De Laurentis, A. Paliathanasis, and M. Tsamparlis, “Noether symmetries and analytical solutions in $f(t)$ -cosmology: A complete study,” *Phys. Rev. D* **88** (2013) 103526, [arXiv:1311.2173 \[gr-qc\]](#).
- [928] A. Paliathanasis, J. D. Barrow, and P. G. L. Leach, “Cosmological solutions of $f(t)$ gravity,” *Phys. Rev. D* **94** no. 2, (2016) 023525, [arXiv:1606.00659 \[gr-qc\]](#).
- [929] S. Chattopadhyay and A. Pasqua, “Reconstruction of $f(t)$ gravity from the holographic dark energy,” *Astrophys. Space Sci.* **344** (2013) 269–274, [arXiv:1211.2707 \[physics.gen-ph\]](#).
- [930] G. R. Bengochea and R. Ferraro, “Dark torsion as the cosmic speed-up,” *Phys. Rev. D* **79** (2009) 124019, [arXiv:0812.1205 \[astro-ph\]](#).
- [931] E. V. Linder, “Einstein’s other gravity and the acceleration of the universe,” *Phys. Rev. D* **81** (2010) 127301, [arXiv:1005.3039 \[astro-ph.CO\]](#). [Erratum: *Phys. Rev. D* **82**, 109902(2010)].
- [932] E. J. Copeland, M. Kopp, A. Padilla, P. M. Saffin, and C. Skordis, “Dark energy after gw170817 revisited,” *Phys. Rev. Lett.* **122** no. 6, (2019) 061301, [arXiv:1810.08239 \[gr-qc\]](#).
- [933] B. Li, T. P. Sotiriou, and J. D. Barrow, “ $f(t)$ gravity and local lorentz invariance,” *Phys. Rev. D* **83** (2011) 064035, [arXiv:1010.1041 \[gr-qc\]](#).

- [934] B. Li, T. P. Sotiriou, and J. D. Barrow, “Large-scale structure in $f(t)$ gravity,” *Phys. Rev.* **D83** (2011) 104017, [arXiv:1103.2786 \[astro-ph.CO\]](#).
- [935] R. C. Nunes, S. Pan, and E. N. Saridakis, “New observational constraints on $f(t)$ gravity from cosmic chronometers,” *JCAP* **1608** no. 08, (2016) 011, [arXiv:1606.04359 \[gr-qc\]](#).
- [936] K. Bamba and C.-Q. Geng, “Thermodynamics of cosmological horizons in $f(t)$ gravity,” *JCAP* **1111** (2011) 008, [arXiv:1109.1694 \[gr-qc\]](#).
- [937] Y.-P. Wu and C.-Q. Geng, “Primordial fluctuations within teleparallelism,” *Phys. Rev.* **D86** (2012) 104058, [arXiv:1110.3099 \[gr-qc\]](#).
- [938] R. Myrzakulov, “Cosmology of $f(t)$ gravity and k-essence,” *Entropy* **14** (2012) 1627–1651, [arXiv:1212.2155 \[gr-qc\]](#).
- [939] K. Izumi and Y. C. Ong, “Cosmological perturbation in $f(t)$ gravity revisited,” *JCAP* **1306** (2013) 029, [arXiv:1212.5774 \[gr-qc\]](#).
- [940] K. Izumi, J.-A. Gu, and Y. C. Ong, “Acausality and nonunique evolution in generalized teleparallel gravity,” *Phys. Rev.* **D89** no. 8, (2014) 084025, [arXiv:1309.6461 \[gr-qc\]](#).
- [941] V. K. Oikonomou, “Viability of the intermediate inflation scenario with $f(t)$ gravity,” *Phys. Rev.* **D95** no. 8, (2017) 084023, [arXiv:1703.10515 \[gr-qc\]](#).
- [942] S. Capozziello, G. Lambiase, and E. N. Saridakis, “Constraining $f(t)$ teleparallel gravity by big bang nucleosynthesis,” *Eur. Phys. J.* **C77** no. 9, (2017) 576, [arXiv:1702.07952 \[astro-ph.CO\]](#).
- [943] W. El Hanafy and G. G. L. Nashed, “Generic phase portrait analysis of finite-time singularities and generalized teleparallel gravity,” *Chin. Phys.* **C41** no. 12, (2017) 125103, [arXiv:1702.05786 \[gr-qc\]](#).
- [944] W. El Hanafy and G. G. L. Nashed, “The hidden flat like universe,” *Eur. Phys. J.* **C75** (2015) 279, [arXiv:1409.7199 \[hep-th\]](#).
- [945] S. Chattopadhyay, “Qcd ghost reconstruction of $f(t)$ gravity in flat frw universe,” *Eur. Phys. J. Plus* **129** (2014) 82, [arXiv:1403.8116 \[gr-qc\]](#).
- [946] G. G. L. Nashed and W. El Hanafy, “A built-in inflation in the $f(t)$ -cosmology,” *Eur. Phys. J.* **C74** (2014) 3099, [arXiv:1403.0913 \[gr-qc\]](#).
- [947] A. de la Cruz-Dombriz, P. K. S. Dunsby, and D. Saez-Gomez, “Junction conditions in extended teleparallel gravities,” *JCAP* **12** (2014) 048, [arXiv:1406.2334 \[gr-qc\]](#).
- [948] H. Wei, X.-J. Guo, and L.-F. Wang, “Noether symmetry in $f(t)$ theory,” *Phys. Lett.* **B707** (2012) 298–304, [arXiv:1112.2270 \[gr-qc\]](#).
- [949] J.-T. Li, C.-C. Lee, and C.-Q. Geng, “Einstein static universe in exponential $f(t)$ gravity,” *Eur. Phys. J.* **C73** no. 2, (2013) 2315, [arXiv:1302.2688 \[gr-qc\]](#).
- [950] K. Bamba, R. Myrzakulov, S. Nojiri, and S. D. Odintsov, “Reconstruction of $f(t)$ gravity: Rip cosmology, finite-time future singularities and thermodynamics,” *Phys. Rev.* **D85** (2012) 104036, [arXiv:1202.4057 \[gr-qc\]](#).
- [951] M. Hamani Daouda, M. E. Rodrigues, and M. J. S. Houndjo, “Reconstruction of $f(t)$ gravity according to holographic dark energy,” *Eur. Phys. J.* **C72** (2012) 1893, [arXiv:1111.6575 \[gr-qc\]](#).
- [952] G. Farrugia and J. L. Said, “Stability of the flat flrw metric in $f(t)$ gravity,” *Phys. Rev.* **D94** no. 12, (2016) 124054, [arXiv:1701.00134 \[gr-qc\]](#).
- [953] R. C. Nunes, A. Bonilla, S. Pan, and E. N. Saridakis, “Observational constraints on $f(t)$ gravity from varying fundamental constants,” *Eur. Phys. J.* **C77** no. 4, (2017) 230, [arXiv:1608.01960 \[gr-qc\]](#).
- [954] S. Capozziello, M. De Laurentis, and K. F. Dialektopoulos, “Noether symmetries in gauss–bonnet–teleparallel cosmology,” *Eur. Phys. J. C* **76** no. 11, (2016) 629, [arXiv:1609.09289 \[gr-qc\]](#).

- [955] K. Bamba, S. Nojiri, and S. D. Odintsov, “Trace-anomaly driven inflation in $f(t)$ gravity and in minimal massive bigravity,” *Phys. Lett. B* **731** (2014) 257–264, [arXiv:1401.7378 \[gr-qc\]](#).
- [956] M. E. RODRIGUES, M. J. S. HOUNDJIO, D. MOMENI, and R. MYRZAKULOV, “Planar symmetry in $f(t)$ gravity,” *International Journal of Modern Physics D* **22** no. 08, (2013) 1350043.
- [957] A. Jawad, D. Momeni, S. Rani, and R. Myrzakulov, “Dynamical instability of cylindrical symmetric collapsing star in generalized teleparallel gravity,” *Astrophys. Space Sci.* **361** no. 4, (2016) 141, [arXiv:1511.03655 \[gr-qc\]](#).
- [958] M. J. S. Houndjo, D. Momeni, and R. Myrzakulov, “Cylindrical solutions in modified $f(t)$ gravity,” *Int. J. Mod. Phys. D* **21** (2012) 1250093, [arXiv:1206.3938 \[physics.gen-ph\]](#).
- [959] P. Chen, K. Izumi, J. M. Nester, and Y. C. Ong, “Remnant symmetry, propagation and evolution in $f(t)$ gravity,” *Phys. Rev. D* **91** no. 6, (2015) 064003, [arXiv:1412.8383 \[gr-qc\]](#).
- [960] R. Ferraro and M. J. Guzmán, “Hamiltonian formalism for $f(t)$ gravity,” *Phys. Rev. D* **97** no. 10, (2018) 104028, [arXiv:1802.02130 \[gr-qc\]](#).
- [961] R. Ferraro and F. Fiorini, “Remnant group of local lorentz transformations in $\{f(t)\}$ theories,” *Phys. Rev. D* **91** no. 6, (2015) 064019, [arXiv:1412.3424 \[gr-qc\]](#).
- [962] Y. C. Ong, K. Izumi, J. M. Nester, and P. Chen, “Problems with propagation and time evolution in $f(t)$ gravity,” *Phys. Rev. D* **88** (2013) 024019, [arXiv:1303.0993 \[gr-qc\]](#).
- [963] M. Li, R.-X. Miao, and Y.-G. Miao, “Degrees of freedom of $f(t)$ gravity,” *JHEP* **07** (2011) 108, [arXiv:1105.5934 \[hep-th\]](#).
- [964] M. Jamil, D. Momeni, and R. Myrzakulov, “Energy conditions in generalized teleparallel gravity models,” *Gen. Rel. Grav.* **45** (2013) 263–273, [arXiv:1211.3740 \[physics.gen-ph\]](#).
- [965] D. Liu and M. J. Reboucas, “Energy conditions bounds on $f(t)$ gravity,” *Phys. Rev. D* **86** (2012) 083515, [arXiv:1207.1503 \[astro-ph.CO\]](#).
- [966] R. Ferraro and F. Fiorini, “Non trivial frames for $f(t)$ theories of gravity and beyond,” *Phys. Lett. B* **702** (2011) 75–80, [arXiv:1103.0824 \[gr-qc\]](#).
- [967] N. Tamanini and C. G. Boehmer, “Good and bad tetrads in $f(t)$ gravity,” *Phys. Rev. D* **86** (2012) 044009, [arXiv:1204.4593 \[gr-qc\]](#).
- [968] R. Ferraro, “ $f(r)$ and $f(t)$ theories of modified gravity,” *AIP Conf. Proc.* **1471** (2012) 103–110, [arXiv:1204.6273 \[gr-qc\]](#).
- [969] N. Tamanini and C. G. Böhmer, “Definition of good tetrads for $f(t)$ gravity,” in *13th Marcel Grossmann Meeting on Recent Developments in Theoretical and Experimental General Relativity, Astrophysics, and Relativistic Field Theories*, pp. 1282–1284. 2015. [arXiv:1304.0672 \[gr-qc\]](#).
- [970] M. Krššák and E. N. Saridakis, “The covariant formulation of $f(t)$ gravity,” *Class. Quant. Grav.* **33** no. 11, (2016) 115009, [arXiv:1510.08432 \[gr-qc\]](#).
- [971] Y.-F. Cai, C. Li, E. N. Saridakis, and L. Xue, “ $f(t)$ gravity after gw170817 and grb170817a,” *Phys. Rev. D* **97** no. 10, (2018) 103513, [arXiv:1801.05827 \[gr-qc\]](#).
- [972] K. Bamba, S. Capozziello, M. De Laurentis, S. Nojiri, and D. Sáez-Gómez, “No further gravitational wave modes in $f(t)$ gravity,” *Phys. Lett. B* **727** (2013) 194–198, [arXiv:1309.2698 \[gr-qc\]](#).
- [973] C. G. Boehmer, T. Harko, and F. S. N. Lobo, “Wormhole geometries in modified teleparallel gravity and the energy conditions,” *Phys. Rev. D* **85** (2012) 044033, [arXiv:1110.5756 \[gr-qc\]](#).
- [974] A. Paliathanasis, “de sitter and scaling solutions in a higher-order modified teleparallel theory,” *JCAP* **1708** no. 08, (2017) 027, [arXiv:1706.02662 \[gr-qc\]](#).

- [975] S. Bahamonde and S. Capozziello, “Noether symmetry approach in $f(t, b)$ teleparallel cosmology,” *Eur. Phys. J.* **C77** no. 2, (2017) 107, [arXiv:1612.01299 \[gr-qc\]](#).
- [976] S. Bahamonde, M. Zubair, and G. Abbas, “Thermodynamics and cosmological reconstruction in $f(t, b)$ gravity,” *Phys. Dark Univ.* **19** (2018) 78–90, [arXiv:1609.08373 \[gr-qc\]](#).
- [977] S. Bahamonde, C. G. Böhmer, and M. Wright, “Modified teleparallel theories of gravity,” *Phys. Rev. D* **92** no. 10, (2015) 104042, [arXiv:1508.05120 \[gr-qc\]](#).
- [978] D. Momeni and R. Myrzakulov, “Cosmological reconstruction of $f(t, \mathcal{T})$ gravity,” *Int. J. Geom. Meth. Mod. Phys.* **11** no. 08, (2014) 1450077, [arXiv:1405.5863 \[gr-qc\]](#).
- [979] D. Saez-Gomez, C. S. Carvalho, F. S. N. Lobo, and I. Tereno, “Constraining $f(t, \mathcal{T})$ gravity models using type ia supernovae,” *Phys. Rev.* **D94** no. 2, (2016) 024034, [arXiv:1603.09670 \[gr-qc\]](#).
- [980] S. B. Nassur, M. J. S. Houndjo, A. V. Kpadonou, M. E. Rodrigues, and J. Tossa, “From the early to the late time universe within $f(t, \mathcal{T})$ gravity,” *Astrophys. Space Sci.* **360** no. 2, (2015) 60, [arXiv:1506.09161 \[gr-qc\]](#).
- [981] M. Pace and J. L. Said, “A perturbative approach to neutron stars in $f(t, \mathcal{T})$ gravity,” *Eur. Phys. J.* **C77** no. 5, (2017) 283, [arXiv:1704.03343 \[gr-qc\]](#).
- [982] G. Kofinas and E. N. Saridakis, “Teleparallel equivalent of gauss-bonnet gravity and its modifications,” *Phys. Rev.* **D90** (2014) 084044, [arXiv:1404.2249 \[gr-qc\]](#).
- [983] G. Kofinas, G. Leon, and E. N. Saridakis, “Dynamical behavior in $f(t, t_g)$ cosmology,” *Class. Quant. Grav.* **31** (2014) 175011, [arXiv:1404.7100 \[gr-qc\]](#).
- [984] G. Kofinas and E. N. Saridakis, “Cosmological applications of $f(t, t_g)$ gravity,” *Phys. Rev.* **D90** (2014) 084045, [arXiv:1408.0107 \[gr-qc\]](#).
- [985] A. de la Cruz-Dombriz, G. Farrugia, J. L. Said, and D. Saez-Gomez, “Cosmological reconstructed solutions in extended teleparallel gravity theories with a teleparallel gauss–bonnet term,” *Class. Quant. Grav.* **34** no. 23, (2017) 235011, [arXiv:1705.03867 \[gr-qc\]](#).
- [986] A. de la Cruz-Dombriz, G. Farrugia, J. L. Said, and D. Sáez-Chillón Gómez, “Cosmological bouncing solutions in extended teleparallel gravity theories,” *Phys. Rev. D* **97** no. 10, (2018) 104040, [arXiv:1801.10085 \[gr-qc\]](#).
- [987] S. Chattopadhyay, A. Jawad, D. Momeni, and R. Myrzakulov, “Pilgrim dark energy in $f(t, t_G)$ cosmology,” *Astrophys. Space Sci.* **353** no. 1, (2014) 279–292, [arXiv:1406.2307 \[gr-qc\]](#).
- [988] M. Sharif and K. Nazir, “Lorentz distributed noncommutative $f(t, t_g)$ wormhole solutions,” *Adv. High Energy Phys.* **2018** (2018) 7517634, [arXiv:1802.01446 \[gr-qc\]](#).
- [989] S. Waheed and M. Zubair, “Energy constraints and $f(t, t_G)$ cosmology,” *Astrophys. Space Sci.* **359** no. 2, (2015) 47, [arXiv:1503.07413 \[gr-qc\]](#).
- [990] M. Zubair and A. Jawad, “Generalized second law of thermodynamics in $f(t, t_G)$ gravity,” *Astrophys. Space Sci.* **360** (2015) 11, [arXiv:1505.07337 \[gr-qc\]](#).
- [991] A. Jawad, “Energy conditions in $f(t, t_g)$ gravity,” *The European Physical Journal Plus* **130** no. 5, (May, 2015) 94.
- [992] A. Jawad, “Cosmological reconstruction of pilgrim dark energy model in $f(t, t_g)$ gravity,” *Astrophysics and Space Science* **356** no. 1, (Mar, 2015) 119–127.
- [993] B. Mirza and F. Oboudiat, “Mimetic $f(t)$ teleparallel gravity and cosmology,” *Gen. Rel. Grav.* **51** no. 7, (2019) 96, [arXiv:1712.03363 \[gr-qc\]](#).
- [994] L. Sebastiani, S. Vagnozzi, and R. Myrzakulov, “Mimetic gravity: a review of recent developments and applications to cosmology and astrophysics,” *Adv. High Energy Phys.* **2017** (2017) 3156915, [arXiv:1612.08661 \[gr-qc\]](#).

- [995] J. G. Pereira, T. Vargas, and C. M. Zhang, “Axial vector torsion and the teleparallel kerr space-time,” *Class. Quant. Grav.* **18** (2001) 833–842, [arXiv:gr-qc/0102070](#) [gr-qc].
- [996] L. Fabbri, “A discussion on the most general torsion-gravity with electrodynamics for dirac spinor matter fields,” *Int. J. Geom. Meth. Mod. Phys.* **12** no. 09, (2015) 1550099, [arXiv:1409.2007](#) [gr-qc].
- [997] W.-H. Cheng, D.-C. Chern, and J. M. Nester, “Canonical analysis of the one-parameter teleparallel theory,” *Phys. Rev. D* **38** (Oct, 1988) 2656–2658.
<https://link.aps.org/doi/10.1103/PhysRevD.38.2656>.
- [998] S. Bahamonde, C. G. Böhm, and M. Krššák, “New classes of modified teleparallel gravity models,” *Phys. Lett. B* **775** (2017) 37–43, [arXiv:1706.04920](#) [gr-qc].
- [999] Yu. N. Obukhov and J. G. Pereira, “Metric affine approach to teleparallel gravity,” *Phys. Rev.* **D67** (2003) 044016, [arXiv:gr-qc/0212080](#) [gr-qc].
- [1000] A. A. Sousa and J. W. Maluf, “Black holes in 2+1 teleparallel theories of gravity,” *Prog. Theor. Phys.* **108** (2002) 457–470, [arXiv:gr-qc/0301079](#) [gr-qc].
- [1001] Yu. N. Obukhov and T. Vargas, “Goedel type solution in teleparallel gravity,” *Phys. Lett.* **A327** (2004) 365–373, [arXiv:gr-qc/0406016](#) [gr-qc].
- [1002] S. Bahamonde, S. Capozziello, and K. F. Dialektopoulos, “Constraining generalized non-local cosmology from noether symmetries,” *Eur. Phys. J.* **C77** no. 11, (2017) 722, [arXiv:1708.06310](#) [gr-qc].
- [1003] S. Bahamonde, S. Capozziello, M. Faizal, and R. C. Nunes, “Nonlocal teleparallel cosmology,” *Eur. Phys. J.* **C77** no. 9, (2017) 628, [arXiv:1709.02692](#) [gr-qc].
- [1004] K. Bamba, D. Momeni, and M. A. Ajmi, “Phase space description of nonlocal teleparallel gravity,” *Eur. Phys. J. C* **78** no. 9, (2018) 771, [arXiv:1711.10475](#) [gr-qc].
- [1005] P. Channuie and D. Momeni, “Noether symmetry in a nonlocal $f(t)$ gravity,” *Nucl. Phys. B* **935** (2018) 256–270, [arXiv:1712.07927](#) [gr-qc].
- [1006] J. M. Nester and H.-J. Yo, “Symmetric teleparallel general relativity,” *Chin. J. Phys.* **37** (1999) 113, [arXiv:gr-qc/9809049](#) [gr-qc].
- [1007] F. W. Hehl, J. D. McCrea, E. W. Mielke, and Y. Ne’eman, “Metric affine gauge theory of gravity: Field equations, noether identities, world spinors, and breaking of dilation invariance,” *Phys. Rept.* **258** (1995) 1–171, [arXiv:gr-qc/9402012](#) [gr-qc].
- [1008] J. Beltrán Jiménez, L. Heisenberg, and T. Koivisto, “Coincident general relativity,” *Phys. Rev. D* **98** no. 4, (2018) 044048, [arXiv:1710.03116](#) [gr-qc].
- [1009] A. Golovnev, T. Koivisto, and M. Sandstad, “On the covariance of teleparallel gravity theories,” *Class. Quant. Grav.* **34** no. 14, (2017) 145013, [arXiv:1701.06271](#) [gr-qc].
- [1010] J. Beltran Jimenez and T. S. Koivisto, “Spacetimes with vector distortion: Inflation from generalised weyl geometry,” *Phys. Lett.* **B756** (2016) 400–404, [arXiv:1509.02476](#) [gr-qc].
- [1011] A. Conroy and T. Koivisto, “The spectrum of symmetric teleparallel gravity,” *Eur. Phys. J. C* **78** no. 11, (2018) 923, [arXiv:1710.05708](#) [gr-qc].
- [1012] L. Järv, M. Rünkla, M. Saal, and O. Vilson, “Nonmetricity formulation of general relativity and its scalar-tensor extension,” *Phys. Rev. D* **97** no. 12, (2018) 124025, [arXiv:1802.00492](#) [gr-qc].
- [1013] V. A. Penas, “Deformed weitzenböck connections and teleparallel gravity,” (6, 2017) , [arXiv:1706.09008](#) [gr-qc].
- [1014] Z. Haghani, T. Harko, H. R. Sepangi, and S. Shahidi, “Weyl-cartan-weitzenboeck gravity as a generalization of teleparallel gravity,” *JCAP* **1210** (2012) 061, [arXiv:1202.1879](#) [gr-qc].

- [1015] J. Beltrán Jiménez, L. Heisenberg, and T. S. Koivisto, “Teleparallel palatini theories,” *JCAP* **08** (2018) 039, [arXiv:1803.10185](#) [gr-qc].
- [1016] S. Bahamonde, M. Marciu, and P. Rudra, “Generalised teleparallel quintom dark energy non-minimally coupled with the scalar torsion and a boundary term,” *JCAP* **04** (2018) 056, [arXiv:1802.09155](#) [gr-qc].
- [1017] C.-Q. Geng, C.-C. Lee, and E. N. Saridakis, “Observational constraints on teleparallel dark energy,” *JCAP* **1201** (2012) 002, [arXiv:1110.0913](#) [astro-ph.CO].
- [1018] G. Kofinas, E. Papantonopoulos, and E. N. Saridakis, “Self-gravitating spherically symmetric solutions in scalar-torsion theories,” *Phys. Rev.* **D91** no. 10, (2015) 104034, [arXiv:1501.00365](#) [gr-qc].
- [1019] C. Xu, E. N. Saridakis, and G. Leon, “Phase-space analysis of teleparallel dark energy,” *JCAP* **1207** (2012) 005, [arXiv:1202.3781](#) [gr-qc].
- [1020] C.-Q. Geng, C.-C. Lee, E. N. Saridakis, and Y.-P. Wu, ““teleparallel” dark energy,” *Phys. Lett. B* **704** (2011) 384–387, [arXiv:1109.1092](#) [hep-th].
- [1021] S. Bahamonde and M. Wright, “Teleparallel quintessence with a nonminimal coupling to a boundary term,” *Phys. Rev.* **D92** no. 8, (2015) 084034, [arXiv:1508.06580](#) [gr-qc]. [Erratum: *Phys. Rev.* **D93**, no. 10, 109901 (2016)].
- [1022] L. Jarv and A. Toporensky, “General relativity as an attractor for scalar-torsion cosmology,” *Phys. Rev.* **D93** no. 2, (2016) 024051, [arXiv:1511.03933](#) [gr-qc].
- [1023] S. Bahamonde, U. Camci, S. Capozziello, and M. Jamil, “Scalar-tensor teleparallel wormholes by noether symmetries,” *Phys. Rev.* **D94** no. 8, (2016) 084042, [arXiv:1608.03918](#) [gr-qc].
- [1024] M. Zubair, S. Bahamonde, and M. Jamil, “Generalized second law of thermodynamic in modified teleparallel theory,” *Eur. Phys. J.* **C77** no. 7, (2017) 472, [arXiv:1604.02996](#) [gr-qc].
- [1025] G. Gecim and Y. Kucukakca, “Scalar-tensor teleparallel gravity with boundary term by noether symmetries,” *Int. J. Geom. Meth. Mod. Phys.* **15** no. 09, (2018) 1850151, [arXiv:1708.07430](#) [gr-qc].
- [1026] G. Kofinas, “Hyperscaling violating black holes in scalar-torsion theories,” *Phys. Rev.* **D92** no. 8, (2015) 084022, [arXiv:1507.07434](#) [hep-th].
- [1027] Z.-C. Chen, Y. Wu, and H. Wei, “Post-newtonian approximation of teleparallel gravity coupled with a scalar field,” *Nucl. Phys.* **B894** (2015) 422–438, [arXiv:1410.7715](#) [gr-qc].
- [1028] M. Hohmann, L. Järv, and U. Ualikhanova, “Covariant formulation of scalar-torsion gravity,” *Phys. Rev. D* **97** no. 10, (2018) 104011, [arXiv:1801.05786](#) [gr-qc].
- [1029] M. Hohmann, “Scalar-torsion theories of gravity i: general formalism and conformal transformations,” *Phys. Rev. D* **98** no. 6, (2018) 064002, [arXiv:1801.06528](#) [gr-qc].
- [1030] D. Horvat, S. Ilijić, A. Kirin, and Z. Narančić, “Nonminimally coupled scalar field in teleparallel gravity: boson stars,” *Class. Quant. Grav.* **32** no. 3, (2015) 035023, [arXiv:1407.2067](#) [gr-qc].
- [1031] M. Jamil, D. Momeni, and R. Myrzakulov, “Stability of a non-minimally conformally coupled scalar field in $f(t)$ cosmology,” *Eur. Phys. J.* **C72** (2012) 2075, [arXiv:1208.0025](#) [gr-qc].
- [1032] M. A. Skugoreva, E. N. Saridakis, and A. V. Toporensky, “Dynamical features of scalar-torsion theories,” *Phys. Rev.* **D91** (2015) 044023, [arXiv:1412.1502](#) [gr-qc].
- [1033] M. Hohmann, “Scalar-torsion theories of gravity iii: analogue of scalar-tensor gravity and conformal invariants,” *Phys. Rev. D* **98** no. 6, (2018) 064004, [arXiv:1801.06531](#) [gr-qc].
- [1034] M. Hohmann and C. Pfeifer, “Scalar-torsion theories of gravity ii: $l(t, x, y, \phi)$ theory,” *Phys. Rev. D* **98** no. 6, (2018) 064003, [arXiv:1801.06536](#) [gr-qc].

- [1035] G. Otalora and E. N. Saridakis, “Modified teleparallel gravity with higher-derivative torsion terms,” *Phys. Rev.* **D94** no. 8, (2016) 084021, [arXiv:1605.04599 \[gr-qc\]](#).
- [1036] S. Carloni, F. S. N. Lobo, G. Otalora, and E. N. Saridakis, “Dynamical system analysis for a nonminimal torsion-matter coupled gravity,” *Phys. Rev.* **D93** (2016) 024034, [arXiv:1512.06996 \[gr-qc\]](#).
- [1037] H. Hildebrandt *et al.*, “Kids+viking-450: Cosmic shear tomography with optical and infrared data,” *Astron. Astrophys.* **633** (2020) A69, [arXiv:1812.06076 \[astro-ph.CO\]](#).
- [1038] F. Kiani and K. Nozari, “Energy conditions in $f(t, \theta)$ gravity and compatibility with a stable de sitter solution,” *Phys. Lett.* **B728** (2014) 554–561, [arXiv:1309.1948 \[gr-qc\]](#).
- [1039] T. Harko, F. S. N. Lobo, G. Otalora, and E. N. Saridakis, “Nonminimal torsion-matter coupling extension of $f(t)$ gravity,” *Phys. Rev.* **D89** (2014) 124036, [arXiv:1404.6212 \[gr-qc\]](#).
- [1040] M. Krššák, “Holographic renormalization in teleparallel gravity,” *Eur. Phys. J.* **C77** no. 1, (2017) 44, [arXiv:1510.06676 \[gr-qc\]](#).
- [1041] M. Krššák, “Variational problem and bigravity nature of modified teleparallel theories,” [arXiv:1705.01072 \[gr-qc\]](#).
- [1042] T. Koivisto, “On an integrable geometrical foundation of gravity,” 2018. [arXiv:1802.00650 \[gr-qc\]](#). <https://inspirehep.net/record/1652843/files/arXiv:1802.00650.pdf>.
- [1043] C. Escamilla-Rivera, “Precision cosmology in modified and extended theories of gravity: an insightful test,” in *9th International Workshop on Astronomy and Relativistic Astrophysics*. 10, 2020. [arXiv:2010.13838 \[gr-qc\]](#).
- [1044] C. Escamilla-Rivera and J. C. Fabris, “The possibility of a non-lagrangian theory of gravity,” *Universe* **7** no. 7, (2021) 230, [arXiv:2005.09739 \[gr-qc\]](#).
- [1045] **CMB-S4** Collaboration, K. N. Abazajian *et al.*, “Cmb-s4 science book, first edition,” (10, 2016) , [arXiv:1610.02743 \[astro-ph.CO\]](#).
- [1046] K. Abazajian *et al.*, “Cmb-s4 science case, reference design, and project plan,” [arXiv:1907.04473 \[astro-ph.IM\]](#).
- [1047] W. Yang, E. Di Valentino, S. Pan, S. Basilakos, and A. Paliathanasis, “Metastable dark energy models in light of *planck* 2018 data: Alleviating the h_0 tension,” *Phys. Rev. D* **102** no. 6, (2020) 063503, [arXiv:2001.04307 \[astro-ph.CO\]](#).
- [1048] S. Pan, G. S. Sharov, and W. Yang, “Field theoretic interpretations of interacting dark energy scenarios and recent observations,” *Phys. Rev. D* **101** no. 10, (2020) 103533, [arXiv:2001.03120 \[astro-ph.CO\]](#).
- [1049] N. Blinov and G. Marques-Tavares, “Interacting radiation after planck and its implications for the hubble tension,” *JCAP* **09** (2020) 029, [arXiv:2003.08387 \[astro-ph.CO\]](#).
- [1050] W. D. Kenworthy, D. Scolnic, and A. Riess, “The local perspective on the hubble tension: Local structure does not impact measurement of the hubble constant,” *Astrophys. J.* **875** no. 2, (2019) 145, [arXiv:1901.08681 \[astro-ph.CO\]](#).
- [1051] H.-Y. Wu and D. Huterer, “Sample variance in the local measurements of the hubble constant,” *Mon. Not. Roy. Astron. Soc.* **471** no. 4, (2017) 4946–4955, [arXiv:1706.09723 \[astro-ph.CO\]](#).
- [1052] L. A. Anchordoqui, “Hubble hullabaloo and string cosmology,” [arXiv:2005.01217 \[astro-ph.CO\]](#).
- [1053] A. Chudaykin, D. Gorbunov, and N. Nedelko, “Combined analysis of planck and sptpol data favors the early dark energy models,” *JCAP* **08** (2020) 013, [arXiv:2004.13046 \[astro-ph.CO\]](#).
- [1054] G. Alestas, L. Kazantzidis, and L. Perivolaropoulos, “ h_0 tension, phantom dark energy and cosmological parameter degeneracies,” *Phys. Rev. D* **101** no. 12, (2020) 123516, [arXiv:2004.08363 \[astro-ph.CO\]](#).

- [1055] D. Wang and D. Mota, “Can $f(t)$ gravity resolve the h_0 tension?,” *Phys. Rev. D* **102** no. 6, (2020) 063530, [arXiv:2003.10095 \[astro-ph.CO\]](#).
- [1056] M. Archidiacono, S. Gariazzo, C. Giunti, S. Hannestad, and T. Tram, “Sterile neutrino self-interactions: h_0 tension and short-baseline anomalies,” *JCAP* **12** (2020) 029, [arXiv:2006.12885 \[astro-ph.CO\]](#).
- [1057] F. Niedermann and M. S. Sloth, “Resolving the hubble tension with new early dark energy,” *Phys. Rev. D* **102** no. 6, (2020) 063527, [arXiv:2006.06686 \[astro-ph.CO\]](#).
- [1058] S. J. Clark, K. Vattis, and S. M. Koushiappas, “Cosmological constraints on late-universe decaying dark matter as a solution to the h_0 tension,” *Phys. Rev. D* **103** no. 4, (2021) 043014, [arXiv:2006.03678 \[astro-ph.CO\]](#).
- [1059] R.-G. Cai, J.-F. Ding, Z.-K. Guo, S.-J. Wang, and W.-W. Yu, “Do the observational data favor a local void?,” *Phys. Rev. D* **103** no. 12, (2021) 123539, [arXiv:2012.08292 \[astro-ph.CO\]](#).
- [1060] L. A. Anchordoqui and S. E. Perez Bergliaffa, “Hot thermal universe endowed with massive dark vector fields and the hubble tension,” *Phys. Rev. D* **100** no. 12, (2019) 123525, [arXiv:1910.05860 \[astro-ph.CO\]](#).
- [1061] M. Ballardini, M. Braglia, F. Finelli, D. Paoletti, A. A. Starobinsky, and C. Umiltà, “Scalar-tensor theories of gravity, neutrino physics, and the h_0 tension,” *JCAP* **10** (2020) 044, [arXiv:2004.14349 \[astro-ph.CO\]](#).
- [1062] E. Di Valentino, S. Pan, W. Yang, and L. A. Anchordoqui, “Touch of neutrinos on the vacuum metamorphosis: Is the h_0 solution back?,” *Phys. Rev. D* **103** no. 12, (2021) 123527, [arXiv:2102.05641 \[astro-ph.CO\]](#).
- [1063] E. Di Valentino, E. V. Linder, and A. Melchiorri, “ h_0 ex machina: Vacuum metamorphosis and beyond h_0 ,” *Phys. Dark Univ.* **30** (2020) 100733, [arXiv:2006.16291 \[astro-ph.CO\]](#).
- [1064] F. Melia, “Cosmological test using the hubble diagram of high- z quasars,” *Mon. Not. Roy. Astron. Soc.* **489** no. 1, (2019) 517–523, [arXiv:1907.13127 \[astro-ph.CO\]](#).
- [1065] G. Ye and Y.-S. Piao, “Is the hubble tension a hint of ads phase around recombination?,” *Phys. Rev. D* **101** no. 8, (2020) 083507, [arXiv:2001.02451 \[astro-ph.CO\]](#).
- [1066] T. Sekiguchi and T. Takahashi, “Early recombination as a solution to the h_0 tension,” *Phys. Rev. D* **103** no. 8, (2021) 083507, [arXiv:2007.03381 \[astro-ph.CO\]](#).
- [1067] **Planck** Collaboration, N. Aghanim *et al.*, “Planck 2018 results. i. overview and the cosmological legacy of planck,” *Astron. Astrophys.* **641** (2020) A1, [arXiv:1807.06205 \[astro-ph.CO\]](#).
- [1068] W. L. Freedman, B. F. Madore, T. Hoyt, I. S. Jang, R. Beaton, M. G. Lee, A. Monson, J. Neeley, and J. Rich, “Calibration of the tip of the red giant branch (trgb),” (2, 2020) , [arXiv:2002.01550 \[astro-ph.GA\]](#).
- [1069] G. Benevento, J. A. Kable, G. E. Addison, and C. L. Bennett, “An exploration of an early gravity transition in light of cosmological tensions,” (2, 2022) , [arXiv:2202.09356 \[astro-ph.CO\]](#).
- [1070] G. Benevento, W. Hu, and M. Raveri, “Can late dark energy transitions raise the hubble constant?,” *Phys. Rev. D* **101** no. 10, (2020) 103517, [arXiv:2002.11707 \[astro-ph.CO\]](#).
- [1071] K. Liao, A. Shafieloo, R. E. Keeley, and E. V. Linder, “Determining model-independent h_0 and consistency tests,” *Astrophys. J. Lett.* **895** no. 2, (2020) L29, [arXiv:2002.10605 \[astro-ph.CO\]](#).
- [1072] R. E. Keeley, A. Shafieloo, B. L’Huillier, and E. V. Linder, “Debiasing cosmic gravitational wave sirens,” *Mon. Not. Roy. Astron. Soc.* **491** no. 3, (2020) 3983–3989, [arXiv:1905.10216 \[astro-ph.CO\]](#).
- [1073] A. Shafieloo, R. E. Keeley, and E. V. Linder, “Will cosmic gravitational wave sirens determine the hubble constant?,” *JCAP* **03** (2020) 019, [arXiv:1812.07775 \[astro-ph.CO\]](#).

- [1074] R. D’Agostino and R. C. Nunes, “Measurements of h_0 in modified gravity theories: The role of lensed quasars in the late-time universe,” *Phys. Rev. D* **101** no. 10, (2020) 103505, [arXiv:2002.06381](#) [[astro-ph.CO](#)].
- [1075] S. Pan, W. Yang, and A. Paliathanasis, “Nonlinear interacting cosmological models after planck 2018 legacy release and the h_0 tension,” [arXiv:2002.03408](#) [[astro-ph.CO](#)].
- [1076] A. Perez, D. Sudarsky, and E. Wilson-Ewing, “Resolving the h_0 tension with diffusion,” *Gen. Rel. Grav.* **53** no. 1, (2021) 7, [arXiv:2001.07536](#) [[astro-ph.CO](#)].
- [1077] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2013 results. xxxi. consistency of the planck data,” *Astron. Astrophys.* **571** (2014) A31, [arXiv:1508.03375](#) [[astro-ph.CO](#)].
- [1078] H. Amirhashchi and A. K. Yadav, “Interacting dark sectors in anisotropic universe: Observational constraints and h_0 tension,” [arXiv:2001.03775](#) [[astro-ph.CO](#)].
- [1079] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2015 results. xix. constraints on primordial magnetic fields,” *Astron. Astrophys.* **594** (2016) A19, [arXiv:1502.01594](#) [[astro-ph.CO](#)].
- [1080] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2015 results. xiv. dark energy and modified gravity,” *Astron. Astrophys.* **594** (2016) A14, [arXiv:1502.01590](#) [[astro-ph.CO](#)].
- [1081] L. A. Anchordoqui, I. Antoniadis, D. Lüst, J. F. Soriano, and T. R. Taylor, “ h_0 tension and the string swampland,” *Phys. Rev. D* **101** (2020) 083532, [arXiv:1912.00242](#) [[hep-th](#)].
- [1082] L. A. Anchordoqui, I. Antoniadis, D. Lüst, and J. F. Soriano, “Dark energy, ricci-nonflat spaces, and the swampland,” *Phys. Lett. B* **816** (2021) 136199, [arXiv:2005.10075](#) [[hep-th](#)].
- [1083] S. Weinberg, “Goldstone bosons as fractional cosmic neutrinos,” *Phys. Rev. Lett.* **110** no. 24, (2013) 241301, [arXiv:1305.1971](#) [[astro-ph.CO](#)].
- [1084] L. A. Anchordoqui and H. Goldberg, “Neutrino cosmology after wmap 7-year data and lhc first z' bounds,” *Phys. Rev. Lett.* **108** (2012) 081805, [arXiv:1111.7264](#) [[hep-ph](#)].
- [1085] T. D. Jacques, L. M. Krauss, and C. Lunardini, “Additional light sterile neutrinos and cosmology,” *Phys. Rev. D* **87** no. 8, (2013) 083515, [arXiv:1301.3119](#) [[astro-ph.CO](#)]. [Erratum: *Phys.Rev.D* 88, 109901 (2013)].
- [1086] G. B. Gelmini, A. Kusenko, and V. Takhistov, “Possible hints of sterile neutrinos in recent measurements of the hubble parameter,” *JCAP* **06** (2021) 002, [arXiv:1906.10136](#) [[astro-ph.CO](#)].
- [1087] A. Banerjee, E. O. Colgáin, M. Sasaki, M. M. Sheikh-Jabbari, and T. Yang, “On problems with cosmography in cosmic dark ages,” *Phys. Lett. B* **818** (2021) 136366, [arXiv:2009.04109](#) [[astro-ph.CO](#)].
- [1088] V. Poulin, T. L. Smith, D. Grin, T. Karwal, and M. Kamionkowski, “Cosmological implications of ultralight axionlike fields,” *Phys. Rev. D* **98** no. 8, (2018) 083525, [arXiv:1806.10608](#) [[astro-ph.CO](#)].
- [1089] D. Baumann, D. Green, and B. Wallisch, “New target for cosmic axion searches,” *Phys. Rev. Lett.* **117** no. 17, (2016) 171301, [arXiv:1604.08614](#) [[astro-ph.CO](#)].
- [1090] G. Steigman, D. Schramm, and J. Gunn, “Cosmological limits to the number of massive leptons,” *Phys. Lett. B* **66** (1977) 202–204.
- [1091] G. Steigman, “Primordial nucleosynthesis in the precision cosmology era,” *Ann. Rev. Nucl. Part. Sci.* **57** (2007) 463–491, [arXiv:0712.1100](#) [[astro-ph](#)].
- [1092] W. Yang, S. Pan, E. Di Valentino, and E. N. Saridakis, “Observational constraints on dynamical dark energy with pivoting redshift,” *Universe* **5** no. 11, (2019) 219, [arXiv:1811.06932](#) [[astro-ph.CO](#)].
- [1093] W. Yang, E. Di Valentino, O. Mena, and S. Pan, “Dynamical dark sectors and neutrino masses and abundances,” *Phys. Rev. D* **102** no. 2, (2020) 023535, [arXiv:2003.12552](#) [[astro-ph.CO](#)].

- [1094] **CMB-S4** Collaboration, K. Abazajian *et al.*, “Cmb-s4: Forecasting constraints on primordial gravitational waves,” [arXiv:2008.12619](#) [[astro-ph.CO](#)].
- [1095] E. Di Valentino, A. Mukherjee, and A. A. Sen, “Dark energy with phantom crossing and the h_0 tension,” *Entropy* **23** no. 4, (2021) 404, [arXiv:2005.12587](#) [[astro-ph.CO](#)].
- [1096] W. Cardona, M. Kunz, and V. Pettorino, “Determining h_0 with bayesian hyper-parameters,” *JCAP* **1703** no. 03, (2017) 056, [arXiv:1611.06088](#) [[astro-ph.CO](#)].
- [1097] **DES** Collaboration, A. Shajib *et al.*, “Strides: a 3.9 per cent measurement of the hubble constant from the strong lens system des j0408-5354,” *Mon. Not. Roy. Astron. Soc.* **494** no. 4, (2020) 6072–6102, [arXiv:1910.06306](#) [[astro-ph.CO](#)].
- [1098] Y. J. Kim, J. Kang, M. G. Lee, and I. S. Jang, “Determination of the local hubble constant from virgo infall using trgb distances,” *Astrophys. J.* **905** no. 2, (2020) 104, [arXiv:2010.01364](#) [[astro-ph.CO](#)].
- [1099] X. Li and A. Shafieloo, “Evidence for emergent dark energy,” *Astrophys. J.* **902** no. 1, (2020) 58, [arXiv:2001.05103](#) [[astro-ph.CO](#)].
- [1100] Z. Liu and H. Miao, “Update constraints on neutrino mass and mass hierarchy in light of dark energy models,” *Int. J. Mod. Phys. D* **29** no. 13, (2020) 2050088, [arXiv:2002.05563](#) [[astro-ph.CO](#)].
- [1101] M. Rezaei, T. Naderi, M. Malekjani, and A. Mehrabi, “A bayesian comparison between λ cdm and phenomenologically emergent dark energy models,” *Eur. Phys. J. C* **80** no. 5, (2020) 374, [arXiv:2004.08168](#) [[astro-ph.CO](#)].
- [1102] X. Li and A. Shafieloo, “A simple phenomenological emergent dark energy model can resolve the hubble tension,” *Astrophys. J. Lett.* **883** no. 1, (2019) L3, [arXiv:1906.08275](#) [[astro-ph.CO](#)].
- [1103] H. Velten and S. Gomes, “Is the hubble diagram of quasars in tension with concordance cosmology?,” *Phys. Rev. D* **101** no. 4, (2020) 043502, [arXiv:1911.11848](#) [[astro-ph.CO](#)].
- [1104] N. Frusciante, S. Peirone, L. Atayde, and A. De Felice, “Phenomenology of the generalized cubic covariant galileon model and cosmological bounds,” *Phys. Rev. D* **101** no. 6, (2020) 064001, [arXiv:1912.07586](#) [[astro-ph.CO](#)].
- [1105] T. Kobayashi, M. Yamaguchi, and J. Yokoyama, “Generalized g-inflation: Inflation with the most general second-order field equations,” *Prog. Theor. Phys.* **126** (2011) 511–529, [arXiv:1105.5723](#) [[hep-th](#)].
- [1106] S. Capozziello, M. Benetti, and A. D. A. M. Spallicci, “Addressing the cosmological h_0 tension by the heisenberg uncertainty,” *Found. Phys.* **50** no. 9, (2020) 893–899, [arXiv:2007.00462](#) [[gr-qc](#)].
- [1107] A. De Felice and S. Tsujikawa, “Conditions for the cosmological viability of the most general scalar-tensor theories and their applications to extended galileon dark energy models,” *JCAP* **02** (2012) 007, [arXiv:1110.3878](#) [[gr-qc](#)].
- [1108] C. Van De Bruck and J. Mifsud, “Searching for dark matter - dark energy interactions: going beyond the conformal case,” *Phys. Rev. D* **97** no. 2, (2018) 023506, [arXiv:1709.04882](#) [[astro-ph.CO](#)].
- [1109] A. De Felice, T. Kobayashi, and S. Tsujikawa, “Effective gravitational couplings for cosmological perturbations in the most general scalar-tensor theories with second-order field equations,” *Phys. Lett. B* **706** (2011) 123–133, [arXiv:1108.4242](#) [[gr-qc](#)].
- [1110] A. Gómez-Valent, V. Pettorino, and L. Amendola, “Update on coupled dark energy and the h_0 tension,” *Phys. Rev. D* **101** no. 12, (2020) 123513, [arXiv:2004.00610](#) [[astro-ph.CO](#)].
- [1111] I. Sawicki and E. Bellini, “Limits of quasistatic approximation in modified-gravity cosmologies,” *Phys. Rev. D* **92** no. 8, (2015) 084061, [arXiv:1503.06831](#) [[astro-ph.CO](#)].
- [1112] E. J. Baxter and B. D. Sherwin, “Determining the hubble constant without the sound horizon scale: Measurements from cmb lensing,” *Mon. Not. Roy. Astron. Soc.* **501** no. 2, (2021) 1823–1835, [arXiv:2007.04007](#) [[astro-ph.CO](#)].

- [1113] S. Tsujikawa, “Matter density perturbations and effective gravitational constant in modified gravity models of dark energy,” *Phys. Rev. D* **76** (2007) 023514, [arXiv:0705.1032 \[astro-ph\]](#).
- [1114] N. Frusciante and F. Pace, “Growth of non-linear structures and spherical collapse in the galileon ghost condensate model,” *Phys. Dark Univ.* **30** (2020) 100686, [arXiv:2004.11881 \[astro-ph.CO\]](#).
- [1115] C.-P. Ma and E. Bertschinger, “Cosmological perturbation theory in the synchronous and conformal newtonian gauges,” *Astrophys. J.* **455** (1995) 7–25, [arXiv:astro-ph/9506072](#).
- [1116] R. Kase and S. Tsujikawa, “Dark energy scenario consistent with gw170817 in theories beyond horndeski gravity,” *Phys. Rev. D* **97** no. 10, (2018) 103501, [arXiv:1802.02728 \[gr-qc\]](#).
- [1117] C. Deffayet, G. Esposito-Farese, and A. Vikman, “Covariant galileon,” *Phys. Rev. D* **79** (2009) 084003, [arXiv:0901.1314 \[hep-th\]](#).
- [1118] S. Peirone, G. Benevento, N. Frusciante, and S. Tsujikawa, “Cosmological data favor galileon ghost condensate over Λ cdm,” *Phys. Rev. D* **100** no. 6, (2019) 063540, [arXiv:1905.05166 \[astro-ph.CO\]](#).
- [1119] S. Peirone, K. Koyama, L. Pogosian, M. Raveri, and A. Silvestri, “Large-scale structure phenomenology of viable horndeski theories,” *Phys. Rev. D* **97** no. 4, (2018) 043519, [arXiv:1712.00444 \[astro-ph.CO\]](#).
- [1120] N. Frusciante, S. Peirone, S. Casas, and N. A. Lima, “Cosmology of surviving horndeski theory: The road ahead,” *Phys. Rev. D* **99** no. 6, (2019) 063538, [arXiv:1810.10521 \[astro-ph.CO\]](#).
- [1121] R. Kase and S. Tsujikawa, “Dark energy in horndeski theories after gw170817: A review,” *Int. J. Mod. Phys. D* **28** no. 05, (2019) 1942005, [arXiv:1809.08735 \[gr-qc\]](#).
- [1122] C. Deffayet, O. Pujolas, I. Sawicki, and A. Vikman, “Imperfect dark energy from kinetic gravity braiding,” *JCAP* **10** (2010) 026, [arXiv:1008.0048 \[hep-th\]](#).
- [1123] **eBOSS** Collaboration, S. Alam *et al.*, “Completed sdss-iv extended baryon oscillation spectroscopic survey: Cosmological implications from two decades of spectroscopic surveys at the apache point observatory,” *Phys. Rev. D* **103** no. 8, (2021) 083533, [arXiv:2007.08991 \[astro-ph.CO\]](#).
- [1124] **DES** Collaboration, A. Palmese *et al.*, “A statistical standard siren measurement of the hubble constant from the ligo/virgo gravitational wave compact object merger gw190814 and dark energy survey galaxies,” *Astrophys. J. Lett.* **900** no. 2, (2020) L33, [arXiv:2006.14961 \[astro-ph.CO\]](#).
- [1125] S. Borhanian, A. Dhani, A. Gupta, K. G. Arun, and B. S. Sathyaprakash, “Dark sirens to resolve the hubble–lemaître tension,” *Astrophys. J. Lett.* **905** no. 2, (2020) L28, [arXiv:2007.02883 \[astro-ph.CO\]](#).
- [1126] J. Yu, Y. Wang, W. Zhao, and Y. Lu, “Hunting for the host galaxy groups of binary black holes and the application in constraining hubble constant,” *Mon. Not. Roy. Astron. Soc.* **498** no. 2, (2020) 1786–1800, [arXiv:2003.06586 \[astro-ph.CO\]](#).
- [1127] A. Hryczuk and K. Jodłowski, “Self-interacting dark matter from late decays and the h_0 tension,” *Phys. Rev. D* **102** no. 4, (2020) 043024, [arXiv:2006.16139 \[hep-ph\]](#).
- [1128] M. Gonzalez, M. P. Hertzberg, and F. Rompineve, “Ultralight scalar decay and the hubble tension,” *JCAP* **10** (2020) 028, [arXiv:2006.13959 \[astro-ph.CO\]](#).
- [1129] L. Verde, T. Treu, and A. Riess, “Tensions between the early and the late universe,” *Nature Astron.* **3** (7, 2019) 891, [arXiv:1907.10625 \[astro-ph.CO\]](#).
- [1130] C. D. Huang, A. G. Riess, W. Yuan, L. M. Macri, N. L. Zakamska, S. Casertano, P. A. Whitelock, S. L. Hoffmann, A. V. Filippenko, and D. Scolnic, “Hubble space telescope observations of mira variables in the type ia supernova host ngc 1559: An alternative candle to measure the hubble constant,” [arXiv:1908.10883 \[astro-ph.CO\]](#).
- [1131] A. G. Riess, “The expansion of the universe is faster than expected,” *Nature Rev. Phys.* **2** no. 1, (2019) 10–12, [arXiv:2001.03624 \[astro-ph.CO\]](#).

- [1132] A. Heinesen, C. Blake, and D. L. Wiltshire, “Quantifying the accuracy of the alcock-paczynski scaling of baryon acoustic oscillation measurements,” *JCAP* **2001** no. 01, (2020) 038, [arXiv:1908.11508](#) [[astro-ph.CO](#)].
- [1133] A. G. Riess *et al.*, “A 2.4% determination of the local value of the hubble constant,” *Astrophys. J.* **826** no. 1, (2016) 56, [arXiv:1604.01424](#) [[astro-ph.CO](#)].
- [1134] F. Beutler, C. Blake, M. Colless, D. H. Jones, L. Staveley-Smith, L. Campbell, Q. Parker, W. Saunders, and F. Watson, “The 6df galaxy survey: Baryon acoustic oscillations and the local hubble constant,” *Mon. Not. Roy. Astron. Soc.* **416** (2011) 3017–3032, [arXiv:1106.3366](#) [[astro-ph.CO](#)].
- [1135] A. J. Ross, L. Samushia, C. Howlett, W. J. Percival, A. Burden, and M. Manera, “The clustering of the sdss dr7 main galaxy sample – i. a 4 per cent distance measure at $z = 0.15$,” *Mon. Not. Roy. Astron. Soc.* **449** no. 1, (2015) 835–847, [arXiv:1409.3242](#) [[astro-ph.CO](#)].
- [1136] **BOSS** Collaboration, S. Alam *et al.*, “The clustering of galaxies in the completed sdss-iii baryon oscillation spectroscopic survey: cosmological analysis of the dr12 galaxy sample,” *Mon. Not. Roy. Astron. Soc.* **470** no. 3, (2017) 2617–2652, [arXiv:1607.03155](#) [[astro-ph.CO](#)].
- [1137] **DES** Collaboration, M. A. Troxel *et al.*, “Dark energy survey year 1 results: Cosmological constraints from cosmic shear,” *Phys. Rev. D* **98** no. 4, (2018) 043528, [arXiv:1708.01538](#) [[astro-ph.CO](#)].
- [1138] **DES** Collaboration, E. Krause *et al.*, “Dark energy survey year 1 results: Multi-probe methodology and simulated likelihood analyses,” (6, 2017) , [arXiv:1706.09359](#) [[astro-ph.CO](#)].
- [1139] R. J. Cooke, M. Pettini, and C. C. Steidel, “One percent determination of the primordial deuterium abundance,” *Astrophys. J.* **855** no. 2, (2018) 102, [arXiv:1710.11129](#) [[astro-ph.CO](#)].
- [1140] G. W. Horndeski, “Second-order scalar-tensor field equations in a four-dimensional space,” *Int. J. Theor. Phys.* **10** (1974) 363–384.
- [1141] T. Kobayashi, “Horndeski theory and beyond: a review,” *Rept. Prog. Phys.* **82** no. 8, (2019) 086901, [arXiv:1901.07183](#) [[gr-qc](#)].
- [1142] W. Yuan, A. G. Riess, L. M. Macri, S. Casertano, and D. Scolnic, “Consistent calibration of the tip of the red giant branch in the large magellanic cloud on the hubble space telescope photometric system and a re-determination of the hubble constant,” *Astrophys. J.* **886** (2019) 61, [arXiv:1908.00993](#) [[astro-ph.GA](#)].
- [1143] E. Di Valentino, A. Melchiorri, and J. Silk, “Beyond six parameters: extending λ cdm,” *Phys. Rev.* **D92** no. 12, (2015) 121302, [arXiv:1507.06646](#) [[astro-ph.CO](#)].
- [1144] E. Di Valentino, A. Melchiorri, and J. Silk, “Reconciling planck with the local value of h_0 in extended parameter space,” *Phys. Lett.* **B761** (2016) 242–246, [arXiv:1606.00634](#) [[astro-ph.CO](#)].
- [1145] S. Kumar and R. C. Nunes, “Probing the interaction between dark matter and dark energy in the presence of massive neutrinos,” *Phys. Rev.* **D94** no. 12, (2016) 123511, [arXiv:1608.02454](#) [[astro-ph.CO](#)].
- [1146] J. L. Bernal, L. Verde, and A. G. Riess, “The trouble with h_0 ,” *JCAP* **1610** no. 10, (2016) 019, [arXiv:1607.05617](#) [[astro-ph.CO](#)].
- [1147] J. L. Bernal, L. Verde, R. Jimenez, M. Kamionkowski, D. Valcin, and B. D. Wandelt, “The trouble beyond h_0 and the new cosmic triangles,” *Phys. Rev. D* **103** no. 10, (2021) 103533, [arXiv:2102.05066](#) [[astro-ph.CO](#)].
- [1148] A. Banerjee, H. Cai, L. Heisenberg, E. Ó Colgáin, M. M. Sheikh-Jabbari, and T. Yang, “Hubble sinks in the low-redshift swampland,” *Phys. Rev. D* **103** no. 8, (2021) L081305, [arXiv:2006.00244](#) [[astro-ph.CO](#)].
- [1149] S. Kumar and R. C. Nunes, “Echo of interactions in the dark sector,” *Phys. Rev.* **D96** no. 10, (2017) 103511, [arXiv:1702.02143](#) [[astro-ph.CO](#)].

- [1150] E. Di Valentino, A. Melchiorri, and O. Mena, “Can interacting dark energy solve the h_0 tension?,” *Phys. Rev. D* **D96** no. 4, (2017) 043503, [arXiv:1704.08342](#) [[astro-ph.CO](#)].
- [1151] E. Di Valentino, A. Melchiorri, E. V. Linder, and J. Silk, “Constraining dark energy dynamics in extended parameter space,” *Phys. Rev. D* **D96** no. 2, (2017) 023523, [arXiv:1704.00762](#) [[astro-ph.CO](#)].
- [1152] E. Di Valentino, C. Bøehm, E. Hivon, and F. R. Bouchet, “Reducing the h_0 and σ_8 tensions with dark matter-neutrino interactions,” *Phys. Rev. D* **D97** no. 4, (2018) 043513, [arXiv:1710.02559](#) [[astro-ph.CO](#)].
- [1153] E. Di Valentino, E. V. Linder, and A. Melchiorri, “Vacuum phase transition solves the h_0 tension,” *Phys. Rev. D* **D97** no. 4, (2018) 043528, [arXiv:1710.02153](#) [[astro-ph.CO](#)].
- [1154] J. Solà, A. Gómez-Valent, and J. de Cruz Pérez, “The h_0 tension in light of vacuum dynamics in the universe,” *Phys. Lett. B* **B774** (2017) 317–324, [arXiv:1705.06723](#) [[astro-ph.CO](#)].
- [1155] N. Khosravi, S. Baghran, N. Afshordi, and N. Altamirano, “ h_0 tension as a hint for a transition in gravitational theory,” *Phys. Rev. D* **D99** no. 10, (2019) 103526, [arXiv:1710.09366](#) [[astro-ph.CO](#)].
- [1156] E. Belgacem, Y. Dirian, S. Foffa, and M. Maggiore, “Nonlocal gravity. conceptual aspects and cosmological predictions,” *JCAP* **1803** no. 03, (2018) 002, [arXiv:1712.07066](#) [[hep-th](#)].
- [1157] J. Renk, M. Zumalacárregui, F. Montanari, and A. Barreira, “Galileon gravity in light of isw, cmb, bao and h_0 data,” *JCAP* **1710** no. 10, (2017) 020, [arXiv:1707.02263](#) [[astro-ph.CO](#)].
- [1158] E. Di Valentino, “Crack in the cosmological paradigm,” *Nat. Astron.* **1** no. 9, (2017) 569–570, [arXiv:1709.04046](#) [[physics.pop-ph](#)].
- [1159] L. Lancaster, F.-Y. Cyr-Racine, L. Knox, and Z. Pan, “A tale of two modes: Neutrino free-streaming in the early universe,” *JCAP* **1707** no. 07, (2017) 033, [arXiv:1704.06657](#) [[astro-ph.CO](#)].
- [1160] D. Fernández Arenas, E. Terlevich, R. Terlevich, J. Melnick, R. Chávez, F. Bresolin, E. Telles, M. Plionis, and S. Basilakos, “An independent determination of the local hubble constant,” *Mon. Not. Roy. Astron. Soc.* **474** no. 1, (2018) 1250–1276, [arXiv:1710.05951](#) [[astro-ph.CO](#)].
- [1161] T. Binder, M. Gustafsson, A. Kamada, S. M. R. Sandner, and M. Wiesner, “Reannihilation of self-interacting dark matter,” *Phys. Rev. D* **D97** no. 12, (2018) 123004, [arXiv:1712.01246](#) [[astro-ph.CO](#)].
- [1162] E. Mörtzell and S. Dhawan, “Does the hubble constant tension call for new physics?,” *JCAP* **1809** no. 09, (2018) 025, [arXiv:1801.07260](#) [[astro-ph.CO](#)].
- [1163] H. Miyatake *et al.*, “Cosmological inference from the emulator based halo model ii: Joint analysis of galaxy-galaxy weak lensing and galaxy clustering from hsc-y1 and sdss,” [arXiv:2111.02419](#) [[astro-ph.CO](#)].
- [1164] W. Yang, S. Pan, E. Di Valentino, R. C. Nunes, S. Vagnozzi, and D. F. Mota, “Tale of stable interacting dark energy, observational signatures, and the h_0 tension,” *JCAP* **1809** no. 09, (2018) 019, [arXiv:1805.08252](#) [[astro-ph.CO](#)].
- [1165] F. D’Eramo, R. Z. Ferreira, A. Notari, and J. L. Bernal, “Hot axions and the h_0 tension,” *JCAP* **1811** no. 11, (2018) 014, [arXiv:1808.07430](#) [[hep-ph](#)].
- [1166] S. Joudaki *et al.*, “Kids+viking-450 and des-y1 combined: Cosmology with cosmic shear,” *Astron. Astrophys.* **638** (2020) L1, [arXiv:1906.09262](#) [[astro-ph.CO](#)].
- [1167] G. F. Abellán, R. Murgia, V. Poulin, and J. Lavalle, “Hints for decaying dark matter from s_8 measurements,” [arXiv:2008.09615](#) [[astro-ph.CO](#)].
- [1168] A. G. Sanchez, “Arguments against using h^{-1} mpc units in observational cosmology,” *Phys. Rev. D* **102** no. 12, (2020) 123511, [arXiv:2002.07829](#) [[astro-ph.CO](#)].

- [1169] W. Yang, A. Mukherjee, E. Di Valentino, and S. Pan, “Interacting dark energy with time varying equation of state and the h_0 tension,” *Phys. Rev.* **D98** no. 12, (2018) 123527, [arXiv:1809.06883 \[astro-ph.CO\]](#).
- [1170] K. Dutta, A. Roy, Ruchika, A. A. Sen, and M. Sheikh-Jabbari, “Cosmology with low-redshift observations: No signal for new physics,” *Phys. Rev. D* **100** no. 10, (2019) 103501, [arXiv:1908.07267 \[astro-ph.CO\]](#).
- [1171] R.-Y. Guo, J.-F. Zhang, and X. Zhang, “Can the h_0 tension be resolved in extensions to Λ cdm cosmology?,” *JCAP* **1902** (2019) 054, [arXiv:1809.02340 \[astro-ph.CO\]](#).
- [1172] J. Solà Peracaula, A. Gómez-Valent, J. de Cruz Pérez, and C. Moreno-Pulido, “Brans–dicke gravity with a cosmological constant smoothes out Λ cdm tensions,” *Astrophys. J. Lett.* **886** no. 1, (2019) L6, [arXiv:1909.02554 \[astro-ph.CO\]](#).
- [1173] W. Yang, S. Pan, E. Di Valentino, E. N. Saridakis, and S. Chakraborty, “Observational constraints on one-parameter dynamical dark-energy parametrizations and the h_0 tension,” *Phys. Rev.* **D99** no. 4, (2019) 043543, [arXiv:1810.05141 \[astro-ph.CO\]](#).
- [1174] M.-X. Lin, M. Raveri, and W. Hu, “Phenomenology of modified gravity at recombination,” *Phys. Rev.* **D99** no. 4, (2019) 043514, [arXiv:1810.02333 \[astro-ph.CO\]](#).
- [1175] J. Solà Peracaula, A. Gómez-Valent, J. de Cruz Pérez, and C. Moreno-Pulido, “Brans–dicke cosmology with a λ -term: a possible solution to Λ cdm tensions,” *Class. Quant. Grav.* **37** no. 24, (2020) 245003, [arXiv:2006.04273 \[astro-ph.CO\]](#).
- [1176] A. Gómez-Valent, Z. Zheng, L. Amendola, V. Pettorino, and C. Wetterich, “Early dark energy in the pre- and postrecombination epochs,” *Phys. Rev. D* **104** no. 8, (2021) 083536, [arXiv:2107.11065 \[astro-ph.CO\]](#).
- [1177] V. Poulin, T. L. Smith, T. Karwal, and M. Kamionkowski, “Early dark energy can resolve the hubble tension,” *Phys. Rev. Lett.* **122** no. 22, (2019) 221301, [arXiv:1811.04083 \[astro-ph.CO\]](#).
- [1178] A. Banihashemi, N. Khosravi, and A. H. Shirazi, “Phase transition in the dark sector as a proposal to lessen cosmological tensions,” *Phys. Rev. D* **101** no. 12, (2020) 123521, [arXiv:1808.02472 \[astro-ph.CO\]](#).
- [1179] S. Joudaki *et al.*, “Kids-450 + 2df lens: Cosmological parameter constraints from weak gravitational lensing tomography and overlapping redshift-space galaxy clustering,” *Mon. Not. Roy. Astron. Soc.* **474** no. 4, (2018) 4894–4924, [arXiv:1707.06627 \[astro-ph.CO\]](#).
- [1180] N. Arendse *et al.*, “Cosmic dissonance: new physics or systematics behind a short sound horizon?,” *Astron. Astrophys.* **639** (2020) A57, [arXiv:1909.07986 \[astro-ph.CO\]](#).
- [1181] S. Heimersheim, N. Schöneberg, D. C. Hooper, and J. Lesgourgues, “Cannibalism hinders growth: Cannibal dark matter and the s_8 tension,” *JCAP* **12** (2020) 016, [arXiv:2008.08486 \[astro-ph.CO\]](#).
- [1182] S. Joudaki *et al.*, “Kids-450: Testing extensions to the standard cosmological model,” *Mon. Not. Roy. Astron. Soc.* **471** no. 2, (2017) 1259–1279, [arXiv:1610.04606 \[astro-ph.CO\]](#).
- [1183] J. Solà, A. Gómez-Valent, and J. de Cruz Pérez, “Vacuum dynamics in the universe versus a rigid $\lambda = \text{const}$,” *Int. J. Mod. Phys. A* **32** no. 19-20, (2017) 1730014, [arXiv:1709.07451 \[astro-ph.CO\]](#).
- [1184] J. Solà, A. Gómez-Valent, and J. de Cruz Pérez, “Hints of dynamical vacuum energy in the expanding universe,” *Astrophys. J. Lett.* **811** (2015) L14, [arXiv:1506.05793 \[gr-qc\]](#).
- [1185] K. S. Karkare and S. Bird, “Constraining the expansion history and early dark energy with line intensity mapping,” *Phys. Rev. D* **98** no. 4, (2018) 043529, [arXiv:1806.09625 \[astro-ph.CO\]](#).
- [1186] I. Fenech Conti, R. Herbonnet, H. Hoekstra, J. Merten, L. Miller, and M. Viola, “Calibration of weak-lensing shear in the kilo-degree survey,” *Mon. Not. Roy. Astron. Soc.* **467** no. 2, (2017) 1627–1651, [arXiv:1606.05337 \[astro-ph.CO\]](#).

- [1187] J. L. Bernal, P. C. Breysse, and E. D. Kovetz, “Cosmic expansion history from line-intensity mapping,” *Phys. Rev. Lett.* **123** no. 25, (2019) 251301, [arXiv:1907.10065 \[astro-ph.CO\]](#).
- [1188] M. Zumalacarregui, “Gravity in the era of equality: Towards solutions to the hubble problem without fine-tuned initial conditions,” *Phys. Rev. D* **102** no. 2, (2020) 023523, [arXiv:2003.06396 \[astro-ph.CO\]](#).
- [1189] M. G. Santos *et al.*, “Cosmology from a ska hi intensity mapping survey,” *PoS AASKA14* (2015) 019, [arXiv:1501.03989 \[astro-ph.CO\]](#).
- [1190] P. D. Meerburg, “Alleviating the tension at low ℓ through axion monodromy,” *Phys. Rev. D* **90** no. 6, (2014) 063529, [arXiv:1406.3243 \[astro-ph.CO\]](#).
- [1191] A. Pourtsidou and R. B. Metcalf, “Gravitational lensing of cosmological 21 cm emission,” *Mon. Not. Roy. Astron. Soc.* **448** (2015) 2368–2383, [arXiv:1410.2533 \[astro-ph.CO\]](#).
- [1192] A. Chudaykin, D. Gorbunov, and I. Tkachev, “Dark matter component decaying after recombination: Sensitivity to baryon acoustic oscillation and redshift space distortion probes,” *Phys. Rev. D* **97** no. 8, (2018) 083508, [arXiv:1711.06738 \[astro-ph.CO\]](#).
- [1193] P. Bull, S. Camera, A. Raccaelli, C. Blake, P. G. Ferreira, M. G. Santos, and D. J. Schwarz, “Measuring baryon acoustic oscillations with future ska surveys,” in *Advancing Astrophysics with the Square Kilometre Array (AASKA14)*. 1, 2015. [arXiv:1501.04088 \[astro-ph.CO\]](#).
- [1194] C. Howlett, A. S. G. Robotham, C. D. P. Lagos, and A. G. Kim, “Measuring the growth rate of structure with type ia supernovae from lsst,” *Astrophys. J.* **847** no. 2, (2017) 128, [arXiv:1708.08236 \[astro-ph.CO\]](#).
- [1195] **HSC** Collaboration, C. Hikage *et al.*, “Cosmology from cosmic shear power spectra with subaru hyper supprime-cam first-year data,” *Publ. Astron. Soc. Jap.* **71** no. 2, (2019) 43, [arXiv:1809.09148 \[astro-ph.CO\]](#).
- [1196] D. Wang, “Can $f(r)$ gravity relieve h_0 and σ_8 tensions?,” *Eur. Phys. J. C* **81** no. 5, (2021) 482, [arXiv:2008.03966 \[astro-ph.CO\]](#).
- [1197] N. Hamaus, A. Pisani, J.-A. Choi, G. Lavaux, B. D. Wandelt, and J. Weller, “Precision cosmology with voids in the final boss data,” *JCAP* **12** (2020) 023, [arXiv:2007.07895 \[astro-ph.CO\]](#).
- [1198] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2015 results. xxvii. the second planck catalogue of sunyaev-zeldovich sources,” *Astron. Astrophys.* **594** (2016) A27, [arXiv:1502.01598 \[astro-ph.CO\]](#).
- [1199] M. A. Buen-Abad, G. Marques-Tavares, and M. Schmaltz, “Non-abelian dark matter and dark radiation,” *Phys. Rev. D* **92** no. 2, (2015) 023531, [arXiv:1505.03542 \[hep-ph\]](#).
- [1200] E. Di Valentino, A. Melchiorri, and J. Silk, “Cosmological hints of modified gravity?,” *Phys. Rev. D* **93** no. 2, (2016) 023513, [arXiv:1509.07501 \[astro-ph.CO\]](#).
- [1201] A. Klypin, V. Poulin, F. Prada, J. Primack, M. Kamionkowski, V. Avila-Reese, A. Rodriguez-Puebla, P. Behroozi, D. Hellinger, and T. L. Smith, “Clustering and halo abundances in early dark energy cosmological models,” *Mon. Not. Roy. Astron. Soc.* **504** no. 1, (2021) 769–781, [arXiv:2006.14910 \[astro-ph.CO\]](#).
- [1202] H. Hildebrandt *et al.*, “Kids-450: Cosmological parameter constraints from tomographic weak gravitational lensing,” *Mon. Not. Roy. Astron. Soc.* **465** (2017) 1454, [arXiv:1606.05338 \[astro-ph.CO\]](#).
- [1203] E. V. Linder, “Cosmic growth and expansion conjoined,” *Astropart. Phys.* **86** (2017) 41–45, [arXiv:1610.05321 \[astro-ph.CO\]](#).
- [1204] J. C. Hill, E. McDonough, M. W. Toomey, and S. Alexander, “Early dark energy does not restore cosmological concordance,” *Phys. Rev. D* **102** no. 4, (2020) 043507, [arXiv:2003.07355 \[astro-ph.CO\]](#).

- [1205] E. Di Valentino and S. Bridle, “Exploring the tension between current cosmic microwave background and cosmic shear data,” *Symmetry* **10** no. 11, (2018) 585.
- [1206] T. Hamana *et al.*, “Cosmological constraints from cosmic shear two-point correlation functions with hsc survey first-year data,” *Publ. Astron. Soc. Jap.* **72** no. 1, (2020) Publications of the Astronomical Society of Japan, Volume 72, Issue 1, February 2020, 16, <https://doi.org/10.1093/pasj/psz138>, [arXiv:1906.06041](#) [[astro-ph.CO](#)].
- [1207] T. Tröster *et al.*, “Cosmology from large-scale structure: Constraining Λ cdm with boss,” *Astron. Astrophys.* **633** (2020) L10, [arXiv:1909.11006](#) [[astro-ph.CO](#)].
- [1208] J. N. Dossett, M. Ishak, D. Parkinson, and T. Davis, “Constraints and tensions in testing general relativity from planck and cfhtlens data including intrinsic alignment systematics,” *Phys. Rev. D* **92** no. 2, (2015) 023003, [arXiv:1501.03119](#) [[astro-ph.CO](#)].
- [1209] M. Asgari *et al.*, “Kids+viking-450 and des-y1 combined: Mitigating baryon feedback uncertainty with cosebis,” *Astron. Astrophys.* **634** (2020) A127, [arXiv:1910.05336](#) [[astro-ph.CO](#)].
- [1210] A. Kiessling *et al.*, “Galaxy alignments: Theory, modelling & simulations,” *Space Sci. Rev.* **193** no. 1-4, (2015) 67–136, [arXiv:1504.05546](#) [[astro-ph.GA](#)]. [Erratum: *Space Sci. Rev.* 193, 137 (2015)].
- [1211] C. Heymans *et al.*, “Kids-1000 cosmology: Multi-probe weak gravitational lensing and spectroscopic galaxy clustering constraints,” *Astron. Astrophys.* **646** (2021) A140, [arXiv:2007.15632](#) [[astro-ph.CO](#)].
- [1212] M. A. Troxel and M. Ishak, “The intrinsic alignment of galaxies and its impact on weak gravitational lensing in an era of precision cosmology,” *Phys. Rept.* **558** (2014) 1–59, [arXiv:1407.6990](#) [[astro-ph.CO](#)].
- [1213] DES Collaboration, M. Troxel *et al.*, “Survey geometry and the internal consistency of recent cosmic shear measurements,” *Mon. Not. Roy. Astron. Soc.* **479** no. 4, (2018) 4998–5004, [arXiv:1804.10663](#) [[astro-ph.CO](#)].
- [1214] A. Banihashemi, N. Khosravi, and A. H. Shirazi, “Ginzburg-landau theory of dark energy: A framework to study both temporal and spatial cosmological tensions simultaneously,” *Phys. Rev. D* **99** no. 8, (2019) 083509, [arXiv:1810.11007](#) [[astro-ph.CO](#)].
- [1215] S. Joudaki *et al.*, “Cfhtlens revisited: assessing concordance with planck including astrophysical systematics,” *Mon. Not. Roy. Astron. Soc.* **465** no. 2, (2017) 2033–2052, [arXiv:1601.05786](#) [[astro-ph.CO](#)].
- [1216] T. Erben *et al.*, “Cfhtlens: The canada-france-hawaii telescope lensing survey - imaging data and catalogue products,” *Mon. Not. Roy. Astron. Soc.* **433** (2013) 2545, [arXiv:1210.8156](#) [[astro-ph.CO](#)].
- [1217] K. Kuijken *et al.*, “Gravitational lensing analysis of the kilo degree survey,” *Mon. Not. Roy. Astron. Soc.* **454** no. 4, (2015) 3500–3532, [arXiv:1507.00738](#) [[astro-ph.CO](#)].
- [1218] C. Heymans, M. Brown, A. Heavens, K. Meisenheimer, A. Taylor, and C. Wolf, “Weak lensing with combo-17: estimation and removal of intrinsic alignments,” *Mon. Not. Roy. Astron. Soc.* **347** (2004) 895, [arXiv:astro-ph/0310174](#).
- [1219] C. Heymans *et al.*, “Cfhtlens: The canada-france-hawaii telescope lensing survey,” *Mon. Not. Roy. Astron. Soc.* **427** (2012) 146, [arXiv:1210.0032](#) [[astro-ph.CO](#)].
- [1220] C. Heymans *et al.*, “Cfhtlens tomographic weak lensing cosmological parameter constraints: Mitigating the impact of intrinsic galaxy alignments,” *Mon. Not. Roy. Astron. Soc.* **432** (2013) 2433, [arXiv:1303.1808](#) [[astro-ph.CO](#)].
- [1221] E. Di Valentino and F. R. Bouchet, “A comment on power-law inflation with a dark radiation component,” *JCAP* **10** (2016) 011, [arXiv:1609.00328](#) [[astro-ph.CO](#)].
- [1222] R. A. Battye and A. Moss, “Evidence for massive neutrinos from cosmic microwave background and lensing observations,” *Phys. Rev. Lett.* **112** no. 5, (2014) 051303, [arXiv:1308.5870](#) [[astro-ph.CO](#)].

- [1223] M. Born and L. Infeld, “Foundations of the new field theory,” *Proc. Roy. Soc. Lond. A* **144** no. 852, (1934) 425–451.
- [1224] D. Bertacca, N. Bartolo, A. Diaferio, and S. Matarrese, “How the scalar field of unified dark matter models can cluster,” *JCAP* **10** (2008) 023, [arXiv:0807.1020](#) [[astro-ph](#)].
- [1225] A. Addazi *et al.*, “Quantum gravity phenomenology at the dawn of the multi-messenger era – a review,” (11, 2021) , [arXiv:2111.05659](#) [[hep-ph](#)].
- [1226] S. Camera, M. Martinelli, and D. Bertacca, “Does quartessence ease cosmic tensions?,” *Phys. Dark Univ.* **23** (2019) 100247, [arXiv:1704.06277](#) [[astro-ph.CO](#)].
- [1227] G. Lambiase, S. Mohanty, A. Narang, and P. Parashari, “Testing dark energy models in the light of σ_8 tension,” *Eur. Phys. J. C* **79** no. 2, (2019) 141, [arXiv:1804.07154](#) [[astro-ph.CO](#)].
- [1228] A. Gómez-Valent and J. Solà, “Relaxing the σ_8 -tension through running vacuum in the universe,” *EPL* **120** no. 3, (2017) 39001, [arXiv:1711.00692](#) [[astro-ph.CO](#)].
- [1229] M. M. Ivanov, M. Simonović, and M. Zaldarriaga, “Cosmological parameters from the boss galaxy power spectrum,” *JCAP* **05** (2020) 042, [arXiv:1909.05277](#) [[astro-ph.CO](#)].
- [1230] X. Zhang and Q.-G. Huang, “Constraints on h_0 from wmap and bao measurements,” *Commun. Theor. Phys.* **71** no. 7, (2019) 826–830, [arXiv:1812.01877](#) [[astro-ph.CO](#)].
- [1231] A. Gómez-Valent and J. Solà Peracaula, “Density perturbations for running vacuum: a successful approach to structure formation and to the σ_8 -tension,” *Mon. Not. Roy. Astron. Soc.* **478** no. 1, (2018) 126–145, [arXiv:1801.08501](#) [[astro-ph.CO](#)].
- [1232] D. Scolnic *et al.*, “The next generation of cosmological measurements with type ia supernovae,” [arXiv:1903.05128](#) [[astro-ph.CO](#)].
- [1233] Z. Li, Y. Jing, P. Zhang, and D. Cheng, “Measurement of redshift-space power spectrum for boss galaxies and the growth rate at redshift 0.57,” *Astrophys. J.* **833** no. 2, (2016) 287, [arXiv:1609.03697](#) [[astro-ph.CO](#)].
- [1234] Y.-F. Cai, E. N. Saridakis, M. R. Setare, and J.-Q. Xia, “Quintom cosmology: Theoretical implications and observations,” *Phys. Rept.* **493** (2010) 1–60, [arXiv:0909.2776](#) [[hep-th](#)].
- [1235] Z. Davari, V. Marra, and M. Malekjani, “Cosmological constraints on minimally and non-minimally coupled scalar field models,” *Mon. Not. Roy. Astron. Soc.* **491** no. 2, (2020) 1920–1933, [arXiv:1911.00209](#) [[gr-qc](#)].
- [1236] **KamLAND** Collaboration, T. Araki *et al.*, “Measurement of neutrino oscillation with kamland: Evidence of spectral distortion,” *Phys. Rev. Lett.* **94** (2005) 081801, [arXiv:hep-ex/0406035](#).
- [1237] **Super-Kamiokande** Collaboration, Y. Ashie *et al.*, “A measurement of atmospheric neutrino oscillation parameters by super-kamiokande i,” *Phys. Rev. D* **71** (2005) 112005, [arXiv:hep-ex/0501064](#).
- [1238] J. M. Conrad, W. C. Louis, and M. H. Shaevitz, “The lsnd and miniboone oscillation searches at high δm^2 ,” *Ann. Rev. Nucl. Part. Sci.* **63** (2013) 45–67, [arXiv:1306.6494](#) [[hep-ex](#)].
- [1239] M. C. Gonzalez-Garcia, M. Maltoni, J. Salvado, and T. Schwetz, “Global fit to three neutrino mixing: critical look at present precision,” *JHEP* **12** (2012) 123, [arXiv:1209.3023](#) [[hep-ph](#)].
- [1240] **KamLAND** Collaboration, S. Abe *et al.*, “Precision measurement of neutrino oscillation parameters with kamland,” *Phys. Rev. Lett.* **100** (2008) 221803, [arXiv:0801.4589](#) [[hep-ex](#)].
- [1241] J. Lesgourgues and S. Pastor, “Massive neutrinos and cosmology,” *Phys. Rept.* **429** (2006) 307–379, [arXiv:astro-ph/0603494](#).
- [1242] H. Böhringer and G. Chon, “Constraints on neutrino masses from the study of the nearby large-scale structure and galaxy cluster counts,” *Mod. Phys. Lett. A* **31** no. 21, (2016) 1640008, [arXiv:1610.02855](#) [[astro-ph.CO](#)].

- [1243] X.-m. Chen, Y.-g. Gong, and E. N. Saridakis, “Phase-space analysis of interacting phantom cosmology,” *JCAP* **04** (2009) 001, [arXiv:0812.1117 \[gr-qc\]](#).
- [1244] E. van Uitert *et al.*, “Kids+gama: cosmology constraints from a joint analysis of cosmic shear, galaxy–galaxy lensing, and angular clustering,” *Mon. Not. Roy. Astron. Soc.* **476** no. 4, (2018) 4662–4689, [arXiv:1706.05004 \[astro-ph.CO\]](#).
- [1245] C.-A. Lin and M. Kilbinger, “Quantifying systematics from the shear inversion on weak-lensing peak counts,” *Astron. Astrophys.* **614** (2018) A36, [arXiv:1704.00258 \[astro-ph.CO\]](#).
- [1246] S. Anand, P. Chaubal, A. Mazumdar, and S. Mohanty, “Cosmic viscosity as a remedy for tension between planck and lss data,” *JCAP* **11** (2017) 005, [arXiv:1708.07030 \[astro-ph.CO\]](#).
- [1247] R. Burenin, “Measurements of the matter density perturbation amplitude from cosmological data,” *Astron. Lett.* **44** no. 11, (2018) 653–663, [arXiv:1806.03261 \[astro-ph.CO\]](#).
- [1248] J. Evslin, A. A. Sen, and Ruchika, “Price of shifting the hubble constant,” *Phys. Rev. D* **97** no. 10, (2018) 103511, [arXiv:1711.01051 \[astro-ph.CO\]](#).
- [1249] C. Moreno-Pulido and J. Solà Peracaula, “Running vacuum in quantum field theory in curved spacetime: renormalizing ρ_{vac} without $\sim m^4$ terms,” *Eur. Phys. J. C* **80** no. 8, (2020) 692, [arXiv:2005.03164 \[gr-qc\]](#).
- [1250] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2015 results. xv. gravitational lensing,” *Astron. Astrophys.* **594** (2016) A15, [arXiv:1502.01591 \[astro-ph.CO\]](#).
- [1251] J. Solà Peracaula, J. de Cruz Pérez, and A. Gómez-Valent, “Possible signals of vacuum dynamics in the universe,” *Mon. Not. Roy. Astron. Soc.* **478** no. 4, (2018) 4357–4373, [arXiv:1703.08218 \[astro-ph.CO\]](#).
- [1252] H. Gil-Marín, W. J. Percival, L. Verde, J. R. Brownstein, C.-H. Chuang, F.-S. Kitaura, S. A. Rodríguez-Torres, and M. D. Olmstead, “The clustering of galaxies in the sdss-iii baryon oscillation spectroscopic survey: Rsd measurement from the power spectrum and bispectrum of the dr12 boss galaxies,” *Mon. Not. Roy. Astron. Soc.* **465** no. 2, (2017) 1757–1788, [arXiv:1606.00439 \[astro-ph.CO\]](#).
- [1253] J. Solà, A. Gómez-Valent, and J. de Cruz Pérez, “First evidence of running cosmic vacuum: challenging the concordance model,” *Astrophys. J.* **836** no. 1, (2017) 43, [arXiv:1602.02103 \[astro-ph.CO\]](#).
- [1254] W. Lin, X. Chen, and K. J. Mack, “Early universe physics insensitive and uncalibrated cosmic standards: Constraints on Ω_m and implications for the hubble tension,” *Astrophys. J.* **920** no. 2, (2021) 159, [arXiv:2102.05701 \[astro-ph.CO\]](#).
- [1255] J. Froustey, C. Pitrou, and M. C. Volpe, “Neutrino decoupling including flavour oscillations and primordial nucleosynthesis,” *JCAP* **12** (2020) 015, [arXiv:2008.01074 \[hep-ph\]](#).
- [1256] **KiDS** Collaboration, M. Asgari *et al.*, “Kids-1000 cosmology: Cosmic shear constraints and comparison between two point statistics,” *Astron. Astrophys.* **645** (2021) A104, [arXiv:2007.15633 \[astro-ph.CO\]](#).
- [1257] J. J. Bennett, G. Buldgen, P. F. De Salas, M. Drewes, S. Gariazzo, S. Pastor, and Y. Y. Y. Wong, “Towards a precision calculation of n_{eff} in the standard model ii: Neutrino decoupling in the presence of flavour oscillations and finite-temperature qed,” *JCAP* **04** (2021) 073, [arXiv:2012.02726 \[hep-ph\]](#).
- [1258] F. de Bernardis, A. Melchiorri, L. Verde, and R. Jimenez, “The cosmic neutrino background and the age of the universe,” *JCAP* **03** (2008) 020, [arXiv:0707.4170 \[astro-ph\]](#).
- [1259] W. Giarè, E. Di Valentino, A. Melchiorri, and O. Mena, “New cosmological bounds on hot relics: axions and neutrinos,” *Mon. Not. Roy. Astron. Soc.* **505** no. 2, (2021) 2703–2711, [arXiv:2011.14704 \[astro-ph.CO\]](#).
- [1260] **SPT** Collaboration, T. de Haan *et al.*, “Cosmological constraints from galaxy clusters in the 2500 square-degree spt-sz survey,” *Astrophys. J.* **832** no. 1, (2016) 95, [arXiv:1603.06522 \[astro-ph.CO\]](#).

- [1261] F. La Franca, S. Bianchi, G. Ponti, E. Branchini, and G. Matt, “A new cosmological distance measure using active galactic nucleus x-ray variability,” *Astrophys. J. Lett.* **787** (2014) L12, [arXiv:1404.2607 \[astro-ph.CO\]](#).
- [1262] J. M. Wang, P. Du, D. Valls-Gabaud, C. Hu, and H. Netzer, “Super-eddington accreting massive black holes as long-lived cosmological standards,” *Phys. Rev. Lett.* **110** no. 8, (2013) 081301, [arXiv:1301.4225 \[astro-ph.CO\]](#).
- [1263] E. Di Valentino *et al.*, “Snowmass2021 - letter of interest cosmology intertwined i: Perspectives for the next decade,” *Astropart. Phys.* **131** (2021) 102606, [arXiv:2008.11283 \[astro-ph.CO\]](#).
- [1264] E. Di Valentino *et al.*, “Snowmass2021 - letter of interest cosmology intertwined ii: The hubble constant tension,” *Astropart. Phys.* **131** (2021) 102605, [arXiv:2008.11284 \[astro-ph.CO\]](#).
- [1265] E. Di Valentino *et al.*, “Cosmology intertwined iii: $f\sigma_8$ and s_8 ,” *Astropart. Phys.* **131** (2021) 102604, [arXiv:2008.11285 \[astro-ph.CO\]](#).
- [1266] E. Di Valentino *et al.*, “Snowmass2021 - letter of interest cosmology intertwined iv: The age of the universe and its curvature,” *Astropart. Phys.* **131** (2021) 102607, [arXiv:2008.11286 \[astro-ph.CO\]](#).
- [1267] K. Vattis, S. M. Koushiappas, and A. Loeb, “Dark matter decaying in the late universe can relieve the h_0 tension,” *Phys. Rev.* **D99** no. 12, (2019) 121302, [arXiv:1903.06220 \[astro-ph.CO\]](#).
- [1268] D.-C. Dai, G. D. Starkman, B. Stojkovic, D. Stojkovic, and A. Weltman, “Using quasars as standard clocks for measuring cosmological redshift,” *Phys. Rev. Lett.* **108** (2012) 231302, [arXiv:1204.5191 \[astro-ph.CO\]](#).
- [1269] C. D. Kreisch, F.-Y. Cyr-Racine, and O. Doré, “Neutrino puzzle: Anomalies, interactions, and cosmological tensions,” *Phys. Rev. D* **101** no. 12, (2020) 123505, [arXiv:1902.00534 \[astro-ph.CO\]](#).
- [1270] M. Martinelli, N. B. Hogg, S. Peirone, M. Bruni, and D. Wands, “Constraints on the interacting vacuum-geodesic cdm scenario,” *Mon. Not. Roy. Astron. Soc.* **488** no. 3, (2019) 3423–3438, [arXiv:1902.10694 \[astro-ph.CO\]](#).
- [1271] E. Di Valentino, R. Z. Ferreira, L. Visinelli, and U. Danielsson, “Late time transitions in the quintessence field and the h_0 tension,” *Phys. Dark Univ.* **26** (2019) 100385, [arXiv:1906.11255 \[astro-ph.CO\]](#).
- [1272] R. E. Keeley, S. Joudaki, M. Kaplinghat, and D. Kirkby, “Implications of a transition in the dark energy equation of state for the h_0 and σ_8 tensions,” *JCAP* **12** (2019) 035, [arXiv:1905.10198 \[astro-ph.CO\]](#).
- [1273] L. Visinelli, S. Vagnozzi, and U. Danielsson, “Revisiting a negative cosmological constant from low-redshift data,” *Symmetry* **11** no. 8, (2019) 1035, [arXiv:1907.07953 \[astro-ph.CO\]](#).
- [1274] R. Solomon and D. Stojkovic, “Variability in quasar light curves: using quasars as standard candles,” [arXiv:2110.03671 \[astro-ph.CO\]](#).
- [1275] N. Schöneberg, J. Lesgourgues, and D. C. Hooper, “The bao+bbn take on the hubble tension,” *JCAP* **1910** no. 10, (2019) 029, [arXiv:1907.11594 \[astro-ph.CO\]](#).
- [1276] A. Shafieloo, U. Alam, V. Sahni, and A. A. Starobinsky, “Smoothing supernova data to reconstruct the expansion history of the universe and its age,” *Mon. Not. Roy. Astron. Soc.* **366** (2006) 1081–1095, [arXiv:astro-ph/0505329](#).
- [1277] A. Shafieloo, “Model independent reconstruction of the expansion history of the universe and the properties of dark energy,” *Mon. Not. Roy. Astron. Soc.* **380** (2007) 1573–1580, [arXiv:astro-ph/0703034](#).
- [1278] A. Shafieloo and C. Clarkson, “Model independent tests of the standard cosmological model,” *Phys. Rev. D* **81** (2010) 083537, [arXiv:0911.4858 \[astro-ph.CO\]](#).
- [1279] A. Shafieloo, D. K. Hazra, V. Sahni, and A. A. Starobinsky, “Metastable dark energy with radioactive-like decay,” *Mon. Not. Roy. Astron. Soc.* **473** no. 2, (2018) 2760–2770, [arXiv:1610.05192 \[astro-ph.CO\]](#).

- [1280] J. E. Gonzalez, M. Benetti, R. von Marttens, and J. Alcaniz, “Testing the consistency between cosmological data: the impact of spatial curvature and the dark energy eos,” *JCAP* **11** no. 11, (2021) 060, [arXiv:2104.13455](#) [[astro-ph.CO](#)].
- [1281] K. Liao, A. Shafieloo, R. E. Keeley, and E. V. Linder, “A model-independent determination of the hubble constant from lensed quasars and supernovae using gaussian process regression,” *Astrophys. J. Lett.* **886** no. 1, (2019) L23, [arXiv:1908.04967](#) [[astro-ph.CO](#)].
- [1282] X. Li, A. Shafieloo, V. Sahni, and A. A. Starobinsky, “Revisiting metastable dark energy and tensions in the estimation of cosmological parameters,” *Astrophys. J.* **887** (4, 2019) 153, [arXiv:1904.03790](#) [[astro-ph.CO](#)].
- [1283] M. Martinelli and I. Tutusaus, “Cmb tensions with low-redshift h_0 and s_8 measurements: impact of a redshift-dependent type-ia supernovae intrinsic luminosity,” *Symmetry* **11** no. 8, (2019) 986, [arXiv:1906.09189](#) [[astro-ph.CO](#)].
- [1284] S. Birrer *et al.*, “Tdcosmo - iv. hierarchical time-delay cosmography – joint inference of the hubble constant and galaxy density profiles,” *Astron. Astrophys.* **643** (2020) A165, [arXiv:2007.02941](#) [[astro-ph.CO](#)].
- [1285] H. Desmond, B. Jain, and J. Sakstein, “Local resolution of the hubble tension: The impact of screened fifth forces on the cosmic distance ladder,” *Phys. Rev. D* **100** no. 4, (2019) 043537, [arXiv:1907.03778](#) [[astro-ph.CO](#)].
- [1286] T. Karwal and M. Kamionkowski, “Dark energy at early times, the hubble parameter, and the string axiverse,” *Phys. Rev. D* **94** no. 10, (2016) 103523, [arXiv:1608.01309](#) [[astro-ph.CO](#)].
- [1287] S. Kumar, R. C. Nunes, and S. K. Yadav, “Dark sector interaction: a remedy of the tensions between cmb and lss data,” *Eur. Phys. J. C* **79** no. 7, (2019) 576, [arXiv:1903.04865](#) [[astro-ph.CO](#)].
- [1288] P. Agrawal, G. Obied, and C. Vafa, “ h_0 tension, swampland conjectures, and the epoch of fading dark matter,” *Phys. Rev. D* **103** no. 4, (2021) 043523, [arXiv:1906.08261](#) [[astro-ph.CO](#)].
- [1289] F.-Y. Cyr-Racine, F. Ge, and L. Knox, “A symmetry of cosmological observables, and a high hubble constant as an indicator of a mirror world dark sector,” (7, 2021) , [arXiv:2107.13000](#) [[astro-ph.CO](#)].
- [1290] K. L. Greene and F.-Y. Cyr-Racine, “Hubble distancing: Focusing on distance measurements in cosmology,” (12, 2021) , [arXiv:2112.11567](#) [[astro-ph.CO](#)].
- [1291] G. Efstathiou, “A lockdown perspective on the hubble tension (with comments from the sh0es team),” [arXiv:2007.10716](#) [[astro-ph.CO](#)].
- [1292] W. Yang, S. Pan, A. Paliathanasis, S. Ghosh, and Y. Wu, “Observational constraints of a new unified dark fluid and the h_0 tension,” *Mon. Not. Roy. Astron. Soc.* **490** no. 2, (2019) 2071–2085, [arXiv:1904.10436](#) [[gr-qc](#)].
- [1293] W. Yang, S. Pan, E. Di Valentino, A. Paliathanasis, and J. Lu, “Challenging bulk viscous unified scenarios with cosmological observations,” *Phys. Rev. D* **100** no. 10, (2019) 103518, [arXiv:1906.04162](#) [[astro-ph.CO](#)].
- [1294] V. Sahni, A. Shafieloo, and A. A. Starobinsky, “Model independent evidence for dark energy evolution from baryon acoustic oscillations,” *Astrophys. J. Lett.* **793** no. 2, (2014) L40, [arXiv:1406.2209](#) [[astro-ph.CO](#)].
- [1295] S. Capozziello, R. D’Agostino, and O. Luongo, “Extended gravity cosmography,” *Int. J. Mod. Phys. D* **28** no. 10, (2019) 1930016, [arXiv:1904.01427](#) [[gr-qc](#)].
- [1296] A. Brazier *et al.*, “The nanograv program for gravitational waves and fundamental physics,” [arXiv:1908.05356](#) [[astro-ph.IM](#)].
- [1297] M. Benetti and S. Capozziello, “Connecting early and late epochs by $f(z)$ cdm cosmography,” *JCAP* **12** (2019) 008, [arXiv:1910.09975](#) [[astro-ph.CO](#)].

- [1298] W. Yang, S. Pan, S. Vagnozzi, E. Di Valentino, D. F. Mota, and S. Capozziello, “Dawn of the dark: unified dark sectors and the edges cosmic dawn 21-cm signal,” *JCAP* **1911** (2019) 044, [arXiv:1907.05344 \[astro-ph.CO\]](#).
- [1299] W. Yang, O. Mena, S. Pan, and E. Di Valentino, “Dark sectors with dynamical coupling,” *Phys. Rev. D* **100** no. 8, (2019) 083509, [arXiv:1906.11697 \[astro-ph.CO\]](#).
- [1300] D. Fixsen, “The temperature of the cosmic microwave background,” *The Astrophysical Journal* **707** no. 2, (2009) 916.
- [1301] R. Foot and R. R. Volkas, “Spheroidal galactic halos and mirror dark matter,” *Phys. Rev. D* **70** (2004) 123508, [arXiv:astro-ph/0407522 \[astro-ph\]](#).
- [1302] R. Foot and R. R. Volkas, “Was ordinary matter synthesized from mirror matter? an attempt to explain why $\omega(\text{baryon})$ approximately equal to $0.2 \omega(\text{dark})$,” *Phys. Rev. D* **68** (2003) 021304, [arXiv:hep-ph/0304261 \[hep-ph\]](#).
- [1303] R. Foot and S. Mitra, “Ordinary atom mirror atom bound states: A new window on the mirror world,” *Phys. Rev. D* **66** (2002) 061301, [arXiv:hep-ph/0204256 \[hep-ph\]](#).
- [1304] L. Ackerman, M. R. Buckley, S. M. Carroll, and M. Kamionkowski, “Dark matter and dark radiation,” *Phys. Rev. D* **79** (2009) 023519, [arXiv:0810.5126 \[hep-ph\]](#).
- [1305] R. Foot, “Mirror matter-type dark matter,” *Int. J. Mod. Phys. D* **13** (2004) 2161–2192, [arXiv:astro-ph/0407623 \[astro-ph\]](#).
- [1306] L. Hart and J. Chluba, “Updated fundamental constant constraints from planck 2018 data and possible relations to the hubble tension,” *Mon. Not. Roy. Astron. Soc.* **493** no. 3, (2020) 3255–3263, [arXiv:1912.03986 \[astro-ph.CO\]](#).
- [1307] J. L. Feng, M. Kaplinghat, H. Tu, and H.-B. Yu, “Hidden charged dark matter,” *JCAP* **0907** (2009) 004, [arXiv:0905.3039 \[hep-ph\]](#).
- [1308] P. Agrawal, F.-Y. Cyr-Racine, L. Randall, and J. Scholtz, “Make dark matter charged again,” *JCAP* **1705** no. 05, (2017) 022, [arXiv:1610.04611 \[hep-ph\]](#).
- [1309] O. Zahn and M. Zaldarriaga, “Probing the friedmann equation during recombination with future cmb experiments,” *Phys. Rev. D* **67** (2003) 063002, [arXiv:astro-ph/0212360](#).
- [1310] D. J. Fixsen, E. S. Cheng, J. M. Gales, J. C. Mather, R. A. Shafer, and E. L. Wright, “The cosmic microwave background spectrum from the full coBE FIRAS data set,” *Astrophys. J.* **473** (1996) 576, [arXiv:astro-ph/9605054](#).
- [1311] S. Pan, W. Yang, E. Di Valentino, E. N. Saridakis, and S. Chakraborty, “Interacting scenarios with dynamical dark energy: Observational constraints and alleviation of the h_0 tension,” *Phys. Rev. D* **100** no. 10, (2019) 103520, [arXiv:1907.07540 \[astro-ph.CO\]](#).
- [1312] D. Pesce *et al.*, “The megamaser cosmology project. xiii. combined hubble constant constraints,” *Astrophys. J. Lett.* **891** no. 1, (2020) L1, [arXiv:2001.09213 \[astro-ph.CO\]](#).
- [1313] Y.-F. Cai, M. Khurshudyan, and E. N. Saridakis, “Model-independent reconstruction of $f(t)$ gravity from gaussian processes,” *Astrophys. J.* **888** (2020) 62, [arXiv:1907.10813 \[astro-ph.CO\]](#).
- [1314] L. Herold, E. G. M. Ferreira, and E. Komatsu, “New constraint on early dark energy from planck and boss data using the profile likelihood,” (12, 2021) , [arXiv:2112.12140 \[astro-ph.CO\]](#).
- [1315] B. Bose and L. Lombriser, “Easing cosmic tensions with an open and hotter universe,” *Phys. Rev. D* **103** no. 8, (2021) L081304, [arXiv:2006.16149 \[astro-ph.CO\]](#).
- [1316] M. Reid, D. Pesce, and A. Riess, “An improved distance to ngc 4258 and its implications for the hubble constant,” *Astrophys. J. Lett.* **886** no. 2, (2019) L27, [arXiv:1908.05625 \[astro-ph.GA\]](#).

- [1317] S. Pan, W. Yang, E. Di Valentino, A. Shafieloo, and S. Chakraborty, “Reconciling h_0 tension in a six parameter space?,” *JCAP* **06** no. 06, (2020) 062, [arXiv:1907.12551](#) [[astro-ph.CO](#)].
- [1318] D. E. Holz and S. A. Hughes, “Using gravitational-wave standard sirens,” *Astrophys. J.* **629** (2005) 15–22, [arXiv:astro-ph/0504616](#).
- [1319] B. F. Schutz, “Determining the hubble constant from gravitational wave observations,” *Nature* **323** (1986) 310–311.
- [1320] E. Di Valentino, A. Melchiorri, and J. Silk, “Cosmological constraints in extended parameter space from the planck 2018 legacy release,” *JCAP* **01** (2020) 013, [arXiv:1908.01391](#) [[astro-ph.CO](#)].
- [1321] **SPT** Collaboration, J. Henning *et al.*, “Measurements of the temperature and e-mode polarization of the cmb from 500 square degrees of sptpol data,” *Astrophys. J.* **852** no. 2, (2018) 97, [arXiv:1707.09353](#) [[astro-ph.CO](#)].
- [1322] S. Dhawan, J. Alsing, and S. Vagnozzi, “Non-parametric spatial curvature inference using late-universe cosmological probes,” *Mon. Not. Roy. Astron. Soc.* **506** no. 1, (2021) L1, [arXiv:2104.02485](#) [[astro-ph.CO](#)].
- [1323] E. Ó Colgáin, M. M. Sheikh-Jabbari, and L. Yin, “Can dark energy be dynamical?,” *Phys. Rev. D* **104** no. 2, (2021) 023510, [arXiv:2104.01930](#) [[astro-ph.CO](#)].
- [1324] S. Vagnozzi, “New physics in light of the h_0 tension: an alternative view,” *Phys. Rev. D* **102** no. 2, (2020) 023518, [arXiv:1907.07569](#) [[astro-ph.CO](#)].
- [1325] E. Di Valentino, A. Melchiorri, O. Mena, and S. Vagnozzi, “Nonminimal dark sector physics and cosmological tensions,” *Phys. Rev. D* **101** no. 6, (2020) 063502, [arXiv:1910.09853](#) [[astro-ph.CO](#)].
- [1326] S. Kumar, “Remedy of some cosmological tensions via effective phantom-like behavior of interacting vacuum energy,” *Phys. Dark Univ.* **33** (2021) 100862, [arXiv:2102.12902](#) [[astro-ph.CO](#)].
- [1327] S. Nissanke, D. E. Holz, N. Dalal, S. A. Hughes, J. L. Sievers, and C. M. Hirata, “Determining the hubble constant from gravitational wave observations of merging compact binaries,” [arXiv:1307.2638](#) [[astro-ph.CO](#)].
- [1328] M.-X. Lin, G. Benevento, W. Hu, and M. Raveri, “Acoustic dark energy: Potential conversion of the hubble tension,” *Phys. Rev. D* **100** no. 6, (2019) 063542, [arXiv:1905.12618](#) [[astro-ph.CO](#)].
- [1329] T. L. Smith, V. Poulin, and M. A. Amin, “Oscillating scalar fields and the hubble tension: a resolution with novel signatures,” *Phys. Rev. D* **101** no. 6, (2020) 063523, [arXiv:1908.06995](#) [[astro-ph.CO](#)].
- [1330] E. Di Valentino, A. Melchiorri, O. Mena, and S. Vagnozzi, “Interacting dark energy in the early 2020s: A promising solution to the h_0 and cosmic shear tensions,” *Phys. Dark Univ.* **30** (2020) 100666, [arXiv:1908.04281](#) [[astro-ph.CO](#)].
- [1331] X. Li, R. E. Keeley, A. Shafieloo, X. Zheng, S. Cao, M. Biesiada, and Z.-H. Zhu, “Hubble diagram at higher redshifts: model independent calibration of quasars,” *Mon. Not. Roy. Astron. Soc.* **507** no. 1, (2021) 919–926, [arXiv:2103.16032](#) [[astro-ph.CO](#)].
- [1332] E. Ó Colgáin and H. Yavartanoo, “Testing the swampland: h_0 tension,” *Phys. Lett.* **B797** (2019) 134907, [arXiv:1905.02555](#) [[astro-ph.CO](#)].
- [1333] S. Pan, W. Yang, C. Singha, and E. N. Saridakis, “Observational constraints on sign-changeable interaction models and alleviation of the h_0 tension,” *Phys. Rev.* **D100** no. 8, (2019) 083539, [arXiv:1903.10969](#) [[astro-ph.CO](#)].
- [1334] K. V. Berghaus and T. Karwal, “Thermal friction as a solution to the hubble tension,” *Phys. Rev. D* **101** no. 8, (2020) 083537, [arXiv:1911.06281](#) [[astro-ph.CO](#)].
- [1335] A. Cuceu, J. Farr, P. Lemos, and A. Font-Ribera, “Baryon acoustic oscillations and the hubble constant: Past, present and future,” *JCAP* **1910** no. 10, (2019) 044, [arXiv:1906.11628](#) [[astro-ph.CO](#)].

- [1336] L. Knox and M. Millea, “Hubble constant hunter’s guide,” *Phys. Rev. D* **101** no. 4, (2020) 043533, [arXiv:1908.03663 \[astro-ph.CO\]](#).
- [1337] S. Vagnozzi, A. Loeb, and M. Moresco, “Eppur è piatto? the cosmic chronometers take on spatial curvature and cosmic concordance,” *Astrophys. J.* **908** no. 1, (2021) 84, [arXiv:2011.11645 \[astro-ph.CO\]](#).
- [1338] S. Adhikari and D. Huterer, “Super-cmb fluctuations and the hubble tension,” *Phys. Dark Univ.* **28** (2020) 100539, [arXiv:1905.02278 \[astro-ph.CO\]](#).
- [1339] F. Niedermann and M. S. Sloth, “New early dark energy,” *Phys. Rev. D* **103** no. 4, (2021) L041303, [arXiv:1910.10739 \[astro-ph.CO\]](#).
- [1340] A. Abada and M. Lucente, “Looking for the minimal inverse ν seesaw realisation,” *Nucl. Phys. B* **885** (2014) 651–678, [arXiv:1401.1507 \[hep-ph\]](#).
- [1341] A. Moss, E. Copeland, S. Bamford, and T. Clarke, “A model-independent reconstruction of dark energy to very high redshift,” (9, 2021) , [arXiv:2109.14848 \[astro-ph.CO\]](#).
- [1342] F. Niedermann and M. S. Sloth, “Hot new early dark energy,” *Phys. Rev. D* **105** no. 6, (2022) 063509, [arXiv:2112.00770 \[hep-ph\]](#).
- [1343] F. Niedermann and M. S. Sloth, “Hot new early dark energy: Towards a unified dark sector of neutrinos, dark energy and dark matter,” (12, 2021) , [arXiv:2112.00759 \[hep-ph\]](#).
- [1344] M. Raveri, “Reconstructing gravity on cosmological scales,” *Phys. Rev. D* **101** no. 8, (2020) 083524, [arXiv:1902.01366 \[astro-ph.CO\]](#).
- [1345] A. A. Kjerrgren and E. Mortsell, “On the use of galaxies as clocks and the universal expansion,” (6, 2021) , [arXiv:2106.11317 \[astro-ph.CO\]](#).
- [1346] S.-F. Yan, P. Zhang, J.-W. Chen, X.-Z. Zhang, Y.-F. Cai, and E. N. Saridakis, “Interpreting cosmological tensions from the effective field theory of torsional gravity,” *Phys. Rev. D* **101** no. 12, (2020) 121301, [arXiv:1909.06388 \[astro-ph.CO\]](#).
- [1347] F. K. Anagnostopoulos, S. Basilakos, and E. N. Saridakis, “Bayesian analysis of $f(t)$ gravity using $f\sigma_8$ data,” *Phys. Rev. D* **100** no. 8, (2019) 083517, [arXiv:1907.07533 \[astro-ph.CO\]](#).
- [1348] C. J. Copi, A. N. Davis, and L. M. Krauss, “A new nucleosynthesis constraint on the variation of g ,” *Phys. Rev. Lett.* **92** (2004) 171301, [arXiv:astro-ph/0311334](#).
- [1349] C. J. Copi, D. Huterer, and G. D. Starkman, “Multipole vectors - a new representation of the cmb sky and evidence for statistical anisotropy or non-gaussianity at $2 \leq \ell \leq 8$,” *Phys. Rev. D* **70** (2004) 043515, [arXiv:astro-ph/0310511](#).
- [1350] P. Bielewicz and A. Riazuelo, “The study of topology of the universe using multipole vectors,” *Mon. Not. Roy. Astron. Soc.* **396** (2009) 609, [arXiv:0804.2437 \[astro-ph\]](#).
- [1351] A. Riazuelo, S. Caillerie, M. Lachieze-Rey, R. Lehoucq, and J.-P. Luminet, “Constraining cosmic topology with cmb polarization,” (1, 2006) , [arXiv:astro-ph/0601433](#).
- [1352] S. Nesseris and L. Perivolaropoulos, “The limits of extended quintessence,” *Phys. Rev. D* **75** (2007) 023517, [arXiv:astro-ph/0611238](#).
- [1353] Z. Chen, W. Luo, Y.-F. Cai, and E. N. Saridakis, “New test on general relativity and $f(t)$ torsional gravity from galaxy-galaxy weak lensing surveys,” *Phys. Rev. D* **102** no. 10, (2020) 104044, [arXiv:1907.12225 \[astro-ph.CO\]](#).
- [1354] S.-F. Yan, C. Li, L. Xue, X. Ren, Y.-F. Cai, D. A. Easson, Y.-F. Yuan, and H. Zhao, “Testing the equivalence principle via the shadow of black holes,” *Phys. Rev. Res.* **2** no. 2, (2020) 023164, [arXiv:1912.12629 \[astro-ph.CO\]](#).

- [1355] S. K. Yadav, “Constraints on dark matter-photon coupling in the presence of time-varying dark energy,” *Mod. Phys. Lett. A* **33** (2019) 1950358, [arXiv:1907.05886 \[astro-ph.CO\]](#).
- [1356] Y. Wang, G.-B. Zhao, C.-H. Chuang, M. Pellejero-Ibanez, C. Zhao, F.-S. Kitaura, and S. Rodriguez-Torres, “The clustering of galaxies in the completed sdss-iii baryon oscillation spectroscopic survey: a tomographic analysis of structure growth and expansion rate from anisotropic galaxy clustering,” *Mon. Not. Roy. Astron. Soc.* **481** no. 3, (2018) 3160–3166, [arXiv:1709.05173 \[astro-ph.CO\]](#).
- [1357] H. Gil-Marín *et al.*, “The clustering of the sdss-iv extended baryon oscillation spectroscopic survey dr14 quasar sample: structure growth rate measurement from the anisotropic quasar power spectrum in the redshift range $0.8 < z < 2.2$,” *Mon. Not. Roy. Astron. Soc.* **477** no. 2, (2018) 1604–1638, [arXiv:1801.02689 \[astro-ph.CO\]](#).
- [1358] L. Taddei, M. Martinelli, and L. Amendola, “Model-independent constraints on modified gravity from current data and from the euclid and ska future surveys,” *JCAP* **12** (2016) 032, [arXiv:1604.01059 \[astro-ph.CO\]](#).
- [1359] M. Kasai and T. Futamase, “A possible solution to the hubble constant discrepancy – cosmology where the local volume expansion is driven by the domain average density,” *PTEP* **2019** no. 7, (2019) 073E01, [arXiv:1904.09689 \[gr-qc\]](#).
- [1360] G. Mangano, G. Miele, S. Pastor, T. Pinto, O. Pisanti, and P. D. Serpico, “Relic neutrino decoupling including flavor oscillations,” *Nucl. Phys. B* **729** (2005) 221–234, [arXiv:hep-ph/0506164 \[hep-ph\]](#).
- [1361] P. F. de Salas and S. Pastor, “Relic neutrino decoupling with flavour oscillations revisited,” *JCAP* **1607** no. 07, (2016) 051, [arXiv:1606.06986 \[hep-ph\]](#).
- [1362] S. Carneiro, P. C. de Holanda, C. Pigozzo, and F. Sobreira, “Is the h_0 tension suggesting a fourth neutrino generation?,” *Phys. Rev. D* **100** no. 2, (2019) 023505, [arXiv:1812.06064 \[astro-ph.CO\]](#).
- [1363] A. Paul, A. Ghoshal, A. Chatterjee, and S. Pal, “Inflation, (p)reheating and neutrino anomalies: Production of sterile neutrinos with secret interactions,” *Eur. Phys. J. C* **79** no. 10, (2019) 818, [arXiv:1808.09706 \[astro-ph.CO\]](#).
- [1364] E. Di Valentino, E. Giusarma, O. Mena, A. Melchiorri, and J. Silk, “Cosmological limits on neutrino unknowns versus low redshift priors,” *Phys. Rev. D* **93** no. 8, (2016) 083527, [arXiv:1511.00975 \[astro-ph.CO\]](#).
- [1365] D. Green *et al.*, “Messengers from the early universe: Cosmic neutrinos and other light relics,” *Bull. Am. Astron. Soc.* **51** no. 7, (2019) 159, [arXiv:1903.04763 \[astro-ph.CO\]](#).
- [1366] R. Z. Ferreira and A. Notari, “Observable windows for the qcd axion through the number of relativistic species,” *Phys. Rev. Lett.* **120** no. 19, (2018) 191301, [arXiv:1801.06090 \[hep-ph\]](#).
- [1367] E. Di Valentino, E. Giusarma, M. Lattanzi, O. Mena, A. Melchiorri, and J. Silk, “Cosmological axion and neutrino mass constraints from planck 2015 temperature and polarization data,” *Phys. Lett. B* **752** (2016) 182–185, [arXiv:1507.08665 \[astro-ph.CO\]](#).
- [1368] R. R. Caldwell, W. Komp, L. Parker, and D. A. T. Vanzella, “A sudden gravitational transition,” *Phys. Rev. D* **73** (2006) 023513, [arXiv:astro-ph/0507622 \[astro-ph\]](#).
- [1369] M. Chevallier and D. Polarski, “Accelerating universes with scaling dark matter,” *Int. J. Mod. Phys. D* **10** (2001) 213–224, [arXiv:gr-qc/0009008 \[gr-qc\]](#).
- [1370] E. Calabrese, A. Slosar, A. Melchiorri, G. F. Smoot, and O. Zahn, “Cosmic microwave weak lensing data as a test for the dark universe,” *Phys. Rev. D* **77** (2008) 123531, [arXiv:0803.2309 \[astro-ph\]](#).
- [1371] J. Sakstein and M. Trodden, “Early dark energy from massive neutrinos as a natural resolution of the hubble tension,” *Phys. Rev. Lett.* **124** no. 16, (2020) 161301, [arXiv:1911.11760 \[astro-ph.CO\]](#).

- [1372] M. Moresco, R. Jimenez, L. Verde, A. Cimatti, and L. Pozzetti, “Setting the stage for cosmic chronometers. ii. impact of stellar population synthesis models systematics and full covariance matrix,” *Astrophys. J.* **898** no. 1, (2020) 82, [arXiv:2003.07362](#) [[astro-ph.GA](#)].
- [1373] M. Moresco, L. Pozzetti, A. Cimatti, R. Jimenez, C. Maraston, L. Verde, D. Thomas, A. Citro, R. Tojeiro, and D. Wilkinson, “A 6% measurement of the hubble parameter at $z \sim 0.45$: direct evidence of the epoch of cosmic re-acceleration,” *JCAP* **05** (2016) 014, [arXiv:1601.01701](#) [[astro-ph.CO](#)].
- [1374] M. Moresco, R. Jimenez, L. Verde, L. Pozzetti, A. Cimatti, and A. Citro, “Setting the stage for cosmic chronometers. i. assessing the impact of young stellar populations on hubble parameter measurements,” *Astrophys. J.* **868** no. 2, (2018) 84, [arXiv:1804.05864](#) [[astro-ph.CO](#)].
- [1375] E. Di Valentino, D. E. Holz, A. Melchiorri, and F. Renzi, “The cosmological impact of future constraints on h_0 from gravitational-wave standard sirens,” *Phys. Rev. D* **98** no. 8, (2018) 083523, [arXiv:1806.07463](#) [[astro-ph.CO](#)].
- [1376] A. Palmese *et al.*, “Gravitational wave cosmology and astrophysics with large spectroscopic galaxy surveys,” [arXiv:1903.04730](#) [[astro-ph.CO](#)].
- [1377] E. Di Valentino and A. Melchiorri, “First cosmological constraints combining planck with the recent gravitational-wave standard siren measurement of the hubble constant,” *Phys. Rev. D* **97** no. 4, (2018) 041301, [arXiv:1710.06370](#) [[astro-ph.CO](#)].
- [1378] M. Bucher, A. S. Goldhaber, and N. Turok, “An open universe from inflation,” *Phys. Rev. D* **52** (1995) 3314–3337, [arXiv:hep-ph/9411206](#).
- [1379] R.-G. Cai, Z.-K. Guo, and T. Yang, “Null test of the cosmic curvature using $h(z)$ and supernovae data,” *Phys. Rev. D* **93** no. 4, (2016) 043517, [arXiv:1509.06283](#) [[astro-ph.CO](#)].
- [1380] Y. Liu, S. Cao, T. Liu, X. Li, S. Geng, Y. Lian, and W. Guo, “Model-independent constraints on cosmic curvature: implication from updated hubble diagram of high-redshift standard candles,” *Astrophys. J.* **901** no. 2, (2020) 129, [arXiv:2008.08378](#) [[astro-ph.CO](#)].
- [1381] P. Bull and M. Kamionkowski, “What if planck’s universe isn’t flat?,” *Phys. Rev. D* **87** no. 8, (2013) 081301, [arXiv:1302.1617](#) [[astro-ph.CO](#)]. [Erratum: *Phys.Rev.D* **87**, 129901 (2013)].
- [1382] M. Vardanyan, R. Trotta, and J. Silk, “How flat can you get? a model comparison perspective on the curvature of the universe,” *Mon. Not. Roy. Astron. Soc.* **397** (2009) 431–444, [arXiv:0901.3354](#) [[astro-ph.CO](#)].
- [1383] A. Lasenby and C. Doran, “Closed universes, de sitter space and inflation,” *Phys. Rev. D* **71** (2005) 063502, [arXiv:astro-ph/0307311](#).
- [1384] M. Kamionkowski and D. N. Spergel, “Large angle cosmic microwave background anisotropies in an open universe,” *Astrophys. J.* **432** (1994) 7, [arXiv:astro-ph/9312017](#).
- [1385] M. Kamionkowski, B. Ratra, D. N. Spergel, and N. Sugiyama, “Cbr anisotropy in an open inflation, cdm cosmogony,” *Astrophys. J. Lett.* **434** (1994) L1–L4, [arXiv:astro-ph/9406069](#).
- [1386] A. D. Linde, “Quantum creation of an open inflationary universe,” *Phys. Rev. D* **58** (1998) 083514, [arXiv:gr-qc/9802038](#).
- [1387] J. Gott, “Creation of open universes from de sitter space,” *Nature* **295** (1982) 304–307.
- [1388] A. D. Linde, “Can we have inflation with $\omega > 1$?,” *JCAP* **05** (2003) 002, [arXiv:astro-ph/0303245](#).
- [1389] E. Di Dio, F. Montanari, A. Raccanelli, R. Durrer, M. Kamionkowski, and J. Lesgourgues, “Curvature constraints from large scale structure,” *JCAP* **06** (2016) 013, [arXiv:1603.09073](#) [[astro-ph.CO](#)].
- [1390] T. Waterhouse and J. Zibin, “The cosmic variance of omega,” [arXiv:0804.1771](#) [[astro-ph](#)].
- [1391] L. Knox, “On precision measurement of the mean curvature,” *Phys. Rev. D* **73** (2006) 023503, [arXiv:astro-ph/0503405](#).

- [1392] C. D. Leonard, P. Bull, and R. Allison, “Spatial curvature endgame: Reaching the limit of curvature determination,” *Phys. Rev. D* **94** no. 2, (2016) 023502, [arXiv:1604.01410 \[astro-ph.CO\]](#).
- [1393] S. Capozziello, “Curvature quintessence,” *Int. J. Mod. Phys. D* **11** (2002) 483–492, [arXiv:gr-qc/0201033](#).
- [1394] R. Jimenez, A. Cimatti, L. Verde, M. Moresco, and B. Wandelt, “The local and distant universe: stellar ages and h_0 ,” *JCAP* **03** (2019) 043, [arXiv:1902.07081 \[astro-ph.CO\]](#).
- [1395] R. C. Nunes and A. Bernui, “Bao signatures in the 2-point angular correlations and the hubble tension,” *Eur. Phys. J. C* **80** no. 11, (2020) 1025, [arXiv:2008.03259 \[astro-ph.CO\]](#).
- [1396] **Planck** Collaboration, N. Aghanim *et al.*, “Planck 2018 results. viii. gravitational lensing,” *Astron. Astrophys.* **641** (2020) A8, [arXiv:1807.06210 \[astro-ph.CO\]](#).
- [1397] **Planck** Collaboration, N. Aghanim *et al.*, “Planck 2018 results. v. cmb power spectra and likelihoods,” *Astron. Astrophys.* **641** (2020) A5, [arXiv:1907.12875 \[astro-ph.CO\]](#).
- [1398] K. C. Schlafman, I. B. Thompson, and A. R. Casey, “An ultra metal-poor star near the hydrogen-burning limit,” *The Astrophysical Journal* **867** no. 2, (Nov, 2018) 98. <http://dx.doi.org/10.3847/1538-4357/aadd97>.
- [1399] H. E. Bond, E. P. Nelan, D. A. VandenBerg, G. H. Schaefer, and D. Harmer, “Hd 140283: A star in the solar neighborhood that formed shortly after the big bang,” *Astrophys. J. Lett.* **765** (2013) L12, [arXiv:1302.3180 \[astro-ph.SR\]](#).
- [1400] E. Di Valentino, A. Melchiorri, and J. Silk, “Investigating cosmic discordance,” *Astrophys. J. Lett.* **908** no. 1, (2021) L9, [arXiv:2003.04935 \[astro-ph.CO\]](#).
- [1401] D. Valcin, J. L. Bernal, R. Jimenez, L. Verde, and B. D. Wandelt, “Inferring the age of the universe with globular clusters,” *JCAP* **12** (2020) 002, [arXiv:2007.06594 \[astro-ph.CO\]](#).
- [1402] S. Bera, D. Rana, S. More, and S. Bose, “Incompleteness matters not: Inference of h_0 from binary black hole–galaxy cross-correlations,” *Astrophys. J.* **902** no. 1, (2020) 79, [arXiv:2007.04271 \[astro-ph.CO\]](#).
- [1403] W. Yang, E. Di Valentino, S. Pan, Y. Wu, and J. Lu, “Dynamical dark energy after planck cmb final release and h_0 tension,” *Mon. Not. Roy. Astron. Soc.* **501** no. 4, (2021) 5845–5858, [arXiv:2101.02168 \[astro-ph.CO\]](#).
- [1404] M. Archidiacono, E. Giusarma, S. Hannestad, and O. Mena, “Cosmic dark radiation and neutrinos,” *Adv. High Energy Phys.* **2013** (2013) 191047, [arXiv:1307.0637 \[astro-ph.CO\]](#).
- [1405] G. Efstathiou and S. Gratton, “A detailed description of the camspec likelihood pipeline and a reanalysis of the planck high frequency maps,” [arXiv:1910.00483 \[astro-ph.CO\]](#).
- [1406] G. Addison, Y. Huang, D. Watts, C. Bennett, M. Halpern, G. Hinshaw, and J. Weiland, “Quantifying discordance in the 2015 planck cmb spectrum,” *Astrophys. J.* **818** no. 2, (2016) 132, [arXiv:1511.00055 \[astro-ph.CO\]](#).
- [1407] C. Wetterich, “Cosmology and the fate of dilatation symmetry,” *Nucl. Phys. B* **302** (1988) 668–696, [arXiv:1711.03844 \[hep-th\]](#).
- [1408] S. Mukherjee, “The redshift dependence of black hole mass distribution: Is it reliable for standard sirens cosmology?,” (12, 2021) , [arXiv:2112.10256 \[astro-ph.CO\]](#).
- [1409] G. Efstathiou and S. Gratton, “The evidence for a spatially flat universe,” [arXiv:2002.06892 \[astro-ph.CO\]](#).
- [1410] W. Handley, “Curvature tension: evidence for a closed universe,” *Phys. Rev. D* **103** no. 4, (2021) L041301, [arXiv:1908.09139 \[astro-ph.CO\]](#).
- [1411] E. Di Valentino, A. Melchiorri, and J. Silk, “Planck evidence for a closed universe and a possible crisis for cosmology,” *Nature Astron.* **4** no. 2, (2019) 196–203, [arXiv:1911.02087 \[astro-ph.CO\]](#).

- [1412] **Planck** Collaboration, N. Aghanim *et al.*, “Planck intermediate results. li. features in the cosmic microwave background temperature power spectrum and shifts in cosmological parameters,” *Astron. Astrophys.* **607** (2017) A95, [arXiv:1608.02487](#) [[astro-ph.CO](#)].
- [1413] S. Mastrogiovanni, K. Leyde, C. Karathanasis, E. Chassande-Mottin, D. A. Steer, J. Gair, A. Ghosh, R. Gray, S. Mukherjee, and S. Rinaldi, “On the importance of source population models for gravitational-wave cosmology,” *Phys. Rev. D* **104** no. 6, (2021) 062009, [arXiv:2103.14663](#) [[gr-qc](#)].
- [1414] L. Parker and D. A. T. Vanzella, “Acceleration of the universe, vacuum metamorphosis, and the large time asymptotic form of the heat kernel,” *Phys. Rev.* **D69** (2004) 104009, [arXiv:gr-qc/0312108](#) [[gr-qc](#)].
- [1415] S. Alexander and E. McDonough, “Axion-dilaton destabilization and the hubble tension,” *Phys. Lett.* **B797** (2019) 134830, [arXiv:1904.08912](#) [[astro-ph.CO](#)].
- [1416] H.-Y. Chen, M. Fishbach, and D. E. Holz, “A two per cent hubble constant measurement from standard sirens within five years,” *Nature* **562** no. 7728, (2018) 545–547, [arXiv:1712.06531](#) [[astro-ph.CO](#)].
- [1417] **Planck** Collaboration, N. Aghanim *et al.*, “Planck 2015 results. xi. cmb power spectra, likelihoods, and robustness of parameters,” *Astron. Astrophys.* **594** (2016) A11, [arXiv:1507.02704](#) [[astro-ph.CO](#)].
- [1418] S. Vitale and H.-Y. Chen, “Measuring the hubble constant with neutron star black hole mergers,” *Phys. Rev. Lett.* **121** no. 2, (2018) 021303, [arXiv:1804.07337](#) [[astro-ph.CO](#)].
- [1419] R. Gray *et al.*, “Cosmological inference using gravitational wave standard sirens: A mock data analysis,” *Phys. Rev. D* **101** no. 12, (2020) 122001, [arXiv:1908.06050](#) [[gr-qc](#)].
- [1420] H.-Y. Chen, P. S. Cowperthwaite, B. D. Metzger, and E. Berger, “A program for multimessenger standard siren cosmology in the era of ligo a+, rubin observatory, and beyond,” *Astrophys. J. Lett.* **908** no. 1, (2021) L4, [arXiv:2011.01211](#) [[astro-ph.CO](#)].
- [1421] A. Palmese, C. R. Bom, S. Mucesh, and W. G. Hartley, “A standard siren measurement of the hubble constant using gravitational wave events from the first three ligo/virgo observing runs and the desi legacy survey,” (11, 2021) , [arXiv:2111.06445](#) [[astro-ph.CO](#)].
- [1422] Z. Berezhiani, A. Dolgov, and I. Tkachev, “Reconciling planck results with low redshift astronomical measurements,” *Phys. Rev. D* **92** no. 6, (2015) 061303, [arXiv:1505.03644](#) [[astro-ph.CO](#)].
- [1423] G. Montefalcone, P. J. Steinhardt, and D. H. Wesley, “Dark energy, extra dimensions, and the swampland,” *JHEP* **06** (2020) 091, [arXiv:2005.01143](#) [[hep-th](#)].
- [1424] L. A. Anchordoqui, V. Barger, H. Goldberg, X. Huang, D. Marfatia, L. H. M. da Silva, and T. J. Weiler, “Icecube neutrinos, decaying dark matter, and the hubble constant,” *Phys. Rev. D* **92** no. 6, (2015) 061301, [arXiv:1506.08788](#) [[hep-ph](#)]. [Erratum: *Phys.Rev.D* 94, 069901 (2016)].
- [1425] K. R. Dienes and B. Thomas, “Dynamical dark matter: I. theoretical overview,” *Phys. Rev. D* **85** (2012) 083523, [arXiv:1106.4546](#) [[hep-ph](#)].
- [1426] K. R. Dienes and B. Thomas, “Dynamical dark matter: Ii. an explicit model,” *Phys. Rev. D* **85** (2012) 083524, [arXiv:1107.0721](#) [[hep-ph](#)].
- [1427] K. R. Dienes and B. Thomas, “Phenomenological constraints on axion models of dynamical dark matter,” *Phys. Rev. D* **86** (2012) 055013, [arXiv:1203.1923](#) [[hep-ph](#)].
- [1428] A. Desai, K. R. Dienes, and B. Thomas, “Constraining dark-matter ensembles with supernova data,” *Phys. Rev. D* **101** no. 3, (2020) 035031, [arXiv:1909.07981](#) [[astro-ph.CO](#)].
- [1429] K. R. Dienes, F. Huang, J. Kost, S. Su, and B. Thomas, “Deciphering the archaeological record: Cosmological imprints of nonminimal dark sectors,” *Phys. Rev. D* **101** no. 12, (2020) 123511, [arXiv:2001.02193](#) [[astro-ph.CO](#)].
- [1430] K. R. Dienes, J. Kumar, and B. Thomas, “Direct detection of dynamical dark matter,” *Phys. Rev. D* **86** (2012) 055016, [arXiv:1208.0336](#) [[hep-ph](#)].

- [1431] K. R. Dienes, S. Su, and B. Thomas, “Distinguishing dynamical dark matter at the lhc,” *Phys. Rev. D* **86** (2012) 054008, [arXiv:1204.4183 \[hep-ph\]](#).
- [1432] K. R. Dienes, S. Su, and B. Thomas, “Strategies for probing nonminimal dark sectors at colliders: The interplay between cuts and kinematic distributions,” *Phys. Rev. D* **91** no. 5, (2015) 054002, [arXiv:1407.2606 \[hep-ph\]](#).
- [1433] K. R. Dienes, J. Kumar, and B. Thomas, “Dynamical dark matter and the positron excess in light of ams results,” *Phys. Rev. D* **88** no. 10, (2013) 103509, [arXiv:1306.2959 \[hep-ph\]](#).
- [1434] K. R. Dienes and B. Thomas, “Dynamical dark matter: Introduction, equation of state, and cosmological implications,” *PoS ICHEP2012* (2013) 452.
- [1435] K. R. Dienes and B. Thomas, “Dynamical dark matter: A new framework for dark-matter physics,” *AIP Conf. Proc.* **1534** no. 1, (2013) 57–77.
- [1436] K. R. Dienes and B. Thomas, “Phenomenology of dynamical dark matter,” *PoS ICHEP2012* (2013) 460.
- [1437] K. R. Dienes, F. Huang, S. Su, and B. Thomas, “Regge trajectories and hagedorn behavior: Hadronic realizations of dynamical dark matter,” *AIP Conf. Proc.* **1900** no. 1, (2017) 040003.
- [1438] K. R. Dienes, J. Fennick, J. Kumar, and B. Thomas, “Randomness in the dark sector: Emergent mass spectra and dynamical dark matter ensembles,” *Phys. Rev. D* **93** no. 8, (2016) 083506, [arXiv:1601.05094 \[hep-ph\]](#).
- [1439] Y. Buyukdag, K. R. Dienes, T. Gherghetta, and B. Thomas, “Partially composite dynamical dark matter,” *Phys. Rev. D* **101** no. 7, (2020) 075054, [arXiv:1912.10588 \[hep-ph\]](#).
- [1440] K. R. Dienes, J. Kost, and B. Thomas, “A tale of two timescales: Mixing, mass generation, and phase transitions in the early universe,” *Phys. Rev. D* **93** no. 4, (2016) 043540, [arXiv:1509.00470 \[hep-ph\]](#).
- [1441] K. R. Dienes, S. Su, and B. Thomas, “Beyond the bump-hunt: A game plan for discovering dynamical dark matter at the lhc,” *AIP Conf. Proc.* **1743** no. 1, (2016) 020013.
- [1442] K. R. Dienes, J. Kost, and B. Thomas, “A new approach to the cosmological moduli problem,” *AIP Conf. Proc.* **1743** no. 1, (2016) 020003.
- [1443] K. R. Dienes, J. Kost, and B. Thomas, “Kaluza-klein towers in the early universe: Phase transitions, relic abundances, and applications to axion cosmology,” *Phys. Rev. D* **95** no. 12, (2017) 123539, [arXiv:1612.08950 \[hep-ph\]](#).
- [1444] K. K. Boddy, K. R. Dienes, D. Kim, J. Kumar, J.-C. Park, and B. Thomas, “Lines and boxes: Unmasking dynamical dark matter through correlations in the mev gamma-ray spectrum,” *Phys. Rev. D* **94** no. 9, (2016) 095027, [arXiv:1606.07440 \[hep-ph\]](#).
- [1445] K. K. Boddy, K. R. Dienes, D. Kim, J. Kumar, J.-C. Park, and B. Thomas, “Boxes, boosts, and energy duality: Understanding the galactic-center gamma-ray excess through dynamical dark matter,” *Phys. Rev. D* **95** no. 5, (2017) 055024, [arXiv:1609.09104 \[hep-ph\]](#).
- [1446] K. R. Dienes, F. Huang, S. Su, and B. Thomas, “Dynamical dark matter from strongly-coupled dark sectors,” *Phys. Rev. D* **95** no. 4, (2017) 043526, [arXiv:1610.04112 \[hep-ph\]](#).
- [1447] K. R. Dienes, J. Fennick, J. Kumar, and B. Thomas, “Dynamical dark matter from thermal freeze-out,” *Phys. Rev. D* **97** no. 6, (2018) 063522, [arXiv:1712.09919 \[hep-ph\]](#).
- [1448] D. Curtin *et al.*, “Long-lived particles at the energy frontier: The mathusla physics case,” *Rept. Prog. Phys.* **82** no. 11, (2019) 116201, [arXiv:1806.07396 \[hep-ph\]](#).
- [1449] D. Curtin, K. R. Dienes, and B. Thomas, “Dynamical dark matter, mathusla, and the lifetime frontier,” *Phys. Rev. D* **98** no. 11, (2018) 115005, [arXiv:1809.11021 \[hep-ph\]](#).

- [1450] K. R. Dienes, J. Kumar, B. Thomas, and D. Yaylali, “Dark-matter decay as a complementary probe of multicomponent dark sectors,” *Phys. Rev. Lett.* **114** no. 5, (2015) 051301, [arXiv:1406.4868 \[hep-ph\]](#).
- [1451] K. R. Dienes, F. Huang, S. Su, and B. Thomas, “Dark hadrons as dynamical dark matter,” *PoS Confinement2018* (2018) 008.
- [1452] K. R. Dienes, L. Heurtier, F. Huang, D. Kim, T. M. P. Tait, and B. Thomas, “Stasis in an expanding universe: A recipe for stable mixed-component cosmological eras,” *Phys. Rev. D* **105** no. 2, (2022) 023530, [arXiv:2111.04753 \[astro-ph.CO\]](#).
- [1453] K. R. Dienes, F. Huang, J. Kost, B. Thomas, and H.-B. Yu, “Evaluating lyman- α constraints for general dark-matter velocity distributions: Multiple scales and cautionary tales,” (12, 2021) , [arXiv:2112.09105 \[astro-ph.CO\]](#).
- [1454] K. R. Dienes, F. Huang, J. Kost, K. Manogue, and B. Thomas, “Extracting dark-matter velocities from halo masses: A reconstruction conjecture,” (1, 2021) , [arXiv:2101.10337 \[astro-ph.CO\]](#).
- [1455] Z. Chacko, Y. Cui, S. Hong, T. Okui, and Y. Tsai, “Partially acoustic dark matter, interacting dark radiation, and large scale structure,” *JHEP* **12** (2016) 108, [arXiv:1609.03569 \[astro-ph.CO\]](#).
- [1456] J. König, A. Merle, and M. Totzauer, “keV sterile neutrino dark matter from singlet scalar decays: The most general case,” *JCAP* **11** (2016) 038, [arXiv:1609.01289 \[hep-ph\]](#).
- [1457] J. Heeck and D. Teresi, “Cold keV dark matter from decays and scatterings,” *Phys. Rev. D* **96** no. 3, (2017) 035018, [arXiv:1706.09909 \[hep-ph\]](#).
- [1458] Y. Du, F. Huang, H.-L. Li, Y.-Z. Li, and J.-H. Yu, “Revisit dark matter freeze-in and freeze-out through phase-space distribution,” (11, 2021) , [arXiv:2111.01267 \[hep-ph\]](#).
- [1459] Q. Decant, J. Heisig, D. C. Hooper, and L. Lopez-Honorez, “Lyman- α constraints on freeze-in and superwimps,” (11, 2021) , [arXiv:2111.09321 \[astro-ph.CO\]](#).
- [1460] J. Alcaniz, N. Bernal, A. Masiero, and F. S. Queiroz, “Light dark matter: A common solution to the lithium and h_0 problems,” *Phys. Lett. B* **812** (2021) 136008, [arXiv:1912.05563 \[astro-ph.CO\]](#).
- [1461] R. Akeson *et al.*, “The wide field infrared survey telescope: 100 hubbles for the 2020s,” [arXiv:1902.05569 \[astro-ph.IM\]](#).
- [1462] J. Zhang, B. R. Dinda, M. W. Hossain, A. A. Sen, and W. Luo, “A study on cubic galileon gravity using n-body simulations,” *Phys. Rev. D* **102** no. 4, (2020) 043510, [arXiv:2004.12659 \[astro-ph.CO\]](#).
- [1463] S. Birrer and T. Treu, “Tdcosmo - v. strategies for precise and accurate measurements of the hubble constant with strong lensing,” *Astron. Astrophys.* **649** (2021) A61, [arXiv:2008.06157 \[astro-ph.CO\]](#).
- [1464] B. Ratra and P. J. E. Peebles, “Cosmological consequences of a rolling homogeneous scalar field,” *Phys. Rev. D* **37** (1988) 3406.
- [1465] R. R. Caldwell, R. Dave, and P. J. Steinhardt, “Cosmological imprint of an energy component with general equation of state,” *Phys. Rev. Lett.* **80** (1998) 1582–1585, [arXiv:astro-ph/9708069](#).
- [1466] P. J. E. Peebles and J. T. Yu, “Primeval adiabatic perturbation in an expanding universe,” *Astrophys. J.* **162** (1970) 815–836.
- [1467] R. A. Sunyaev and Y. B. Zeldovich, “Small scale fluctuations of relic radiation,” *Astrophys. Space Sci.* **7** (1970) 3–19.
- [1468] L. Visinelli and S. Vagnozzi, “Cosmological window onto the string axiverse and the supersymmetry breaking scale,” *Phys. Rev. D* **99** no. 6, (2019) 063517, [arXiv:1809.06382 \[hep-ph\]](#).
- [1469] Y. B. Zeldovich and R. A. Sunyaev, “The interaction of matter and radiation in a hot-model universe,” *Astrophys. Space Sci.* **4** (1969) 301–316.

- [1470] S. Birrer *et al.*, “Holicow - ix. cosmographic analysis of the doubly imaged quasar sdss 1206+4332 and a new measurement of the hubble constant,” *Mon. Not. Roy. Astron. Soc.* **484** (2019) 4726, [arXiv:1809.01274 \[astro-ph.CO\]](#).
- [1471] **CSP** Collaboration, C. R. Burns *et al.*, “The carnegie supernova project: Absolute calibration and the hubble constant,” *Astrophys. J.* **869** no. 1, (2018) 56, [arXiv:1809.06381 \[astro-ph.CO\]](#).
- [1472] T. Yang, A. Banerjee, and E. Ó Colgáin, “Cosmography and flat λ cdm tensions at high redshift,” *Phys. Rev. D* **102** no. 12, (2020) 123532, [arXiv:1911.01681 \[astro-ph.CO\]](#).
- [1473] W. L. Freedman, B. F. Madore, V. Scowcroft, C. Burns, A. Monson, S. E. Persson, M. Seibert, and J. Rigby, “Carnegie hubble program: A mid-infrared calibration of the hubble constant,” *Astrophys. J.* **758** (2012) 24, [arXiv:1208.3281 \[astro-ph.CO\]](#).
- [1474] L. Breuval *et al.*, “The milky way cepheid leavitt law based on gaia dr2 parallaxes of companion stars and host open cluster populations,” *Astron. Astrophys.* **643** (2020) A115, [arXiv:2006.08763 \[astro-ph.SR\]](#).
- [1475] O. H. Philcox, M. M. Ivanov, M. Simonović, and M. Zaldarriaga, “Combining full-shape and bao analyses of galaxy power spectra: A 1.6% cmb-independent constraint on h_0 ,” *JCAP* **05** (2020) 032, [arXiv:2002.04035 \[astro-ph.CO\]](#).
- [1476] M. J. Jee, J. A. Tyson, S. Hilbert, M. D. Schneider, S. Schmidt, and D. Wittman, “Cosmic shear results from the deep lens survey - ii: Full cosmological parameter constraints from tomography,” *Astrophys. J.* **824** no. 2, (2016) 77, [arXiv:1510.03962 \[astro-ph.CO\]](#).
- [1477] S. Mukherjee, B. D. Wandelt, S. M. Nissanke, and A. Silvestri, “Accurate precision cosmology with redshift unknown gravitational wave sources,” *Phys. Rev. D* **103** no. 4, (2021) 043520, [arXiv:2007.02943 \[astro-ph.CO\]](#).
- [1478] S. Mukherjee and B. D. Wandelt, “Beyond the classical distance-redshift test: cross-correlating redshift-free standard candles and sirens with redshift surveys,” [arXiv:1808.06615 \[astro-ph.CO\]](#).
- [1479] G. Addison, D. Watts, C. Bennett, M. Halpern, G. Hinshaw, and J. Weiland, “Elucidating λ cdm: Impact of baryon acoustic oscillation measurements on the hubble constant discrepancy,” *Astrophys. J.* **853** no. 2, (2018) 119, [arXiv:1707.06547 \[astro-ph.CO\]](#).
- [1480] V. Sahni and A. Starobinsky, “Reconstructing dark energy,” *Int. J. Mod. Phys. D* **15** (2006) 2105–2132, [arXiv:astro-ph/0610026](#).
- [1481] E. Di Valentino, “A combined analysis of the h_0 late time direct measurements and the impact on the dark energy sector,” *Mon. Not. Roy. Astron. Soc.* **502** no. 2, (2021) 2065–2073, [arXiv:2011.00246 \[astro-ph.CO\]](#).
- [1482] C. Caprini, D. G. Figueroa, R. Flauger, G. Nardini, M. Peloso, M. Pieroni, A. Ricciardone, and G. Tasinato, “Reconstructing the spectral shape of a stochastic gravitational wave background with lisa,” *JCAP* **11** (2019) 017, [arXiv:1906.09244 \[astro-ph.CO\]](#).
- [1483] G. Cañas Herrera, O. Contigiani, and V. Vardanyan, “Cross-correlation of the astrophysical gravitational-wave background with galaxy clustering,” *Phys. Rev. D* **102** no. 4, (2020) 043513, [arXiv:1910.08353 \[astro-ph.CO\]](#).
- [1484] S. Mukherjee, B. D. Wandelt, and J. Silk, “Multimessenger tests of gravity with weakly lensed gravitational waves,” *Phys. Rev. D* **101** no. 10, (2020) 103509, [arXiv:1908.08950 \[astro-ph.CO\]](#).
- [1485] G. Scelfo, N. Bellomo, A. Raccanelli, S. Matarrese, and L. Verde, “Gw\>times\\$lss: chasing the progenitors of merging binary black holes,” *JCAP* **09** (2018) 039, [arXiv:1809.03528 \[astro-ph.CO\]](#).
- [1486] **Simons Observatory** Collaboration, P. Ade *et al.*, “The simons observatory: Science goals and forecasts,” *JCAP* **02** (2019) 056, [arXiv:1808.07445 \[astro-ph.CO\]](#).

- [1487] S. Mukherjee, B. D. Wandelt, and J. Silk, “Testing the general theory of relativity using gravitational wave propagation from dark standard sirens,” *Mon. Not. Roy. Astron. Soc.* **502** no. 1, (2021) 1136–1144, [arXiv:2012.15316 \[astro-ph.CO\]](#).
- [1488] S. Mukherjee, R. Khatri, and B. D. Wandelt, “Constraints on non-resonant photon-axion conversion from the planck satellite data,” *JCAP* **06** (2019) 031, [arXiv:1811.11177 \[astro-ph.CO\]](#).
- [1489] J. M. Ezquiaga, W. Hu, M. Lagos, and M.-X. Lin, “Gravitational wave propagation beyond general relativity: waveform distortions and echoes,” *JCAP* **11** no. 11, (2021) 048, [arXiv:2108.10872 \[astro-ph.CO\]](#).
- [1490] F. Calore, A. Cuoco, T. Regimbau, S. Sachdev, and P. D. Serpico, “Cross-correlating galaxy catalogs and gravitational waves: a tomographic approach,” *Phys. Rev. Res.* **2** (2020) 023314, [arXiv:2002.02466 \[astro-ph.CO\]](#).
- [1491] C. Caprini *et al.*, “Detecting gravitational waves from cosmological phase transitions with lisa: an update,” *JCAP* **03** (2020) 024, [arXiv:1910.13125 \[astro-ph.CO\]](#).
- [1492] V. De Luca, G. Franciolini, and A. Riotto, “Nanograv data hints at primordial black holes as dark matter,” *Phys. Rev. Lett.* **126** no. 4, (2021) 041303, [arXiv:2009.08268 \[astro-ph.CO\]](#).
- [1493] N. Bartolo, V. De Luca, G. Franciolini, A. Lewis, M. Peloso, and A. Riotto, “Primordial black hole dark matter: Lisa serendipity,” *Phys. Rev. Lett.* **122** no. 21, (2019) 211301, [arXiv:1810.12218 \[astro-ph.CO\]](#).
- [1494] S. Mukherjee and J. Silk, “Fundamental physics using the temporal gravitational wave background,” *Phys. Rev. D* **104** no. 6, (2021) 063518, [arXiv:2008.01082 \[astro-ph.HE\]](#).
- [1495] E. Berti *et al.*, “Testing general relativity with present and future astrophysical observations,” *Class. Quant. Grav.* **32** (2015) 243001, [arXiv:1501.07274 \[gr-qc\]](#).
- [1496] E. V. Linder, “Exploring the expansion history of the universe,” *Phys. Rev. Lett.* **90** (2003) 091301, [arXiv:astro-ph/0208512 \[astro-ph\]](#).
- [1497] **LIGO Scientific, Virgo** Collaboration, R. Abbott *et al.*, “Gwtc-2: Compact binary coalescences observed by ligo and virgo during the first half of the third observing run,” *Phys. Rev. X* **11** (2021) 021053, [arXiv:2010.14527 \[gr-qc\]](#).
- [1498] M. Kamionkowski, J. Pradler, and D. G. E. Walker, “Dark energy from the string axiverse,” *Phys. Rev. Lett.* **113** no. 25, (2014) 251302, [arXiv:1409.0549 \[hep-ph\]](#).
- [1499] **LIGO Scientific, Virgo** Collaboration, B. P. Abbott *et al.*, “Gwtc-1: A gravitational-wave transient catalog of compact binary mergers observed by ligo and virgo during the first and second observing runs,” *Phys. Rev. X* **9** no. 3, (2019) 031040, [arXiv:1811.12907 \[astro-ph.HE\]](#).
- [1500] S. E. Perkins, N. Yunes, and E. Berti, “Probing fundamental physics with gravitational waves: The next generation,” *Phys. Rev. D* **103** no. 4, (2021) 044024, [arXiv:2010.09010 \[gr-qc\]](#).
- [1501] Z. Carson and K. Yagi, “Parametrized and inspiral-merger-ringdown consistency tests of gravity with multiband gravitational wave observations,” *Phys. Rev. D* **101** no. 4, (2020) 044047, [arXiv:1911.05258 \[gr-qc\]](#).
- [1502] Z. Carson, B. C. Seymour, and K. Yagi, “Future prospects for probing scalar–tensor theories with gravitational waves from mixed binaries,” *Class. Quant. Grav.* **37** no. 6, (2020) 065008, [arXiv:1907.03897 \[gr-qc\]](#).
- [1503] P. Di Bari, S. F. King, and A. Merle, “Dark radiation or warm dark matter from long lived particle decays in the light of planck,” *Phys. Lett. B* **724** (2013) 77–83, [arXiv:1303.6267 \[hep-ph\]](#).
- [1504] K. Abazajian *et al.*, “Cmb-s4 decadal survey apc white paper,” *Bull. Am. Astron. Soc.* **51** no. 7, (2019) 209, [arXiv:1908.01062 \[astro-ph.IM\]](#).

- [1505] B. Penning, “The pursuit of dark matter at colliders—an overview,” *J. Phys. G* **45** no. 6, (2018) 063001, [arXiv:1712.01391 \[hep-ex\]](#).
- [1506] X. Cid Vidal *et al.*, “Report from Working Group 3: Beyond the Standard Model physics at the HL-LHC and HE-LHC,” *CERN Yellow Rep. Monogr.* **7** (2019) 585–865, [arXiv:1812.07831 \[hep-ph\]](#).
- [1507] H. Akaike, “A new look at the statistical model identification,” *IEEE Transactions on Automatic Control* **19** no. 6, (1974) 716–723.
- [1508] **FASER** Collaboration, A. Ariga *et al.*, “Technical proposal for faser: Forward search experiment at the lhc,” [arXiv:1812.09139 \[physics.ins-det\]](#).
- [1509] N. Cornish, L. Sampson, N. Yunes, and F. Pretorius, “Gravitational wave tests of general relativity with the parameterized post-einsteinian framework,” *Phys. Rev. D* **84** (2011) 062003, [arXiv:1105.2088 \[gr-qc\]](#).
- [1510] G. Schwarz, “Estimating the dimension of a model,” *The Annals of Statistics* **6** no. 2, (1978) 461 – 464. <https://doi.org/10.1214/aos/1176344136>.
- [1511] **FASER** Collaboration, A. Ariga *et al.*, “Faser: Forward search experiment at the lhc,” [arXiv:1901.04468 \[hep-ex\]](#).
- [1512] R. Essig, P. Schuster, and N. Toro, “Probing dark forces and light hidden sectors at low-energy e+e- colliders,” *Phys. Rev. D* **80** (2009) 015003, [arXiv:0903.3941 \[hep-ph\]](#).
- [1513] J. L. Feng, “Faser and the search for light and weakly interacting particles,” *Astrophys. Space Sci. Proc.* **56** (2019) 69–75.
- [1514] A. G. Riess, W. Yuan, S. Casertano, L. M. Macri, and D. Scolnic, “The accuracy of the hubble constant measurement verified through cepheid amplitudes,” *Astrophys. J.* **896** no. 2, (2020) L43, [arXiv:2005.02445 \[astro-ph.CO\]](#).
- [1515] W. M. Farr, M. Fishbach, J. Ye, and D. Holz, “A future percent-level measurement of the hubble expansion at redshift 0.8 with advanced ligo,” *Astrophys. J. Lett.* **883** no. 2, (2019) L42, [arXiv:1908.09084 \[astro-ph.CO\]](#).
- [1516] H. Zhan and J. A. Tyson, “Cosmology with the large synoptic survey telescope: an overview,” *Rept. Prog. Phys.* **81** no. 6, (2018) 066901, [arXiv:1707.06948 \[astro-ph.CO\]](#).
- [1517] N. Yunes and F. Pretorius, “Fundamental theoretical bias in gravitational wave astrophysics and the parameterized post-einsteinian framework,” *Phys. Rev. D* **80** (2009) 122003, [arXiv:0909.3328 \[gr-qc\]](#).
- [1518] L. Hart and J. Chluba, “Improved model-independent constraints on the recombination era and development of a direct projection method,” [arXiv:1912.04682 \[astro-ph.CO\]](#).
- [1519] **LSST** Collaboration, v. Ivezić *et al.*, “Lsst: from science drivers to reference design and anticipated data products,” *Astrophys. J.* **873** no. 2, (2019) 111, [arXiv:0805.2366 \[astro-ph\]](#).
- [1520] M. Liu, Z. Huang, X. Luo, H. Miao, N. K. Singh, and L. Huang, “Can non-standard recombination resolve the hubble tension?,” *Science China Physics, Mechanics & Astronomy* **63** no. 9, (May, 2020) . <http://dx.doi.org/10.1007/s11433-019-1509-5>.
- [1521] S. Mastrogiovanni, L. Haegel, C. Karathanasis, I. M. n. Hernandez, and D. A. Steer, “Gravitational wave friction in light of gw170817 and gw190521,” *JCAP* **02** (2021) 043, [arXiv:2010.04047 \[gr-qc\]](#).
- [1522] K. Blum, E. Castorina, and M. Simonović, “Could quasar lensing time delays hint to a core component in halos, instead of h_0 tension?,” *Astrophys. J. Lett.* **892** no. 2, (2020) L27, [arXiv:2001.07182 \[astro-ph.CO\]](#).
- [1523] A. Mitra, J. Mifsud, D. F. Mota, and D. Parkinson, “Cosmology with the einstein telescope: No slip gravity model and redshift specifications,” *Mon. Not. Roy. Astron. Soc.* **502** no. 4, (2021) 5563–5575, [arXiv:2010.00189 \[astro-ph.CO\]](#).

- [1524] T. Baker and I. Harrison, “Constraining scalar-tensor modified gravity with gravitational waves and large scale structure surveys,” *JCAP* **01** (2021) 068, [arXiv:2007.13791 \[astro-ph.CO\]](#).
- [1525] E. Di Valentino and L. Mersini-Houghton, “Testing predictions of the quantum landscape multiverse 2: The exponential inflationary potential,” *JCAP* **03** (2017) 020, [arXiv:1612.08334 \[astro-ph.CO\]](#).
- [1526] T. Tram, R. Vallance, and V. Vennin, “Inflation model selection meets dark radiation,” *JCAP* **01** (2017) 046, [arXiv:1606.09199 \[astro-ph.CO\]](#).
- [1527] **LIGO Scientific, VIRGO, KAGRA** Collaboration, R. Abbott *et al.*, “Gwtc-3: Compact binary coalescences observed by ligo and virgo during the second part of the third observing run,” (11, 2021) , [arXiv:2111.03606 \[gr-qc\]](#).
- [1528] R. C. Nunes, “Searching for modified gravity in the astrophysical gravitational wave background: Application to ground-based interferometers,” *Phys. Rev. D* **102** no. 2, (2020) 024071, [arXiv:2007.07750 \[gr-qc\]](#).
- [1529] J. Valiviita, E. Majerotto, and R. Maartens, “Instability in interacting dark energy and dark matter fluids,” *JCAP* **07** (2008) 020, [arXiv:0804.0232 \[astro-ph\]](#).
- [1530] M. Gavela, L. Lopez Honorez, O. Mena, and S. Rigolin, “Dark coupling and gauge invariance,” *JCAP* **11** (2010) 044, [arXiv:1005.0295 \[astro-ph.CO\]](#).
- [1531] K.-F. Lyu, E. Stamou, and L.-T. Wang, “Self-interacting neutrinos: Solution to hubble tension versus experimental constraints,” *Phys. Rev. D* **103** no. 1, (2021) 015004, [arXiv:2004.10868 \[hep-ph\]](#).
- [1532] W. J. Wolf and M. Lagos, “Standard sirens as a novel probe of dark energy,” *Phys. Rev. Lett.* **124** no. 6, (2020) 061101, [arXiv:1910.10580 \[gr-qc\]](#).
- [1533] C. Umiltà, M. Ballardini, F. Finelli, and D. Paoletti, “Cmb and bao constraints for an induced gravity dark energy model with a quartic potential,” *JCAP* **08** (2015) 017, [arXiv:1507.00718 \[astro-ph.CO\]](#).
- [1534] K. Akita and M. Yamaguchi, “A precision calculation of relic neutrino decoupling,” *JCAP* **08** (2020) 012, [arXiv:2005.07047 \[hep-ph\]](#).
- [1535] G. Choi, M. Suzuki, and T. T. Yanagida, “Degenerate sub-keV fermion dark matter from a solution to the hubble tension,” *Phys. Rev. D* **101** no. 7, (2020) 075031, [arXiv:2002.00036 \[hep-ph\]](#).
- [1536] G. Choi, M. Suzuki, and T. T. Yanagida, “Quintessence axion dark energy and a solution to the hubble tension,” *Phys. Lett. B* **805** (2020) 135408, [arXiv:1910.00459 \[hep-ph\]](#).
- [1537] M. Rossi, M. Ballardini, M. Braglia, F. Finelli, D. Paoletti, A. A. Starobinsky, and C. Umiltà, “Cosmological constraints on post-newtonian parameters in effectively massless scalar-tensor theories of gravity,” *Phys. Rev. D* **100** no. 10, (2019) 103524, [arXiv:1906.10218 \[astro-ph.CO\]](#).
- [1538] C. Brans and R. H. Dicke, “Mach’s principle and a relativistic theory of gravitation,” *Phys. Rev.* **124** (1961) 925–935.
- [1539] C. Dalang, P. Fleury, and L. Lombriser, “Horndeski gravity and standard sirens,” *Phys. Rev. D* **102** no. 4, (2020) 044036, [arXiv:1912.06117 \[gr-qc\]](#).
- [1540] M. Ballardini, F. Finelli, C. Umiltà, and D. Paoletti, “Cosmological constraints on induced gravity dark energy models,” *JCAP* **05** (2016) 067, [arXiv:1601.03387 \[astro-ph.CO\]](#).
- [1541] J. B. Jiménez, D. Bettoni, and P. Brax, “Charged dark matter and the h_0 tension,” *Phys. Rev. D* **103** no. 10, (2021) 103505, [arXiv:2004.13677 \[astro-ph.CO\]](#).
- [1542] P. Jordan, “Die physikalischen weltkonstanten,” *Naturwissenschaften* **25** (August, 1937) 513–517.
- [1543] G. Calcagni, S. Kuroyanagi, S. Marsat, M. Sakellariadou, N. Tamanini, and G. Tasinato, “Quantum gravity and gravitational-wave astronomy,” *JCAP* **10** (2019) 012, [arXiv:1907.02489 \[gr-qc\]](#).

- [1544] A. Gogoi, R. K. Sharma, P. Chanda, and S. Das, “Early mass-varying neutrino dark energy: Nugget formation and hubble anomaly,” *Astrophys. J.* **915** no. 2, (2021) 132, [arXiv:2005.11889](#) [[astro-ph.CO](#)].
- [1545] E. Belgacem, Y. Dirian, S. Foffa, E. J. Howell, M. Maggiore, and T. Regimbau, “Cosmology and dark energy from joint gravitational wave-grb observations,” *JCAP* **08** (2019) 015, [arXiv:1907.01487](#) [[astro-ph.CO](#)].
- [1546] Ö. Akarsu, S. Kumar, S. Sharma, and L. Tedesco, “Constraints on a bianchi type i spacetime extension of the standard λ cdm model,” *Phys. Rev. D* **100** no. 2, (2019) 023532, [arXiv:1905.06949](#) [[astro-ph.CO](#)].
- [1547] Ö. Akarsu, J. D. Barrow, L. A. Escamilla, and J. A. Vázquez, “Graduated dark energy: Observational hints of a spontaneous sign switch in the cosmological constant,” *Phys. Rev. D* **101** no. 6, (2020) 063528, [arXiv:1912.08751](#) [[astro-ph.CO](#)].
- [1548] D. J. Shaw and J. D. Barrow, “Varying couplings in electroweak theory,” *Phys. Rev. D* **71** (2005) 063525, [arXiv:gr-qc/0412135](#).
- [1549] Ö. Akarsu, J. D. Barrow, C. V. R. Board, N. M. Uzun, and J. A. Vázquez, “Screening λ in a new modified gravity model,” *Eur. Phys. J. C* **79** no. 10, (2019) 846, [arXiv:1903.11519](#) [[gr-qc](#)].
- [1550] Ö. Akarsu, S. Kumar, E. Özülker, and J. A. Vázquez, “Relaxing cosmological tensions with a sign switching cosmological constant,” *Phys. Rev. D* **104** no. 12, (2021) 123512, [arXiv:2108.09239](#) [[astro-ph.CO](#)].
- [1551] A. Banihashemi, N. Khosravi, and A. Shafieloo, “Dark energy as a critical phenomenon: a hint from hubble tension,” *JCAP* **06** (2021) 003, [arXiv:2012.01407](#) [[astro-ph.CO](#)].
- [1552] D. Kimberly and J. Magueijo, “Varying alpha and the electroweak model,” *Phys. Lett. B* **584** (2004) 8–15, [arXiv:hep-ph/0310030](#).
- [1553] F. X. Linares Cedeño, N. Roy, and L. A. Ureña López, “Tracker phantom field and a cosmological constant: Dynamics of a composite dark energy model,” *Phys. Rev. D* **104** no. 12, (2021) 123502, [arXiv:2105.07103](#) [[astro-ph.CO](#)].
- [1554] S. Bag, V. Sahni, A. Shafieloo, and Y. Shtanov, “Phantom braneworld and the hubble tension,” (7, 2021) , [arXiv:2107.03271](#) [[astro-ph.CO](#)].
- [1555] A. A. Sen, S. A. Adil, and S. Sen, “Do cosmological observations allow a negative λ ?,” (12, 2021) , [arXiv:2112.10641](#) [[astro-ph.CO](#)].
- [1556] L. A. Escamilla and J. A. Vázquez, “Model selection applied to non-parametric reconstructions of the dark energy,” (11, 2021) , [arXiv:2111.10457](#) [[astro-ph.CO](#)].
- [1557] Ö. Akarsu, N. Katırcı, N. Özdemir, and J. A. Vázquez, “Anisotropic massive brans-dicke gravity extension of the standard λ cdm model,” *Eur. Phys. J. C* **80** no. 1, (2020) 32, [arXiv:1903.06679](#) [[gr-qc](#)].
- [1558] J. D. Barrow and J. Magueijo, “Redshifting of cosmological black bodies in bekenstein-sandvik-barrow-magueijo varying-alpha theories,” *Phys. Rev. D* **90** no. 12, (2014) 123506, [arXiv:1406.1053](#) [[gr-qc](#)].
- [1559] J. D. Barrow and A. A. H. Graham, “General dynamics of varying-alpha universes,” *Phys. Rev. D* **88** (2013) 103513, [arXiv:1307.6816](#) [[gr-qc](#)].
- [1560] K. Uehara and C. W. Kim, “Brans-dicke cosmology with the cosmological constant,” *Phys. Rev. D* **26** (1982) 2575.
- [1561] B. Boisseau, “Exact cosmological solution of a scalar-tensor gravity theory compatible with the λ cdm model,” *Phys. Rev. D* **83** (2011) 043521, [arXiv:1011.2915](#) [[astro-ph.CO](#)].
- [1562] V. Faraoni, “Scalar field mass in generalized gravity,” *Class. Quant. Grav.* **26** (2009) 145014, [arXiv:0906.1901](#) [[gr-qc](#)].

- [1563] J. M. Maldacena, “The large n limit of superconformal field theories and supergravity,” *Adv. Theor. Math. Phys.* **2** (1998) 231–252, [arXiv:hep-th/9711200](#).
- [1564] J. D. Barrow and S. Z. W. Lip, “A generalized theory of varying α ,” *Phys. Rev. D* **85** (2012) 023514, [arXiv:1110.3120 \[gr-qc\]](#).
- [1565] R. Bousso and J. Polchinski, “Quantization of four form fluxes and dynamical neutralization of the cosmological constant,” *JHEP* **06** (2000) 006, [arXiv:hep-th/0004134](#).
- [1566] M. Farhang and N. Khosravi, “Phenomenological gravitational phase transition: Reconciliation between the late and early universe,” *Phys. Rev. D* **103** no. 8, (2021) 083523, [arXiv:2011.08050 \[astro-ph.CO\]](#).
- [1567] Y. Gu, M. Khlopov, L. Wu, J. M. Yang, and B. Zhu, “Light gravitino dark matter: Lhc searches and the hubble tension,” *Phys. Rev. D* **102** no. 11, (2020) 115005, [arXiv:2006.09906 \[hep-ph\]](#).
- [1568] T. Damour and A. M. Polyakov, “The string dilaton and a least coupling principle,” *Nucl. Phys. B* **423** (1994) 532–558, [arXiv:hep-th/9401069](#).
- [1569] J. D. Barrow and B. Li, “Varying- α cosmologies with potentials,” *Phys. Rev. D* **78** (2008) 083536, [arXiv:0808.1580 \[gr-qc\]](#).
- [1570] X. Gao and X.-Y. Hong, “Propagation of gravitational waves in a cosmological background,” *Phys. Rev. D* **101** no. 6, (2020) 064057, [arXiv:1906.07131 \[gr-qc\]](#).
- [1571] R. D’Agostino and R. C. Nunes, “Probing observational bounds on scalar-tensor theories from standard sirens,” *Phys. Rev. D* **100** no. 4, (2019) 044041, [arXiv:1907.05516 \[gr-qc\]](#).
- [1572] E. Belgacem, Y. Dirian, A. Finke, S. Foffa, and M. Maggiore, “Nonlocal gravity and gravitational-wave observations,” *JCAP* **11** (2019) 022, [arXiv:1907.02047 \[astro-ph.CO\]](#).
- [1573] R. C. Nunes, S. Pan, and E. N. Saridakis, “New observational constraints on $f(t)$ gravity through gravitational-wave astronomy,” *Phys. Rev. D* **98** no. 10, (2018) 104055, [arXiv:1810.03942 \[gr-qc\]](#).
- [1574] J. D. Bekenstein, “Fine structure constant: Is it really a constant?,” *Phys. Rev. D* **25** (1982) 1527–1539.
- [1575] M. Lagos, M. Fishbach, P. Landry, and D. E. Holz, “Standard sirens with a running planck mass,” *Phys. Rev. D* **99** no. 8, (2019) 083504, [arXiv:1901.03321 \[astro-ph.CO\]](#).
- [1576] **LISA Cosmology Working Group** Collaboration, E. Belgacem *et al.*, “Testing modified gravity at cosmological distances with lisa standard sirens,” *JCAP* **07** (2019) 024, [arXiv:1906.01593 \[astro-ph.CO\]](#).
- [1577] S. L. Adler, “Implications of a frame dependent dark energy for the spacetime metric, cosmography, and effective hubble constant,” *Phys. Rev. D* **100** no. 12, (2019) 123503, [arXiv:1905.08228 \[astro-ph.CO\]](#).
- [1578] M. C. D. Marsh, “Exacerbating the cosmological constant problem with interacting dark energy models,” *Phys. Rev. Lett.* **118** no. 1, (2017) 011302, [arXiv:1606.01538 \[astro-ph.CO\]](#).
- [1579] G. Barenboim, W. H. Kinney, and W.-I. Park, “Flavor versus mass eigenstates in neutrino asymmetries: implications for cosmology,” *Eur. Phys. J. C* **77** no. 9, (2017) 590, [arXiv:1609.03200 \[astro-ph.CO\]](#).
- [1580] Z. Zeng, S. Yeung, and M.-C. Chu, “Effects of neutrino mass and asymmetry on cosmological structure formation,” *JCAP* **03** (2019) 015, [arXiv:1808.00357 \[astro-ph.CO\]](#).
- [1581] S. Tsujikawa, “Quintessence: A review,” *Class. Quant. Grav.* **30** (2013) 214003, [arXiv:1304.1961 \[gr-qc\]](#).
- [1582] P. Agrawal, G. Obied, P. J. Steinhardt, and C. Vafa, “On the cosmological implications of the string swampland,” *Phys. Lett. B* **784** (2018) 271–276, [arXiv:1806.09718 \[hep-th\]](#).
- [1583] J. F. Donoghue, “Spatial gradients in the cosmological constant,” *JHEP* **03** (2003) 052, [arXiv:hep-ph/0101130](#).

- [1584] L. Amendola, “Coupled quintessence,” *Phys. Rev. D* **62** (2000) 043511, [arXiv:astro-ph/9908023](#).
- [1585] E. Palti, “The swampland: Introduction and review,” *Fortsch. Phys.* **67** no. 6, (2019) 1900037, [arXiv:1903.06239 \[hep-th\]](#).
- [1586] I. Zlatev, L.-M. Wang, and P. J. Steinhardt, “Quintessence, cosmic coincidence, and the cosmological constant,” *Phys. Rev. Lett.* **82** (1999) 896–899, [arXiv:astro-ph/9807002](#).
- [1587] A. C. O. Leite, C. J. A. P. Martins, and P. Molaro, “Dark energy constraints from espresso tests of the stability of fundamental couplings,” *Universe* **3** no. 2, (2017) 30.
- [1588] C. J. A. P. Martins, “The status of varying constants: a review of the physics, searches and implications,” (9, 2017) , [arXiv:1709.02923 \[astro-ph.CO\]](#).
- [1589] S. Arai and A. Nishizawa, “Generalized framework for testing gravity with gravitational-wave propagation. ii. constraints on horndeski theory,” *Phys. Rev. D* **97** no. 10, (2018) 104038, [arXiv:1711.03776 \[gr-qc\]](#).
- [1590] E. Belgacem, Y. Dirian, S. Foffa, and M. Maggiore, “Modified gravitational-wave propagation and standard sirens,” *Phys. Rev. D* **98** no. 2, (2018) 023510, [arXiv:1805.08731 \[gr-qc\]](#).
- [1591] V. Pettorino, L. Amendola, and C. Wetterich, “How early is early dark energy?,” *Phys. Rev. D* **87** (2013) 083009, [arXiv:1301.5279 \[astro-ph.CO\]](#).
- [1592] V. Pettorino, “Testing modified gravity with planck: the case of coupled dark energy,” *Phys. Rev. D* **88** (2013) 063519, [arXiv:1305.7457 \[astro-ph.CO\]](#).
- [1593] A. G. Riess *et al.*, “New parallaxes of galactic cepheids from spatially scanning the hubble space telescope: Implications for the hubble constant,” *Astrophys. J.* **855** no. 2, (2018) 136, [arXiv:1801.01120 \[astro-ph.SR\]](#).
- [1594] R.-G. Cai, T.-B. Liu, X.-W. Liu, S.-J. Wang, and T. Yang, “Probing cosmic anisotropy with gravitational waves as standard sirens,” *Phys. Rev. D* **97** no. 10, (2018) 103005, [arXiv:1712.00952 \[astro-ph.CO\]](#).
- [1595] R. C. Nunes, M. E. Alves, and J. C. de Araujo, “Primordial gravitational waves in horndeski gravity,” *Phys. Rev. D* **99** no. 8, (2019) 084022, [arXiv:1811.12760 \[gr-qc\]](#).
- [1596] K. Yagi, “Scientific potential of decigo pathfinder and testing gr with space-borne gravitational wave interferometers,” *Int. J. Mod. Phys. D* **22** (2013) 1341013, [arXiv:1302.2388 \[gr-qc\]](#).
- [1597] A. Nishizawa, A. Taruya, and S. Saito, “Tracing the redshift evolution of hubble parameter with gravitational-wave standard sirens,” *Phys. Rev. D* **83** (2011) 084045, [arXiv:1011.5000 \[astro-ph.CO\]](#).
- [1598] A. Gómez-Valent and L. Amendola, “ h_0 from cosmic chronometers and type ia supernovae, with gaussian processes and the novel weighted polynomial regression method,” *JCAP* **04** (2018) 051, [arXiv:1802.01505 \[astro-ph.CO\]](#).
- [1599] B. Audren, D. Blas, M. M. Ivanov, J. Lesgourgues, and S. Sibiryakov, “Cosmological constraints on deviations from lorentz invariance in gravity and dark matter,” *JCAP* **03** (2015) 016, [arXiv:1410.6514 \[astro-ph.CO\]](#).
- [1600] M. P. Dabrowski, V. Salzano, A. Balcerzak, and R. Lazkoz, “New tests of variability of the speed of light,” *EPJ Web Conf.* **126** (2016) 04012.
- [1601] A. Balcerzak, M. P. Dabrowski, and V. Salzano, “Modelling spatial variations of the speed of light,” *Annalen Phys.* **529** no. 9, (2017) 1600409, [arXiv:1604.07655 \[astro-ph.CO\]](#).
- [1602] F. J. Dyson, “Aspects of quantum theory,” ch. 3, pp. 213–236. Cambridge Univ. Press, Cambridge, 1972.
- [1603] N. Leefer, C. T. M. Weber, A. Cingöz, J. R. Torgerson, and D. Budker, “New limits on variation of the fine-structure constant using atomic dysprosium,” *Phys. Rev. Lett.* **111** (2013) 060801, [arXiv:1304.6940 \[physics.atom-ph\]](#).

- [1604] H. Yu, B. Ratra, and F.-Y. Wang, “Hubble parameter and baryon acoustic oscillation measurement constraints on the hubble constant, the deviation from the spatially flat λ cdm model, the deceleration–acceleration transition redshift, and spatial curvature,” *Astrophys. J.* **856** no. 1, (2018) 3, [arXiv:1711.03437 \[astro-ph.CO\]](#).
- [1605] A. Nishizawa, A. Taruya, and S. Kawamura, “Cosmological test of gravity with polarizations of stochastic gravitational waves around 0.1-1 hz,” *Phys. Rev. D* **81** (2010) 104043, [arXiv:0911.0525 \[gr-qc\]](#).
- [1606] W. Yang, S. Pan, and A. Paliathanasis, “Cosmological constraints on an exponential interaction in the dark sector,” *Mon. Not. Roy. Astron. Soc.* **482** no. 1, (2019) 1007–1016, [arXiv:1804.08558 \[gr-qc\]](#).
- [1607] S. Pan, J. de Haro, W. Yang, and J. Amorós, “Understanding the phenomenology of interacting dark energy scenarios and their theoretical bounds,” *Phys. Rev. D* **101** no. 12, (2020) 123506, [arXiv:2001.09885 \[gr-qc\]](#).
- [1608] A. A. H. Graham, “Varying-alpha and k-essence,” *Class. Quant. Grav.* **32** no. 1, (2015) 015019, [arXiv:1408.2788 \[gr-qc\]](#).
- [1609] A. Paliathanasis, S. Pan, and W. Yang, “Dynamics of nonlinear interacting dark energy models,” *Int. J. Mod. Phys. D* **28** no. 12, (2019) 1950161, [arXiv:1903.02370 \[gr-qc\]](#).
- [1610] W. Yang, N. Banerjee, A. Paliathanasis, and S. Pan, “Reconstructing the dark matter and dark energy interaction scenarios from observations,” *Phys. Dark Univ.* **26** (2019) 100383, [arXiv:1812.06854 \[astro-ph.CO\]](#).
- [1611] W. Yang, S. Pan, R. Herrera, and S. Chakraborty, “Large-scale (in) stability analysis of an exactly solved coupled dark-energy model,” *Phys. Rev. D* **98** no. 4, (2018) 043517, [arXiv:1808.01669 \[gr-qc\]](#).
- [1612] J. Magueijo, J. D. Barrow, and H. B. Sandvik, “Is it e or is it c ? experimental tests of varying α ,” *Phys. Lett. B* **549** (2002) 284–289, [arXiv:astro-ph/0202374](#).
- [1613] W. Yang, S. Pan, L. Xu, and D. F. Mota, “Effects of anisotropic stress in interacting dark matter – dark energy scenarios,” *Mon. Not. Roy. Astron. Soc.* **482** no. 2, (2019) 1858–1871, [arXiv:1804.08455 \[astro-ph.CO\]](#).
- [1614] N. Khetan *et al.*, “A new measurement of the hubble constant using type ia supernovae calibrated with surface brightness fluctuations,” *Astron. Astrophys.* **647** (2021) A72, [arXiv:2008.07754 \[astro-ph.CO\]](#).
- [1615] D. Wang and X.-H. Meng, “Model-independent determination on h_0 using the latest cosmic chronometer data,” *Sci. China Phys. Mech. Astron.* **60** no. 11, (2017) 110411, [arXiv:1610.01202 \[gr-qc\]](#).
- [1616] O. H. E. Philcox, B. D. Sherwin, G. S. Farren, and E. J. Baxter, “Determining the hubble constant without the sound horizon: Measurements from galaxy surveys,” *Phys. Rev. D* **103** no. 2, (2021) 023538, [arXiv:2008.08084 \[astro-ph.CO\]](#).
- [1617] H. B. Sandvik, J. D. Barrow, and J. Magueijo, “A simple cosmology with a varying fine structure constant,” *Phys. Rev. Lett.* **88** (2002) 031302, [arXiv:astro-ph/0107512](#).
- [1618] C. Cutler and D. E. Holz, “Ultra-high precision cosmology from gravitational waves,” *Phys. Rev. D* **80** (2009) 104009, [arXiv:0906.3752 \[astro-ph.CO\]](#).
- [1619] W. Yang, S. Pan, R. C. Nunes, and D. F. Mota, “Dark calling dark: Interaction in the dark sector in presence of neutrino properties after planck cmb final release,” *JCAP* **04** (2020) 008, [arXiv:1910.08821 \[astro-ph.CO\]](#).
- [1620] W. Yang, E. Di Valentino, O. Mena, S. Pan, and R. C. Nunes, “All-inclusive interacting dark sector cosmologies,” *Phys. Rev. D* **101** no. 8, (2020) 083509, [arXiv:2001.10852 \[astro-ph.CO\]](#).
- [1621] A. Hernández-Almada, G. Leon, J. Magaña, M. A. García-Aspeitia, and V. Motta, “Generalized emergent dark energy: observational hubble data constraints and stability analysis,” [arXiv:2002.12881 \[astro-ph.CO\]](#).

- [1622] W. Yang, S. Pan, D. F. Mota, and M. Du, “Forecast constraints on anisotropic stress in dark energy using gravitational-waves,” *Mon. Not. Roy. Astron. Soc.* **497** no. 1, (2020) 879–893, [arXiv:2001.02180 \[astro-ph.CO\]](#).
- [1623] D. J. Mortlock, S. M. Feeney, H. V. Peiris, A. R. Williamson, and S. M. Nissanke, “Unbiased hubble constant estimation from binary neutron star mergers,” *Phys. Rev. D* **100** no. 10, (2019) 103523, [arXiv:1811.11723 \[astro-ph.CO\]](#).
- [1624] D. Wang and X.-H. Meng, “Exploring the expansion dynamics of the universe from galaxy cluster surveys,” *Phys. Dark Univ.* **18** (2017) 30–37, [arXiv:1709.04134 \[astro-ph.CO\]](#).
- [1625] S. M. Feeney, H. V. Peiris, A. R. Williamson, S. M. Nissanke, D. J. Mortlock, J. Alsing, and D. Scolnic, “Prospects for resolving the hubble constant tension with standard sirens,” *Phys. Rev. Lett.* **122** no. 6, (2019) 061105, [arXiv:1802.03404 \[astro-ph.CO\]](#).
- [1626] X. Fu, L. Zhou, and J. Chen, “Testing the cosmic distance-duality relation from future gravitational wave standard sirens,” *Phys. Rev. D* **99** no. 8, (2019) 083523, [arXiv:1903.09913 \[gr-qc\]](#).
- [1627] S. M. Feeney, D. J. Mortlock, and N. Dalmaso, “Clarifying the hubble constant tension with a bayesian hierarchical model of the local distance ladder,” *Mon. Not. Roy. Astron. Soc.* **476** no. 3, (2018) 3861–3882, [arXiv:1707.00007 \[astro-ph.CO\]](#).
- [1628] N. Blinov, K. J. Kelly, G. Z. Krnjaic, and S. D. McDermott, “Constraining the self-interacting neutrino interpretation of the hubble tension,” *Phys. Rev. Lett.* **123** no. 19, (2019) 191102, [arXiv:1905.02727 \[astro-ph.CO\]](#).
- [1629] G. Ballesteros, A. Notari, and F. Rompineve, “The h_0 tension: δg_n vs. δn_{eff} ,” *JCAP* **11** (2020) 024, [arXiv:2004.05049 \[astro-ph.CO\]](#).
- [1630] G. L. Pimentel, B. Wallisch, W. L. K. Wu, *et al.*, “Inflation: Theory and observations.” *Snowmass 2021 White Paper*, 2022.
- [1631] W. Yang, S. Vagnozzi, E. Di Valentino, R. C. Nunes, S. Pan, and D. F. Mota, “Listening to the sound of dark sector interactions with gravitational wave standard sirens,” *JCAP* **07** (2019) 037, [arXiv:1905.08286 \[astro-ph.CO\]](#).
- [1632] J.-Z. Qi, S. Cao, C. Zheng, Y. Pan, Z. Li, J. Li, and T. Liu, “Testing the etherington distance duality relation at higher redshifts: Combined radio quasar and gravitational wave data,” *Phys. Rev. D* **99** no. 6, (2019) 063507, [arXiv:1902.01988 \[astro-ph.CO\]](#).
- [1633] J.-F. Zhang, H.-Y. Dong, J.-Z. Qi, and X. Zhang, “Prospect for constraining holographic dark energy with gravitational wave standard sirens from the einstein telescope,” *Eur. Phys. J. C* **80** no. 3, (2020) 217, [arXiv:1906.07504 \[astro-ph.CO\]](#).
- [1634] Z. Zhai, J. L. Tinker, A. Banerjee, J. DeRose, H. Guo, Y.-Y. Mao, S. McLaughlin, K. Storey-Fisher, and R. H. Wechsler, “The aemulus project v: Cosmological constraint from small-scale clustering of boss galaxies,” [arXiv:2203.08999 \[astro-ph.CO\]](#).
- [1635] T. de Jaeger, B. E. Stahl, W. Zheng, A. V. Filippenko, A. G. Riess, and L. Galbany, “A measurement of the hubble constant from type ii supernovae,” *Mon. Not. Roy. Astron. Soc.* **496** no. 3, (2020) 3402–3411, [arXiv:2006.03412 \[astro-ph.CO\]](#).
- [1636] T. de Jaeger, L. Galbany, A. G. Riess, B. E. Stahl, B. J. Shappee, A. V. Filippenko, and W. Zheng, “A 5% measurement of the hubble constant from type ii supernovae,” (3, 2022) , [arXiv:2203.08974 \[astro-ph.CO\]](#).
- [1637] D. Wang and X.-H. Meng, “Determining h_0 with the latest hii galaxy measurements,” *Astrophys. J.* **843** no. 2, (2017) 100, [arXiv:1612.09023 \[astro-ph.CO\]](#).
- [1638] W. Yang, S. Pan, E. Di Valentino, B. Wang, and A. Wang, “Forecasting interacting vacuum-energy models using gravitational waves,” *JCAP* **05** (2020) 050, [arXiv:1904.11980 \[astro-ph.CO\]](#).

- [1639] L.-F. Wang, X.-N. Zhang, J.-F. Zhang, and X. Zhang, “Impacts of gravitational-wave standard siren observation of the einstein telescope on weighing neutrinos in cosmology,” *Phys. Lett. B* **782** (2018) 87–93, [arXiv:1802.04720 \[astro-ph.CO\]](#).
- [1640] X.-N. Zhang, L.-F. Wang, J.-F. Zhang, and X. Zhang, “Improving cosmological parameter estimation with the future gravitational-wave standard siren observation from the einstein telescope,” *Phys. Rev. D* **99** no. 6, (2019) 063510, [arXiv:1804.08379 \[astro-ph.CO\]](#).
- [1641] J.-J. Wei, “Model-independent curvature determination from gravitational-wave standard sirens and cosmic chronometers,” *Astrophys. J.* **868** no. 1, (2018) 29, [arXiv:1806.09781 \[astro-ph.CO\]](#).
- [1642] D. Benisty, E. I. Guendelman, E. N. Saridakis, H. Stoecker, J. Struckmeier, and D. Vasak, “Inflation from fermions with curvature-dependent mass,” *Phys. Rev. D* **100** no. 4, (2019) 043523, [arXiv:1905.03731 \[gr-qc\]](#).
- [1643] D. Benisty and A.-C. Davis, “Dark energy interactions near the galactic center,” *Phys. Rev. D* **105** no. 2, (2022) 024052, [arXiv:2108.06286 \[astro-ph.CO\]](#).
- [1644] D. Benisty, M. Chaichian, and M. Oksanen, “Mimetic tensor-vector-scalar cosmology: Unified dark energy, dark matter and stiff matter,” (7, 2021) , [arXiv:2107.12161 \[gr-qc\]](#).
- [1645] E. Kourkchi, R. B. Tully, G. S. Anand, H. M. Courtois, A. Dupuy, J. D. Neill, L. Rizzi, and M. Seibert, “Cosmicflows-4: The calibration of optical and infrared tully–fisher relations,” *Astrophys. J.* **896** no. 1, (2020) 3, [arXiv:2004.14499 \[astro-ph.GA\]](#).
- [1646] J. Schombert, S. McGaugh, and F. Lelli, “Using the baryonic tully-fisher relation to measure h_o ,” *Astron. J.* **160** no. 2, (2020) 71, [arXiv:2006.08615 \[astro-ph.CO\]](#).
- [1647] M. Du, W. Yang, L. Xu, S. Pan, and D. F. Mota, “Future constraints on dynamical dark-energy using gravitational-wave standard sirens,” *Phys. Rev. D* **100** no. 4, (2019) 043535, [arXiv:1812.01440 \[astro-ph.CO\]](#).
- [1648] A. Chudaykin, D. Gorbunov, and I. Tkachev, “Dark matter component decaying after recombination: Lensing constraints with planck data,” *Phys. Rev. D* **94** (2016) 023528, [arXiv:1602.08121 \[astro-ph.CO\]](#).
- [1649] D. Berechya and U. Leonhardt, “Lifshitz cosmology: quantum vacuum and hubble tension,” *Mon. Not. Roy. Astron. Soc.* **507** no. 3, (2021) 3473, [arXiv:2008.04789 \[gr-qc\]](#).
- [1650] R. Allahverdi, M. Cicoli, B. Dutta, and K. Sinha, “Correlation between dark matter and dark radiation in string compactifications,” *JCAP* **10** (2014) 002, [arXiv:1401.4364 \[hep-ph\]](#).
- [1651] S. Kawamura *et al.*, “Current status of space gravitational wave antenna decigo and b-decigo,” *PTEP* **2021** no. 5, (2021) 05A105, [arXiv:2006.13545 \[gr-qc\]](#).
- [1652] **TianQin** Collaboration, J. Luo *et al.*, “Tianqin: a space-borne gravitational wave detector,” *Class. Quant. Grav.* **33** no. 3, (2016) 035010, [arXiv:1512.02076 \[astro-ph.IM\]](#).
- [1653] D. Benisty and D. Staicova, “Testing late-time cosmic acceleration with uncorrelated baryon acoustic oscillation dataset,” *Astron. Astrophys.* **647** (2021) A38, [arXiv:2009.10701 \[astro-ph.CO\]](#).
- [1654] D. Benisty, E. I. Guendelman, A. van de Venn, D. Vasak, J. Struckmeier, and H. Stoecker, “The dark side of the torsion: Dark energy from kinetic torsion,” (9, 2021) , [arXiv:2109.01052 \[astro-ph.CO\]](#).
- [1655] M. Maggiore *et al.*, “Science case for the einstein telescope,” *JCAP* **03** (2020) 050, [arXiv:1912.02622 \[astro-ph.CO\]](#).
- [1656] D. Reitze *et al.*, “Cosmic explorer: The u.s. contribution to gravitational-wave astronomy beyond ligo,” *Bull. Am. Astron. Soc.* **51** (7, 2019) 035, [arXiv:1907.04833 \[astro-ph.IM\]](#).
- [1657] W.-R. Hu and Y.-L. Wu, “The taiji program in space for gravitational wave physics and the nature of gravity,” *Natl. Sci. Rev.* **4** no. 5, (2017) 685–686.

- [1658] M. Rezaei, S. Pour-Ojaghi, and M. Malekjani, “A cosmography approach to dark energy cosmologies: New constraints using the hubble diagrams of supernovae, quasars, and gamma-ray bursts,” *Astrophys. J.* **900** no. 1, (2020) 70, [arXiv:2008.03092 \[astro-ph.CO\]](#).
- [1659] L. Parker and A. Raval, “New quantum aspects of a vacuum dominated universe,” *Phys. Rev.* **D62** (2000) 083503, [arXiv:gr-qc/0003103 \[gr-qc\]](#). [Erratum: *Phys. Rev.* **D67**, 029903(2003)].
- [1660] L. A. Anchordoqui, H. Goldberg, and G. Steigman, “Right-handed neutrinos as the dark radiation: Status and forecasts for the lhc,” *Phys. Lett. B* **718** (2013) 1162–1165, [arXiv:1211.0186 \[hep-ph\]](#).
- [1661] V. Poulin, P. D. Serpico, and J. Lesgourgues, “A fresh look at linear cosmological constraints on a decaying dark matter component,” *JCAP* **1608** (2016) 036, [arXiv:1606.02073 \[astro-ph.CO\]](#).
- [1662] R. Flores, G. R. Blumenthal, A. Dekel, and J. R. Primack, “Is the universe dominated by relativistic particles?,” *Nature* **323** (1986) 781–784.
- [1663] A. G. Doroshkevich, M. Khlopov, and A. A. Klypin, “Large-scale structure of the universe in unstable dark matter models,” *Mon. Not. Roy. Astron. Soc.* **239** (1989) 923–938. <https://doi.org/10.1093/mnras/239.3.923>.
- [1664] B. Audren, J. Lesgourgues, G. Mangano, P. D. Serpico, and T. Tram, “Strongest model-independent bound on the lifetime of dark matter,” *JCAP* **1412** (2014) 028, [arXiv:1407.2418 \[astro-ph.CO\]](#).
- [1665] K. Enqvist, S. Nadathur, T. Sekiguchi, and T. Takahashi, “Decaying dark matter and the tension in σ_8 ,” *JCAP* **1509** (2015) 067, [arXiv:1505.05511 \[astro-ph.CO\]](#).
- [1666] B. S. Haridasu and M. Viel, “Late-time decaying dark matter: constraints and implications for the h_0 -tension,” *Mon. Not. Roy. Astron. Soc.* **497** no. 2, (2020) 1757–1764, [arXiv:2004.07709 \[astro-ph.CO\]](#).
- [1667] M.-Y. Wang, A. H. G. Peter, L. E. Strigari, A. R. Zentner, B. Arant, S. Garrison-Kimmel, and M. Rocha, “Cosmological simulations of decaying dark matter: implications for small-scale structure of dark matter haloes,” *Mon. Not. Roy. Astron. Soc.* **445** no. 1, (2014) 614–629, [arXiv:1406.0527 \[astro-ph.CO\]](#).
- [1668] D. Cheng, M. C. Chu, and J. Tang, “Cosmological structure formation in decaying dark matter models,” *JCAP* **1507** (2015) 009, [arXiv:1503.05682 \[astro-ph.CO\]](#).
- [1669] S. Aoyama, T. Sekiguchi, K. Ichiki, and N. Sugiyama, “Evolution of perturbations and cosmological constraints in decaying dark matter models with arbitrary decay mass products,” *JCAP* **1407** (2014) 021, [arXiv:1402.2972 \[astro-ph.CO\]](#).
- [1670] E. Del Nobile, M. Nardecchia, and P. Panci, “Millicharge or decay: A critical take on minimal dark matter,” *JCAP* **1604** (2016) 048, [arXiv:1512.05353 \[hep-ph\]](#).
- [1671] A. Nygaard, T. Tram, and S. Hannestad, “Updated constraints on decaying cold dark matter,” *JCAP* **05** (2021) 017, [arXiv:2011.01632 \[astro-ph.CO\]](#).
- [1672] G. Blackadder and S. M. Koushiappas, “Dark matter with two- and many-body decays and supernovae type ia,” *Phys. Rev.* **D90** no. 10, (2014) 103527, [arXiv:1410.0683 \[astro-ph.CO\]](#).
- [1673] G. Blackadder and S. M. Koushiappas, “Cosmological constraints to dark matter with two- and many-body decays,” *Phys. Rev.* **D93** no. 2, (2016) 023510, [arXiv:1510.06026 \[astro-ph.CO\]](#).
- [1674] A. Ibarra, A. S. Lamperstorfer, and J. Silk, “Dark matter annihilations and decays after the ams-02 positron measurements,” *Phys. Rev.* **D89** no. 6, (2014) 063539, [arXiv:1309.2570 \[hep-ph\]](#).
- [1675] M. Cirelli, E. Moulin, P. Panci, P. D. Serpico, and A. Viana, “Gamma ray constraints on decaying dark matter,” *Phys. Rev.* **D86** (2012) 083506, [arXiv:1205.5283 \[astro-ph.CO\]](#).
- [1676] M. R. Lovell, G. Bertone, A. Boyarsky, A. Jenkins, and O. Ruchayskiy, “Decaying dark matter: the case for a deep x-ray observation of draco,” *Mon. Not. Roy. Astron. Soc.* **451** (2015) 1573–1585, [arXiv:1411.0311 \[astro-ph.CO\]](#).

- [1677] D. Iakubovskiy, “New emission line at ~ 3.5 keV - observational status, connection with radiatively decaying dark matter and directions for future studies,” [arXiv:1410.2852](#) [astro-ph.HE].
- [1678] A. Ibarra, D. Tran, and C. Weniger, “Indirect searches for decaying dark matter,” *Int. J. Mod. Phys. A* **28** (2013) 1330040, [arXiv:1307.6434](#) [hep-ph].
- [1679] M. Escudero Abenza and S. J. Witte, “Could the Hubble tension be pointing towards the neutrino mass mechanism?,” in *Prospects in Neutrino Physics*. 4, 2020. [arXiv:2004.01470](#) [hep-ph].
- [1680] Gravity Collaboration, E. Sturm, *et al.*, “Spatially resolved rotation of the broad-line region of a quasar at sub-parsec scale,” *Nature* **563** no. 7733, (November, 2018) 657–660, [arXiv:1811.11195](#) [astro-ph.GA].
- [1681] **GRAVITY** Collaboration, A. Amorim *et al.*, “The spatially resolved broad line region of IRS 09149–6206,” *Astron. Astrophys.* **643** (2020) A154, [arXiv:2009.08463](#) [astro-ph.GA].
- [1682] R. D. Blandford and C. F. McKee, “Reverberation mapping of the emission line regions of Seyfert galaxies and quasars,” *Astrophys. J.* **255** (April, 1982) 419–439.
- [1683] B. M. Peterson, “Reverberation mapping of active galactic nuclei,” *Publ. Astron. Soc. Pac.* **685** (1993) 247–268.
- [1684] M. C. Bentz *et al.*, “The low-luminosity end of the radius-luminosity relationship for active galactic nuclei,” *Astrophys. J.* **767** (2013) 149, [arXiv:1303.1742](#) [astro-ph.CO].
- [1685] P. Du and J.-M. Wang, “The radius-luminosity relationship depends on optical spectra in active galactic nuclei,” *Astrophys. J.* **886** no. 1, (November, 2019) 42, [arXiv:1909.06735](#) [astro-ph.GA].
- [1686] J.-M. Wang, Y.-Y. Songsheng, Y.-R. Li, P. Du, and Z.-X. Zhang, “A parallax distance to 3C 273 through spectroastrometry and reverberation mapping,” *Nature Astron.* **4** (2020) 517–525, [arXiv:1906.08417](#) [astro-ph.CO].
- [1687] A. Pancoast, B. J. Brewer, and T. Treu, “Geometric and dynamical models of reverberation mapping data,” *Astrophys. J.* **730** (2011) 139, [arXiv:1101.4952](#) [astro-ph.CO].
- [1688] D. Harvey, “A 4% measurement of h_0 using the cumulative distribution of strong-lensing time delays in doubly-imaged quasars,” [arXiv:2011.09488](#) [astro-ph.CO].
- [1689] Y.-R. Li, Y.-Y. Songsheng, J. Qiu, C. Hu, P. Du, K.-X. Lu, Y.-K. Huang, J.-M. Bai, W.-H. Bian, Y.-F. Yuan, L. C. Ho, and J.-M. Wang, “Supermassive black holes with high accretion rates in active galactic nuclei. VIII. Structure of the broad-line region and mass of the central black hole in Mrk 142,” *Astrophys. J.* **869** no. 2, (December, 2018) 137, [arXiv:1811.06302](#) [astro-ph.GA].
- [1690] Z.-X. Zhang, P. Du, P. S. Smith, Y. Zhao, C. Hu, M. Xiao, Y.-R. Li, Y.-K. Huang, K. Wang, J.-M. Bai, L. C. Ho, and J.-M. Wang, “Kinematics of the broad-line region of 3C 273 from a 10 yr reverberation mapping campaign,” *Astrophys. J.* **876** no. 1, (May, 2019) 49, [arXiv:1811.03812](#) [astro-ph.GA].
- [1691] S. Pan, A. Mukherjee, and N. Banerjee, “Astronomical bounds on a cosmological model allowing a general interaction in the dark sector,” *Mon. Not. Roy. Astron. Soc.* **477** no. 1, (2018) 1189–1205, [arXiv:1710.03725](#) [astro-ph.CO].
- [1692] W. Yang, S. Pan, and D. F. Mota, “Novel approach toward the large-scale stable interacting dark-energy models and their astronomical bounds,” *Phys. Rev. D* **96** no. 12, (2017) 123508, [arXiv:1709.00006](#) [astro-ph.CO].
- [1693] W. Yang, S. Pan, and J. D. Barrow, “Large-scale stability and astronomical constraints for coupled dark-energy models,” *Phys. Rev. D* **97** no. 4, (2018) 043529, [arXiv:1706.04953](#) [astro-ph.CO].
- [1694] G. S. Sharov, S. Bhattacharya, S. Pan, R. C. Nunes, and S. Chakraborty, “A new interacting two fluid model and its consequences,” *Mon. Not. Roy. Astron. Soc.* **466** no. 3, (2017) 3497–3506, [arXiv:1701.00780](#) [gr-qc].

- [1695] E. Di Valentino and L. Mersini-Houghton, “Testing predictions of the quantum landscape multiverse 3: The hilltop inflationary potential,” *Symmetry* **11** no. 4, (2019) 520, [arXiv:1807.10833 \[astro-ph.CO\]](#).
- [1696] E. Di Valentino and L. Mersini-Houghton, “Testing predictions of the quantum landscape multiverse 1: The starobinsky inflationary potential,” *JCAP* **03** (2017) 002, [arXiv:1612.09588 \[astro-ph.CO\]](#).
- [1697] R. Holman, L. Mersini-Houghton, and T. Takahashi, “Cosmological avatars of the landscape i: Bracketing the susy breaking scale,” *Phys. Rev. D* **77** (2006) 063510, [arXiv:hep-th/0611223](#).
- [1698] R. Holman, L. Mersini-Houghton, and T. Takahashi, “Cosmological avatars of the landscape. ii. cmb and lss signatures,” *Phys. Rev. D* **77** (2006) 063511, [arXiv:hep-th/0612142](#).
- [1699] L. Mersini-Houghton, “Predictions of the quantum landscape multiverse,” *Class. Quant. Grav.* **34** no. 4, (2017) 047001, [arXiv:1612.07129 \[hep-th\]](#).
- [1700] L. Mersini-Houghton, “Can we predict lambda for the non-susy sector of the landscape,” *Class. Quant. Grav.* **22** (2005) 3481–3490, [arXiv:hep-th/0504026](#).
- [1701] A. Kobakhidze and L. Mersini-Houghton, “Birth of the universe from the landscape of string theory,” *Eur. Phys. J. C* **49** (2007) 869–873, [arXiv:hep-th/0410213](#).
- [1702] L. Mersini-Houghton, “Cosmological implications of the string theory landscape,” *AIP Conf. Proc.* **878** no. 1, (2006) 315–322, [arXiv:hep-ph/0609157](#).
- [1703] R. Holman and L. Mersini-Houghton, “Why the universe started from a low entropy state,” *Phys. Rev. D* **74** (2006) 123510, [arXiv:hep-th/0511102](#).
- [1704] R. Holman and L. Mersini-Houghton, “Why did the universe start from a low entropy state?,” (12, 2005) , [arXiv:hep-th/0512070](#).
- [1705] L. Mersini-Houghton, “Birth of the universe from the multiverse,” in *13th Marcel Grossmann Meeting on Recent Developments in Theoretical and Experimental General Relativity, Astrophysics, and Relativistic Field Theories*, pp. 1619–1621. 2015. [arXiv:1406.6275 \[hep-th\]](#).
- [1706] L. Mersini-Houghton, “Birth of the universe from the multiverse,” (9, 2008) , [arXiv:0809.3623 \[hep-th\]](#).
- [1707] S. Pan and G. S. Sharov, “A model with interaction of dark components and recent observational data,” *Mon. Not. Roy. Astron. Soc.* **472** no. 4, (2017) 4736–4749, [arXiv:1609.02287 \[gr-qc\]](#).
- [1708] R.-G. Cai and A. Wang, “Cosmology with interaction between phantom dark energy and dark matter and the coincidence problem,” *JCAP* **03** (2005) 002, [arXiv:hep-th/0411025](#).
- [1709] J. D. Barrow and T. Clifton, “Cosmologies with energy exchange,” *Phys. Rev. D* **73** (2006) 103520, [arXiv:gr-qc/0604063](#).
- [1710] N. E. Chisari *et al.*, “Modelling baryonic feedback for survey cosmology,” *Open J. Astrophys.* **2** no. 1, (2019) 4, [arXiv:1905.06082 \[astro-ph.CO\]](#).
- [1711] L. P. Chimento, A. S. Jakubi, D. Pavon, and W. Zimdahl, “Interacting quintessence solution to the coincidence problem,” *Phys. Rev. D* **67** (2003) 083513, [arXiv:astro-ph/0303145](#).
- [1712] S. Pan, S. Bhattacharya, and S. Chakraborty, “An analytic model for interacting dark energy and its observational constraints,” *Mon. Not. Roy. Astron. Soc.* **452** no. 3, (2015) 3038–3046, [arXiv:1210.0396 \[gr-qc\]](#).
- [1713] M. Li, “A model of holographic dark energy,” *Phys. Lett. B* **603** (2004) 1, [arXiv:hep-th/0403127](#).
- [1714] Q.-G. Huang and M. Li, “Anthropic principle favors the holographic dark energy,” *JCAP* **03** (2005) 001, [arXiv:hep-th/0410095](#).
- [1715] K. Boone, G. Aldering, Y. Copin, S. Dixon, R. S. Domagalski, E. Gangler, E. Pecontal, and S. Perlmutter, “A binary offset effect in ccd readout and its impact on astronomical data,” *Publ. Astron. Soc. Pac.* **130** no. 988, (2018) 064504, [arXiv:1802.06914 \[astro-ph.IM\]](#).

- [1716] **LSST Dark Energy Science** Collaboration, M. M. Rau *et al.*, “A composite likelihood approach for inference under photometric redshift uncertainty,” *Mon. Not. Roy. Astron. Soc.* **509** no. 4, (2021) 4886–4907, [arXiv:2101.01184](#) [[astro-ph.CO](#)].
- [1717] R. Massey, C. Stoughton, A. Leauthaud, J. Rhodes, A. Koekemoer, R. Ellis, and E. Shaghoulain, “Pixel-based correction for charge transfer inefficiency in the hubble space telescope advanced camera for surveys,” *Mon. Not. Roy. Astron. Soc.* **401** (2010) 371–384, [arXiv:0909.0507](#) [[astro-ph.CO](#)].
- [1718] W. R. Coulton, R. Armstrong, K. M. Smith, R. H. Lupton, and D. N. Spergel, “Exploring the brighter-fatter effect with the hyper supprime-cam,” *Astronomical Journal* **155** no. 6, (June, 2018) 258, [arXiv:1711.06273](#) [[astro-ph.IM](#)].
- [1719] X. Li *et al.*, “The three-year shear catalog of the subaru hyper supprime-cam ssp survey,” (6, 2021) , [arXiv:2107.00136](#) [[astro-ph.CO](#)].
- [1720] L. M. Voigt and S. L. Bridle, “Limitations of model fitting methods for lensing shear estimation,” *Mon. Not. Roy. Astron. Soc.* **404** (2010) 458, [arXiv:0905.4801](#) [[astro-ph.CO](#)].
- [1721] M. A. Troxel and M. Ishak, “Self-calibration technique for 3-point intrinsic alignment correlations in weak lensing surveys,” *Mon. Not. Roy. Astron. Soc.* **419** (2012) 1804–1823, [arXiv:1109.4896](#) [[astro-ph.CO](#)].
- [1722] V. Trimble, “Existence and nature of dark matter in the universe,” *Ann. Rev. Astron. Astrophys.* **25** (1987) 425–472.
- [1723] “Nancy grace roman space telescope.” <https://roman.gsfc.nasa.gov/>.
- [1724] “Euclid.” <http://www.euclid-ec.org/>.
- [1725] “Dark energy spectroscopic instrument.” <https://www.desi.lbl.gov/>.
- [1726] “Large synoptic survey telescope.” <https://www.lsst.org/>.
- [1727] “Hyper supprime-cam.” <https://hsc.mtk.nao.ac.jp/ssp/>.
- [1728] “Dark energy survey.” <https://www.darkenergysurvey.org>.
- [1729] “Kilo-degree survey.” <http://kids.strw.leidenuniv.nl/>.
- [1730] “Canada-france imaging survey.” <https://panstarrs.ifa.hawaii.edu/pswww/>.
- [1731] “Panoramic survey telescope and rapid response system on maui.” <https://www.cfht.hawaii.edu/Science/CFIS/>.
- [1732] “Ultraviolet near- infrared optical northern survey.” <https://www.cosmostat.org/projects/unions-cfis>.
- [1733] R. Mandelbaum, “Weak lensing for precision cosmology,” *Ann. Rev. Astron. Astrophys.* **56** (2018) 393–433, [arXiv:1710.03235](#) [[astro-ph.CO](#)].
- [1734] J. Yao, M. Ishak, W. Lin, and M. A. Troxel, “Effects of self-calibration of intrinsic alignment on cosmological parameter constraints from future cosmic shear surveys,” *JCAP* **10** (2017) 056, [arXiv:1707.01072](#) [[astro-ph.CO](#)].
- [1735] H.-J. Huang, T. Eifler, R. Mandelbaum, and S. Dodelson, “Modelling baryonic physics in future weak lensing surveys,” *Mon. Not. Roy. Astron. Soc.* **488** no. 2, (2019) 1652–1678, [arXiv:1809.01146](#) [[astro-ph.CO](#)].
- [1736] J.-F. Zhang, M.-M. Zhao, J.-L. Cui, and X. Zhang, “Revisiting the holographic dark energy in a non-flat universe: alternative model and cosmological parameter constraints,” *Eur. Phys. J. C* **74** no. 11, (2014) 3178, [arXiv:1409.6078](#) [[astro-ph.CO](#)].
- [1737] E. Di Valentino, S. Gariazzo, C. Giunti, O. Mena, S. Pan, and W. Yang, “Minimal dark energy: key to sterile neutrino and hubble constant tensions?,” (10, 2021) , [arXiv:2110.03990](#) [[astro-ph.CO](#)].

- [1738] R.-G. Cai, Z.-K. Guo, L. Li, S.-J. Wang, and W.-W. Yu, “Chameleon dark energy can resolve the hubble tension,” *Phys. Rev. D* **103** no. 12, (2021) 121302, [arXiv:2102.02020](#) [astro-ph.CO].
- [1739] A. G. Riess *et al.*, “Milky way cepheid standards for measuring cosmic distances and application to gaia dr2: Implications for the hubble constant,” *Astrophys. J.* **861** no. 2, (2018) 126, [arXiv:1804.10655](#) [astro-ph.CO].
- [1740] J. Soltis, S. Casertano, and A. G. Riess, “The parallax of ω centauri measured from gaia edr3 and a direct, geometric calibration of the tip of the red giant branch and the hubble constant,” *Astrophys. J. Lett.* **908** no. 1, (2021) L5, [arXiv:2012.09196](#) [astro-ph.GA].
- [1741] B. Reid *et al.*, “Sdss-iii baryon oscillation spectroscopic survey data release 12: galaxy target selection and large scale structure catalogues,” *Mon. Not. Roy. Astron. Soc.* **455** no. 2, (2016) 1553–1573, [arXiv:1509.06529](#) [astro-ph.CO].
- [1742] F.-S. Kitaura *et al.*, “The clustering of galaxies in the sdss-iii baryon oscillation spectroscopic survey: mock galaxy catalogues for the boss final data release,” *Mon. Not. Roy. Astron. Soc.* **456** no. 4, (2016) 4156–4173, [arXiv:1509.06400](#) [astro-ph.CO].
- [1743] G. Lavaux, J. Jasche, and F. Leclercq, “Systematic-free inference of the cosmic matter density field from sdss3-boss data,” (9, 2019) , [arXiv:1909.06396](#) [astro-ph.CO].
- [1744] M. Scrimgeour *et al.*, “The wigglez dark energy survey: the transition to large-scale cosmic homogeneity,” *Mon. Not. Roy. Astron. Soc.* **425** (2012) 116–134, [arXiv:1205.6812](#) [astro-ph.CO].
- [1745] J. Khoury and A. Weltman, “Chameleon fields: Awaiting surprises for tests of gravity in space,” *Phys. Rev. Lett.* **93** (2004) 171104, [arXiv:astro-ph/0309300](#).
- [1746] J. Khoury and A. Weltman, “Chameleon cosmology,” *Phys. Rev. D* **69** (2004) 044026, [arXiv:astro-ph/0309411](#).
- [1747] M. Deal and C. J. A. P. Martins, “Primordial nucleosynthesis with varying fundamental constants - solutions to the lithium problem and the deuterium discrepancy,” *Astron. Astrophys.* **653** (2021) A48, [arXiv:2106.13989](#) [astro-ph.CO].
- [1748] J. Wang, L. Hui, and J. Khoury, “No-go theorems for generalized chameleon field theories,” *Phys. Rev. Lett.* **109** (2012) 241301, [arXiv:1208.4612](#) [astro-ph.CO].
- [1749] A. Upadhye, W. Hu, and J. Khoury, “Quantum stability of chameleon field theories,” *Phys. Rev. Lett.* **109** (2012) 041301, [arXiv:1204.3906](#) [hep-ph].
- [1750] J. Khoury, “Chameleon field theories,” *Class. Quant. Grav.* **30** (2013) 214004, [arXiv:1306.4326](#) [astro-ph.CO].
- [1751] R. C. Keenan, A. J. Barger, and L. L. Cowie, “Evidence for a ~ 300 megaparsec scale under-density in the local galaxy distribution,” *Astrophys. J.* **775** (2013) 62, [arXiv:1304.2884](#) [astro-ph.CO].
- [1752] V. de Lapparent, M. J. Geller, and J. P. Huchra, “A slice of the universe,” *Astrophys. J. Lett.* **302** (1986) L1–L5.
- [1753] H. Lietzen, E. Tempel, L. J. Liivamägi, A. Montero-Dorta, M. Einasto, A. Streblyanska, C. Maraston, J. A. Rubiño Martín, and E. Saar, “Discovery of a massive supercluster system at $z \sim 0.47$,” *Astron. Astrophys.* **588** (2016) L4, [arXiv:1602.08498](#) [astro-ph.CO].
- [1754] W.-M. Dai, Y.-Z. Ma, and H.-J. He, “Reconciling hubble constant discrepancy from holographic dark energy,” *Phys. Rev. D* **102** (2020) 121302, [arXiv:2003.03602](#) [astro-ph.CO].
- [1755] A. Ijjas, P. J. Steinhardt, and A. Loeb, “Inflationary paradigm in trouble after planck2013,” *Phys. Lett. B* **723** (2013) 261–266, [arXiv:1304.2785](#) [astro-ph.CO].
- [1756] J.-L. Lehnert and P. J. Steinhardt, “Planck 2013 results support the cyclic universe,” *Phys. Rev. D* **87** no. 12, (2013) 123533, [arXiv:1304.3122](#) [astro-ph.CO].

- [1757] A. Ijjas and P. J. Steinhardt, “Classically stable nonsingular cosmological bounces,” *Phys. Rev. Lett.* **117** no. 12, (2016) 121304, [arXiv:1606.08880 \[gr-qc\]](#).
- [1758] D. Wang, “Assessing the potential of cluster edges as a standard ruler on constraining dark energy models,” *Phys. Rev. D* **103** no. 12, (2021) 123538, [arXiv:2011.11924 \[astro-ph.CO\]](#).
- [1759] C. J. Grier, A. Pancoast, A. J. Barth, M. M. Fausnaugh, B. J. Brewer, T. Treu, and B. M. Peterson, “The structure of the broad-line region in active galactic nuclei. ii. dynamical modeling of data from the agn10 reverberation mapping campaign,” *Astrophys. J.* **849** no. 2, (November, 2017) 146, [arXiv:1705.02346 \[astro-ph.GA\]](#).
- [1760] B. M. Peterson, “Measuring the masses of supermassive black holes,” *Space Science Reviews* **222** (September, 2014) 253–275.
- [1761] Y.-Y. Songsheng, Y.-R. Li, P. U. Du, and J.-M. Wang, “Geometric distances of quasars measured by spectroastrometry and reverberation mapping: Monte carlo simulations,” *Astrophys. J. Suppl.* **253** no. 2, (2021) 57, [arXiv:2103.00138 \[astro-ph.GA\]](#).
- [1762] L. Pogosian, G.-B. Zhao, and K. Jedamzik, “Recombination-independent determination of the sound horizon and the hubble constant from bao,” *Astrophys. J. Lett.* **904** no. 2, (2020) L17, [arXiv:2009.08455 \[astro-ph.CO\]](#).
- [1763] C. Guidorzi *et al.*, “Improved constraints on h_0 from a combined analysis of gravitational-wave and electromagnetic emission from gw170817,” *Astrophys. J. Lett.* **851** no. 2, (2017) L36, [arXiv:1710.06426 \[astro-ph.CO\]](#).
- [1764] K. Hotokezaka, E. Nakar, O. Gottlieb, S. Nissanke, K. Masuda, G. Hallinan, K. P. Mooley, and A. Deller, “A hubble constant measurement from superluminal motion of the jet in gw170817,” *Nature Astron.* **3** no. 10, (2019) 940–944, [arXiv:1806.10596 \[astro-ph.CO\]](#).
- [1765] **DES, LIGO Scientific, Virgo** Collaboration, M. Soares-Santos *et al.*, “First measurement of the hubble constant from a dark standard siren using the dark energy survey galaxies and the ligo/virgo binary–black-hole merger gw170814,” *Astrophys. J. Lett.* **876** no. 1, (2019) L7, [arXiv:1901.01540 \[astro-ph.CO\]](#).
- [1766] **LIGO Scientific, Virgo** Collaboration, B. P. Abbott *et al.*, “Properties of the binary neutron star merger gw170817,” *Phys. Rev. X* **9** no. 1, (2019) 011001, [arXiv:1805.11579 \[gr-qc\]](#).
- [1767] **LIGO Scientific, Virgo** Collaboration, R. Abbott *et al.*, “Gw190814: Gravitational waves from the coalescence of a 23 solar mass black hole with a 2.6 solar mass compact object,” *Astrophys. J. Lett.* **896** no. 2, (2020) L44, [arXiv:2006.12611 \[astro-ph.HE\]](#).
- [1768] L. A. Anchordoqui, “Decaying dark matter, the h_0 tension, and the lithium problem,” *Phys. Rev. D* **103** no. 3, (2021) 035025, [arXiv:2010.09715 \[hep-ph\]](#).
- [1769] P. F. Depta, M. Hufnagel, and K. Schmidt-Hoberg, “Updated bbn constraints on electromagnetic decays of mev-scale particles,” *JCAP* **04** (2021) 011, [arXiv:2011.06519 \[hep-ph\]](#).
- [1770] L. Perivolaropoulos, “Six puzzles for lcdm cosmology,” [arXiv:0811.4684 \[astro-ph\]](#).
- [1771] L. Perivolaropoulos, “Lcdm: Triumphs, puzzles and remedies,” *J. Cosmol.* **15** (2011) 6054, [arXiv:1104.0539 \[astro-ph.CO\]](#).
- [1772] L. Kazantzidis, H. Koo, S. Nesseris, L. Perivolaropoulos, and A. Shafieloo, “Hints for possible low redshift oscillation around the best-fitting λ cdm model in the expansion history of the universe,” *Mon. Not. Roy. Astron. Soc.* **501** no. 3, (2021) 3421–3426, [arXiv:2010.03491 \[astro-ph.CO\]](#).
- [1773] L. Kazantzidis and L. Perivolaropoulos, “Hints of a local matter underdensity or modified gravity in the low z pantheon data,” *Phys. Rev. D* **102** no. 2, (2020) 023520, [arXiv:2004.02155 \[astro-ph.CO\]](#).
- [1774] A. Heinesen, “Multipole decomposition of redshift drift – model independent mapping of the expansion history of the universe,” *Phys. Rev. D* **103** no. 2, (2021) 023537, [arXiv:2011.10048 \[gr-qc\]](#).

- [1775] A. Heinesen, “Redshift drift cosmography for model-independent cosmological inference,” *Phys. Rev. D* **104** no. 12, (2021) 123527, [arXiv:2107.08674 \[astro-ph.CO\]](#).
- [1776] M. Korzyński and J. Kopiński, “Optical drift effects in general relativity,” *JCAP* **03** (2018) 012, [arXiv:1711.00584 \[gr-qc\]](#).
- [1777] E. Ó Colgáin, “A hint of matter underdensity at low z ?,” *JCAP* **09** (2019) 006, [arXiv:1903.11743 \[astro-ph.CO\]](#).
- [1778] S. Vagnozzi, E. Di Valentino, S. Gariazzo, A. Melchiorri, O. Mena, and J. Silk, “The galaxy power spectrum take on spatial curvature and cosmic concordance,” *Phys. Dark Univ.* **33** (2021) 100851, [arXiv:2010.02230 \[astro-ph.CO\]](#).
- [1779] **DES** Collaboration, A. Kovács *et al.*, “More out of less: an excess integrated sachs-wolfe signal from supervoids mapped out by the dark energy survey,” *Mon. Not. Roy. Astron. Soc.* **484** (2019) 5267–5277, [arXiv:1811.07812 \[astro-ph.CO\]](#).
- [1780] B. R. Granett, M. C. Neyrinck, and I. Szapudi, “An imprint of super-structures on the microwave background due to the integrated sachs-wolfe effect,” *Astrophys. J. Lett.* **683** (2008) L99–L102, [arXiv:0805.3695 \[astro-ph\]](#).
- [1781] M. Cruz, L. Cayon, E. Martinez-Gonzalez, P. Vielva, and J. Jin, “The non-gaussian cold spot in the 3-year wmap data,” *Astrophys. J.* **655** (2007) 11–20, [arXiv:astro-ph/0603859](#).
- [1782] C. L. Bennett, A. Banday, K. M. Gorski, G. Hinshaw, P. Jackson, P. Keegstra, A. Kogut, G. F. Smoot, D. T. Wilkinson, and E. L. Wright, “Four year coBE dmr cosmic microwave background observations: Maps and basic results,” *Astrophys. J. Lett.* **464** (1996) L1–L4, [arXiv:astro-ph/9601067](#).
- [1783] **COBE** Collaboration, G. F. Smoot *et al.*, “Structure in the coBE differential microwave radiometer first year maps,” *Astrophys. J. Lett.* **396** (1992) L1–L5.
- [1784] G. Hinshaw, A. J. Banday, C. L. Bennett, K. M. Gorski, A. Kogut, C. H. Lineweaver, G. F. Smoot, and E. L. Wright, “2-point correlations in the coBE dmr 4-year anisotropy maps,” *Astrophys. J. Lett.* **464** (1996) L25–L28, [arXiv:astro-ph/9601061](#).
- [1785] C. L. Bennett, N. W. Boggess, E. S. Cheng, M. G. Hauser, T. Kelsall, J. C. Mather, S. H. Moseley, T. L. Murdock, R. A. Shafer, R. F. Silverberg, G. F. Smoot, R. Weiss, and E. L. Wright, “Scientific results from the cosmic background explorer (coBE),” *Proceedings of the National Academy of Sciences* **90** no. 11, (1993) 4766–4773, <https://www.pnas.org/content/90/11/4766.full.pdf>.
<https://www.pnas.org/content/90/11/4766>.
- [1786] D. J. Schwarz, C. J. Copi, D. Huterer, and G. D. Starkman, “Cmb anomalies after planck,” *Class. Quant. Grav.* **33** no. 18, (2016) 184001, [arXiv:1510.07929 \[astro-ph.CO\]](#).
- [1787] C. Monteserin, R. Barreiro, P. Vielva, E. Martinez-Gonzalez, M. Hobson, and A. Lasenby, “A low cmb variance in the wmap data,” *Mon. Not. Roy. Astron. Soc.* **387** (2008) 209–219, [arXiv:0706.4289 \[astro-ph\]](#).
- [1788] J.-Q. Jiang and Y.-S. Piao, “Towards early dark energy and $n_s=1$ with planck, act and spt,” [arXiv:2202.13379 \[astro-ph.CO\]](#).
- [1789] M. Cruz, P. Vielva, E. Martinez-Gonzalez, and R. B. Barreiro, “Anomalous variance in the wmap data and galactic foreground residuals,” *Mon. Not. Roy. Astron. Soc.* **412** (2011) 2383, [arXiv:1005.1264 \[astro-ph.CO\]](#).
- [1790] A. Gruppuso, P. Natoli, F. Paci, F. Finelli, D. Molinari, A. De Rosa, and N. Mandolesi, “Low variance at large scales of wmap 9 year data,” *JCAP* **07** (2013) 047, [arXiv:1304.5493 \[astro-ph.CO\]](#).
- [1791] F. K. Hansen, A. J. Banday, and K. M. Gorski, “Testing the cosmological principle of isotropy: Local power spectrum estimates of the wmap data,” *Mon. Not. Roy. Astron. Soc.* **354** (2004) 641–665, [arXiv:astro-ph/0404206](#).

- [1792] M. O’Dwyer, C. J. Copi, L. Knox, and G. D. Starkman, “Cmb-s4 and the hemispherical variance anomaly,” *Mon. Not. Roy. Astron. Soc.* **470** no. 1, (2017) 372–378, [arXiv:1608.02234 \[astro-ph.CO\]](#).
- [1793] M. O’Dwyer, C. J. Copi, J. M. Nagy, C. B. Netterfield, J. Ruhl, and G. D. Starkman, “Hemispherical variance anomaly and reionization optical depth,” (12, 2019) , [arXiv:1912.02376 \[astro-ph.CO\]](#).
- [1794] R. Aurich, H. S. Janzer, S. Lustig, and F. Steiner, “Do we live in a small universe?,” *Class. Quant. Grav.* **25** (2008) 125006, [arXiv:0708.1420 \[astro-ph\]](#).
- [1795] R. Aurich and S. Lustig, “Cosmic topology of polyhedral double-action manifolds,” *Class. Quant. Grav.* **29** (2012) 235028, [arXiv:1207.4378 \[astro-ph.CO\]](#).
- [1796] R. Aurich and S. Lustig, “The hantzsche-wendt manifold in cosmic topology,” *Class. Quant. Grav.* **31** (2014) 165009, [arXiv:1403.2190 \[astro-ph.CO\]](#).
- [1797] A. Bernui, C. P. Novaes, T. S. Pereira, and G. D. Starkman, “Topology and the suppression of cmb large-angle correlations,” (9, 2018) , [arXiv:1809.05924 \[astro-ph.CO\]](#).
- [1798] J. D. McEwen, T. Josset, S. M. Feeney, H. V. Peiris, and A. N. Lasenby, “Bayesian analysis of anisotropic cosmologies: Bianchi vii_h and wmap,” *Mon. Not. Roy. Astron. Soc.* **436** (2013) 3680–3694, [arXiv:1303.3409 \[astro-ph.CO\]](#).
- [1799] N. J. Cornish, D. N. Spergel, and G. D. Starkman, “Circles in the sky: Finding topology with the microwave background radiation,” *Class. Quant. Grav.* **15** (1998) 2657–2670, [arXiv:astro-ph/9801212](#).
- [1800] M. Oguri, “Effect of gravitational lensing on the distribution of gravitational waves from distant binary black hole mergers,” *Mon. Not. Roy. Astron. Soc.* **480** no. 3, (2018) 3842–3855, [arXiv:1807.02584 \[astro-ph.CO\]](#).
- [1801] S.-S. Li, S. Mao, Y. Zhao, and Y. Lu, “Gravitational lensing of gravitational waves: A statistical perspective,” *Mon. Not. Roy. Astron. Soc.* **476** no. 2, (2018) 2220–2229, [arXiv:1802.05089 \[astro-ph.CO\]](#).
- [1802] Y. Wang, A. Stebbins, and E. L. Turner, “Gravitational lensing of gravitational waves from merging neutron star binaries,” *Phys. Rev. Lett.* **77** (1996) 2875–2878, [arXiv:astro-ph/9605140](#).
- [1803] N. J. Cornish, D. N. Spergel, G. D. Starkman, and E. Komatsu, “Constraining the topology of the universe,” *Phys. Rev. Lett.* **92** (2004) 201302, [arXiv:astro-ph/0310233](#).
- [1804] J. Shapiro Key, N. J. Cornish, D. N. Spergel, and G. D. Starkman, “Extending the wmap bound on the size of the universe,” *Phys. Rev. D* **75** (2007) 084034, [arXiv:astro-ph/0604616](#).
- [1805] P. M. Vaudrevange, G. D. Starkman, N. J. Cornish, and D. N. Spergel, “Constraints on the topology of the universe: Extension to general geometries,” *Phys. Rev. D* **86** (2012) 083526, [arXiv:1206.2939 \[astro-ph.CO\]](#).
- [1806] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2013 results. xxvi. background geometry and topology of the universe,” *Astron. Astrophys.* **571** (2014) A26, [arXiv:1303.5086 \[astro-ph.CO\]](#).
- [1807] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2013 results. xxiii. isotropy and statistics of the cmb,” *Astron. Astrophys.* **571** (2014) A23, [arXiv:1303.5083 \[astro-ph.CO\]](#).
- [1808] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2015 results - xviii. background geometry and topology of the universe,” *Astron. Astrophys.* **594** (2016) A18, [arXiv:1502.01593 \[astro-ph.CO\]](#).
- [1809] G. Aslanyan, A. V. Manohar, and A. P. S. Yadav, “The topology and size of the universe from cmb temperature and polarization data,” *JCAP* **08** (2013) 009, [arXiv:1304.1811 \[astro-ph.CO\]](#).
- [1810] P. Motloch and W. Hu, “Lensinglike tensions in the *planck* legacy release,” *Phys. Rev. D* **101** no. 8, (2020) 083515, [arXiv:1912.06601 \[astro-ph.CO\]](#).
- [1811] J. Kim and P. Naselsky, “Lack of angular correlation and odd-parity preference in cmb data,” *Astrophys. J.* **739** (2011) 79, [arXiv:1011.0377 \[astro-ph.CO\]](#).

- [1812] L. Verde, P. Protopapas, and R. Jimenez, “Planck and the local universe: Quantifying the tension,” *Phys. Dark Univ.* **2** (2013) 166–175, [arXiv:1306.6766 \[astro-ph.CO\]](#).
- [1813] D. L. Wiltshire, P. R. Smale, T. Mattsson, and R. Watkins, “Hubble flow variance and the cosmic rest frame,” *Phys. Rev. D* **88** (2013) 083529, [arXiv:1201.5371 \[astro-ph.CO\]](#).
- [1814] C. Bengaly, R. Maartens, and M. Santos, “Probing the cosmological principle in the counts of radio galaxies at different frequencies,” *JCAP* **04** (2018) 031, [arXiv:1710.08804 \[astro-ph.CO\]](#).
- [1815] V. Dumont and J. K. Webb, “Modelling long-range wavelength distortions in quasar absorption echelle spectra,” *Mon. Not. Roy. Astron. Soc.* **468** no. 2, (2017) 1568–1574, [arXiv:1701.03176 \[astro-ph.CO\]](#).
- [1816] D. F. Chernoff and L. S. Finn, “Gravitational radiation, inspiraling binaries, and cosmology,” *Astrophys. J. Lett.* **411** (1993) L5–L8, [arXiv:gr-qc/9304020](#).
- [1817] J. M. Ezquiaga and D. E. Holz, “Spectral sirens: cosmology from the full mass distribution of compact binaries,” (2, 2022) , [arXiv:2202.08240 \[astro-ph.CO\]](#).
- [1818] J. Webb, J. King, M. Murphy, V. Flambaum, R. Carswell, and M. Bainbridge, “Indications of a spatial variation of the fine structure constant,” *Phys. Rev. Lett.* **107** (2011) 191101, [arXiv:1008.3907 \[astro-ph.CO\]](#).
- [1819] J. Evslin, “Isolating the lyman alpha forest bao anomaly,” *JCAP* **04** (2017) 024, [arXiv:1604.02809 \[astro-ph.CO\]](#).
- [1820] G. Risaliti and E. Lusso, “Cosmological constraints from the hubble diagram of quasars at high redshifts,” *Nature Astron.* **3** no. 3, (2019) 272–277, [arXiv:1811.02590 \[astro-ph.CO\]](#).
- [1821] R. Gannouji, L. Perivolaropoulos, D. Polarski, and F. Skara, “Weak gravity on a λ cdm background,” *Phys. Rev. D* **103** no. 6, (2021) 063509, [arXiv:2011.01517 \[gr-qc\]](#).
- [1822] F. Skara and L. Perivolaropoulos, “Tension of the e_g statistic and redshift space distortion data with the planck - λ cdm model and implications for weakening gravity,” *Phys. Rev. D* **101** no. 6, (2020) 063521, [arXiv:1911.10609 \[astro-ph.CO\]](#).
- [1823] E. Garcia-Berro, E. Gaztanaga, J. Isern, O. Benvenuto, and L. Althaus, “On the evolution of cosmological type ia supernovae and the gravitational constant,” [arXiv:astro-ph/9907440](#).
- [1824] L. Amendola, P. S. Corasaniti, and F. Occhionero, “Time variability of the gravitational constant and type ia supernovae,” (7, 1999) , [arXiv:astro-ph/9907222](#).
- [1825] L. Kazantzidis and L. Perivolaropoulos, “ σ_8 tension. is gravity getting weaker at low z ? observational evidence and theoretical implications,” (2021) 507–537.
- [1826] R. Gannouji, L. Kazantzidis, L. Perivolaropoulos, and D. Polarski, “Consistency of modified gravity with a decreasing $g_{\text{eff}}(z)$ in a λ cdm background,” *Phys. Rev. D* **98** no. 10, (2018) 104044, [arXiv:1809.07034 \[gr-qc\]](#).
- [1827] M. Wittner, G. Laverda, O. F. Piattella, and L. Amendola, “Transient weak gravity in scalar-tensor theories,” *JCAP* **07** (2020) 019, [arXiv:2003.08950 \[gr-qc\]](#).
- [1828] L. Kazantzidis and L. Perivolaropoulos, “Evolution of the $f\sigma_8$ tension with the planck15/ λ cdm determination and implications for modified gravity theories,” *Phys. Rev. D* **97** no. 10, (2018) 103503, [arXiv:1803.01337 \[astro-ph.CO\]](#).
- [1829] S. Nesseris, G. Pantazis, and L. Perivolaropoulos, “Tension and constraints on modified gravity parametrizations of $g_{\text{eff}}(z)$ from growth rate and planck data,” *Phys. Rev. D* **96** no. 2, (2017) 023542, [arXiv:1703.10538 \[astro-ph.CO\]](#).
- [1830] M. Clara and C. Martins, “Primordial nucleosynthesis with varying fundamental constants: Improved constraints and a possible solution to the lithium problem,” *Astron. Astrophys.* **633** (2020) L11, [arXiv:2001.01787 \[astro-ph.CO\]](#).

- [1831] **DES** Collaboration, T. M. C. Abbott *et al.*, “Dark energy survey year 1 results: Measurement of the baryon acoustic oscillation scale in the distribution of galaxies to redshift 1,” *Mon. Not. Roy. Astron. Soc.* **483** no. 4, (2019) 4866–4883, [arXiv:1712.06209](#) [[astro-ph.CO](#)].
- [1832] J. Venzor, G. Garcia-Arroyo, A. Pérez-Lorezana, and J. De-Santiago, “Massive neutrino self-interactions with a light mediator in cosmology,” (2, 2022) , [arXiv:2202.09310](#) [[astro-ph.CO](#)].
- [1833] E. Macaulay, I. K. Wehus, and H. K. Eriksen, “Lower growth rate from recent redshift space distortion measurements than expected from planck,” *Phys. Rev. Lett.* **111** no. 16, (2013) 161301, [arXiv:1303.6583](#) [[astro-ph.CO](#)].
- [1834] P. Bull *et al.*, “Beyond λ cdm: Problems, solutions, and the road ahead,” *Phys. Dark Univ.* **12** (2016) 56–99, [arXiv:1512.05356](#) [[astro-ph.CO](#)].
- [1835] L. Perivolaropoulos, “Submillimeter spatial oscillations of newton’s constant: Theoretical models and laboratory tests,” *Phys. Rev. D* **95** no. 8, (2017) 084050, [arXiv:1611.07293](#) [[gr-qc](#)].
- [1836] K.-i. Maeda and S. Panpanich, “Cuscuta-galileon cosmology: Dynamics, gravitational ”constant”s and hubble constant,” [arXiv:2202.04908](#) [[gr-qc](#)].
- [1837] R. K. Sharma, K. L. Pandey, and S. Das, “Multi-parameter dynamical dark energy equation of state and present cosmological tensions,” (2, 2022) , [arXiv:2202.01749](#) [[astro-ph.CO](#)].
- [1838] T. Giannantonio, C. Porciani, J. Carron, A. Amara, and A. Pillepich, “Constraining primordial non-gaussianity with future galaxy surveys,” *Mon. Not. Roy. Astron. Soc.* **422** (2012) 2854–2877, [arXiv:1109.0958](#) [[astro-ph.CO](#)].
- [1839] X. Fang, E. Krause, T. Eifler, and N. MacCrann, “Beyond limber: Efficient computation of angular power spectra for galaxy clustering and weak lensing,” *JCAP* **05** (2020) 010, [arXiv:1911.11947](#) [[astro-ph.CO](#)].
- [1840] T. D. Kitching, J. Alsing, A. F. Heavens, R. Jimenez, J. D. McEwen, and L. Verde, “The limits of cosmic shear,” *Mon. Not. Roy. Astron. Soc.* **469** no. 3, (2017) 2737–2749, [arXiv:1611.04954](#) [[astro-ph.CO](#)].
- [1841] D. N. Limber, “The analysis of counts of the extragalactic nebulae in terms of a fluctuating density field. ii,” *Astrophys. J.* **119** (1954) 655.
- [1842] N. Roy, S. Goswami, and S. Das, “Quintessence or phantom: Study of scalar field dark energy models through a general parametrization of the hubble parameter,” (1, 2022) , [arXiv:2201.09306](#) [[astro-ph.CO](#)].
- [1843] A. Antony, F. Finelli, D. K. Hazra, and A. Shafieloo, “Discordances in cosmology and the violation of slow-roll inflationary dynamics,” (2, 2022) , [arXiv:2202.14028](#) [[astro-ph.CO](#)].
- [1844] M. LoVerde and N. Afshordi, “Extended limber approximation,” *Phys. Rev. D* **78** (2008) 123506, [arXiv:0809.5112](#) [[astro-ph](#)].
- [1845] M. Kilbinger *et al.*, “Precision calculations of the cosmic shear power spectrum projection,” *Mon. Not. Roy. Astron. Soc.* **472** no. 2, (2017) 2126–2141, [arXiv:1702.05301](#) [[astro-ph.CO](#)].
- [1846] P. Lemos, A. Challinor, and G. Efstathiou, “The effect of limber and flat-sky approximations on galaxy weak lensing,” *JCAP* **05** (2017) 014, [arXiv:1704.01054](#) [[astro-ph.CO](#)].
- [1847] F. Salahedin, R. Pazhouhesh, and M. Malekjani, “Cosmological constrains on new generalized chaplygin gas model,” *Eur. Phys. J. Plus* **135** no. 6, (2020) 429, [arXiv:2201.06866](#) [[astro-ph.CO](#)].
- [1848] A. Banihashemi and N. Khosravi, “Fluctuations in the ginzburg-landau theory of dark energy: internal (in-)consistencies in planck data set,” (1, 2022) , [arXiv:2201.04119](#) [[astro-ph.CO](#)].
- [1849] B. J. Barros, L. Amendola, T. Barreiro, and N. J. Nunes, “Coupled quintessence with a λ cdm background: removing the σ_8 tension,” *JCAP* **01** (2019) 007, [arXiv:1802.09216](#) [[astro-ph.CO](#)].

- [1850] S. Joudaki and M. Kaplinghat, “Dark energy and neutrino masses from future measurements of the expansion history and growth of structure,” *Phys. Rev. D* **86** (2012) 023526, [arXiv:1106.0299 \[astro-ph.CO\]](#).
- [1851] I. Antoniou and L. Perivolaropoulos, “Constraints on spatially oscillating sub-mm forces from the stanford optically levitated microsphere experiment data,” *Phys. Rev. D* **96** no. 10, (2017) 104002, [arXiv:1708.02117 \[gr-qc\]](#).
- [1852] A. Mariano and L. Perivolaropoulos, “Cmb maximum temperature asymmetry axis: Alignment with other cosmic asymmetries,” *Phys. Rev. D* **87** no. 4, (2013) 043511, [arXiv:1211.5915 \[astro-ph.CO\]](#).
- [1853] E. M. Teixeira, A. Nunes, and N. J. Nunes, “Conformally coupled tachyonic dark energy,” *Phys. Rev. D* **100** no. 4, (2019) 043539, [arXiv:1903.06028 \[gr-qc\]](#).
- [1854] L. Pizzuti, I. D. Saltas, S. Casas, L. Amendola, and A. Biviano, “Future constraints on the gravitational slip with the mass profiles of galaxy clusters,” *Mon. Not. Roy. Astron. Soc.* **486** no. 1, (2019) 596–607, [arXiv:1901.01961 \[astro-ph.CO\]](#).
- [1855] Z. Sakr and D. Sapone, “Can varying the gravitational constant alleviate the tensions?,” [arXiv:2112.14173 \[astro-ph.CO\]](#).
- [1856] W. Chao, S. Jiang, Z.-Y. Wang, and Y.-F. Zhou, “Pseudo-dirac sterile neutrino dark matter,” (12, 2021) , [arXiv:2112.14527 \[hep-ph\]](#).
- [1857] E. M. Teixeira, A. Nunes, and N. J. Nunes, “Disformally coupled quintessence,” *Phys. Rev. D* **101** no. 8, (2020) 083506, [arXiv:1912.13348 \[gr-qc\]](#).
- [1858] J. C. Bueno Sanchez and L. Perivolaropoulos, “Topological quintessence,” *Phys. Rev. D* **84** (2011) 123516, [arXiv:1110.2587 \[astro-ph.CO\]](#).
- [1859] A. G. Riess *et al.*, “Type ia supernova distances at redshift > 1.5 from the hubble space telescope multi-cycle treasury programs: The early expansion rate,” *Astrophys. J.* **853** no. 2, (2018) 126, [arXiv:1710.00844 \[astro-ph.CO\]](#).
- [1860] Y. Minami and E. Komatsu, “New extraction of the cosmic birefringence from the planck 2018 polarization data,” *Phys. Rev. Lett.* **125** no. 22, (2020) 221301, [arXiv:2011.11254 \[astro-ph.CO\]](#).
- [1861] P. Diego-Palazuelos *et al.*, “Cosmic birefringence from the planck data release 4,” *Phys. Rev. Lett.* **128** no. 9, (2022) 091302, [arXiv:2201.07682 \[astro-ph.CO\]](#).
- [1862] C. van de Bruck and E. M. Teixeira, “Dark d-brane cosmology: from background evolution to cosmological perturbations,” *Phys. Rev. D* **102** no. 10, (2020) 103503, [arXiv:2007.15414 \[gr-qc\]](#).
- [1863] J. R. Eskilt, “Frequency-dependent constraints on cosmic birefringence from the lfi and hfi planck data release 4,” (1, 2022) , [arXiv:2201.13347 \[astro-ph.CO\]](#).
- [1864] A. Hernández-Almada, G. Leon, J. Magaña, M. A. García-Aspeitia, V. Motta, E. N. Saridakis, K. Yesmakhanova, and A. D. Millano, “Observational constraints and dynamical analysis of kaniadakis horizon-entropy cosmology,” (12, 2021) , [arXiv:2112.04615 \[astro-ph.CO\]](#).
- [1865] **Planck** Collaboration, Y. Akrami *et al.*, “*planck* intermediate results. lvii. joint planck lfi and hfi data processing,” *Astron. Astrophys.* **643** (2020) A42, [arXiv:2007.04997 \[astro-ph.CO\]](#).
- [1866] B. Bose, K. Koyama, W. A. Hellwing, G.-B. Zhao, and H. A. Winther, “Theoretical accuracy in cosmological growth estimation,” *Phys. Rev. D* **96** no. 2, (2017) 023519, [arXiv:1702.02348 \[astro-ph.CO\]](#).
- [1867] A. Barreira, A. G. Sánchez, and F. Schmidt, “Validating estimates of the growth rate of structure with modified gravity simulations,” *Phys. Rev. D* **94** no. 8, (2016) 084022, [arXiv:1605.03965 \[astro-ph.CO\]](#).

- [1868] A. Taruya, K. Koyama, T. Hiramatsu, and A. Oka, “Beyond consistency test of gravity with redshift-space distortions at quasilinear scales,” *Phys. Rev. D* **89** no. 4, (2014) 043509, [arXiv:1309.6783 \[astro-ph.CO\]](#).
- [1869] E. Di Valentino and A. Melchiorri, “Neutrino mass bounds in the era of tension cosmology,” [arXiv:2112.02993 \[astro-ph.CO\]](#).
- [1870] A. G. Sanchez *et al.*, “The clustering of galaxies in the sdss-iii baryon oscillation spectroscopic survey: cosmological implications of the large-scale two-point correlation function,” *Mon. Not. Roy. Astron. Soc.* **425** (2012) 415, [arXiv:1203.6616 \[astro-ph.CO\]](#).
- [1871] A. Taruya, T. Nishimichi, and S. Saito, “Baryon acoustic oscillations in 2d: Modeling redshift-space power spectrum from perturbation theory,” *Phys. Rev. D* **82** (2010) 063522, [arXiv:1006.0699 \[astro-ph.CO\]](#).
- [1872] P. Carter, F. Beutler, W. J. Percival, J. DeRose, R. H. Wechsler, and C. Zhao, “The impact of the fiducial cosmology assumption on bao distance scale measurements,” *Mon. Not. Roy. Astron. Soc.* **494** no. 2, (2020) 2076–2089, [arXiv:1906.03035 \[astro-ph.CO\]](#).
- [1873] B. D. Sherwin and M. White, “The impact of wrong assumptions in bao reconstruction,” *JCAP* **02** (2019) 027, [arXiv:1808.04384 \[astro-ph.CO\]](#).
- [1874] M. A. Corona, R. Murgia, M. Cadeddu, M. Archidiacono, S. Gariazzo, C. Giunti, and S. Hannestad, “Pseudoscalar sterile neutrino self-interactions in light of planck, spt and act data,” [arXiv:2112.00037 \[astro-ph.CO\]](#).
- [1875] E.-M. Mueller, W. Percival, E. Linder, S. Alam, G.-B. Zhao, A. G. Sánchez, F. Beutler, and J. Brinkmann, “The clustering of galaxies in the completed sdss-iii baryon oscillation spectroscopic survey: constraining modified gravity,” *Mon. Not. Roy. Astron. Soc.* **475** no. 2, (2018) 2122–2131, [arXiv:1612.00812 \[astro-ph.CO\]](#).
- [1876] M. Cataneo, L. Lombriser, C. Heymans, A. Mead, A. Barreira, S. Bose, and B. Li, “On the road to percent accuracy: non-linear reaction of the matter power spectrum to dark energy and modified gravity,” *Mon. Not. Roy. Astron. Soc.* **488** no. 2, (2019) 2121–2142, [arXiv:1812.05594 \[astro-ph.CO\]](#).
- [1877] B. Giblin, M. Cataneo, B. Moews, and C. Heymans, “On the road to per cent accuracy – ii. calibration of the non-linear matter power spectrum for arbitrary cosmologies,” *Mon. Not. Roy. Astron. Soc.* **490** no. 4, (2019) 4826–4840, [arXiv:1906.02742 \[astro-ph.CO\]](#).
- [1878] M. M. Ivanov, E. McDonough, J. C. Hill, M. Simonović, M. W. Toomey, S. Alexander, and M. Zaldarriaga, “Constraining early dark energy with large-scale structure,” *Phys. Rev. D* **102** no. 10, (2020) 103502, [arXiv:2006.11235 \[astro-ph.CO\]](#).
- [1879] R. Arjona, L. Espinosa-Portales, J. García-Bellido, and S. Nesseris, “A great model comparison against the cosmological constant,” (11, 2021) , [arXiv:2111.13083 \[astro-ph.CO\]](#).
- [1880] M. Artymowski, I. Ben-Dayan, and U. Kumar, “Emergent dark energy from unparticles,” *Phys. Rev. D* **103** no. 12, (2021) L121303, [arXiv:2010.02998 \[hep-ph\]](#).
- [1881] M. Artymowski, I. Ben-Dayan, and U. Kumar, “More on emergent dark energy from unparticles,” (11, 2021) , [arXiv:2111.09946 \[astro-ph.CO\]](#).
- [1882] E. Belgacem and T. Prokopec, “Quantum origin of dark energy and the hubble tension,” (11, 2021) , [arXiv:2111.04803 \[astro-ph.CO\]](#).
- [1883] H. N. Luu, “Axi-higgs cosmology: Cosmic microwave background and cosmological tensions,” (11, 2021) , [arXiv:2111.01347 \[astro-ph.CO\]](#).
- [1884] SDSS Collaboration, D. J. Eisenstein *et al.*, “Spectroscopic target selection for the sloan digital sky survey: The luminous red galaxy sample,” *Astron. J.* **122** (2001) 2267, [arXiv:astro-ph/0108153](#).

- [1885] R. Cannon *et al.*, “The 2df-sdss lrg and qso (2slaq) luminous red galaxy survey,” *Mon. Not. Roy. Astron. Soc.* **372** (2006) 425–442, [arXiv:astro-ph/0607631](#).
- [1886] R. G. Abraham *et al.*, “The gemini deep deep survey. 1. introduction to the survey, catalogs and composite spectra,” *Astron. J.* **127** (2004) 2455, [arXiv:astro-ph/0402436](#).
- [1887] G. D’Amico, L. Senatore, P. Zhang, and H. Zheng, “The hubble tension in light of the full-shape analysis of large-scale structure data,” *JCAP* **05** (2021) 072, [arXiv:2006.12420](#) [[astro-ph.CO](#)].
- [1888] C. T. Hill, D. N. Schramm, and J. N. Fry, “Cosmological structure formation from soft topological defects,” *Comments Nucl. Part. Phys.* **19** no. 1, (1989) 25–39.
- [1889] R. Murgia, G. F. Abellán, and V. Poulin, “Early dark energy resolution to the hubble tension in light of weak lensing surveys and lensing anomalies,” *Phys. Rev. D* **103** no. 6, (2021) 063502, [arXiv:2009.10733](#) [[astro-ph.CO](#)].
- [1890] T. L. Smith, V. Poulin, J. L. Bernal, K. K. Boddy, M. Kamionkowski, and R. Murgia, “Early dark energy is not excluded by current large-scale structure data,” *Phys. Rev. D* **103** no. 12, (2021) 123542, [arXiv:2009.10740](#) [[astro-ph.CO](#)].
- [1891] S. J. Clark, K. Vattis, J. Fan, and S. M. Koushiappas, “The h_0 and s_8 tensions necessitate early and late time changes to λ cdm,” (10, 2021) , [arXiv:2110.09562](#) [[astro-ph.CO](#)].
- [1892] S. Dhawan, D. Brout, D. Scolnic, A. Goobar, A. G. Riess, and V. Miranda, “Cosmological model insensitivity of local h_0 from the cepheid distance ladder,” *Astrophys. J.* **894** no. 1, (2020) 54, [arXiv:2001.09260](#) [[astro-ph.CO](#)].
- [1893] W. Israel, “Singular hypersurfaces and thin shells in general relativity,” *Nuovo Cim. B* **44S10** (1966) 1. [Erratum: *Nuovo Cim.B* 48, 463 (1967)].
- [1894] N. Deruelle and V. F. Mukhanov, “On matching conditions for cosmological perturbations,” *Phys. Rev. D* **52** (1995) 5549–5555, [arXiv:gr-qc/9503050](#) [[gr-qc](#)].
- [1895] Z. J. Weiner, P. Adshead, and J. T. Giblin, “Constraining early dark energy with gravitational waves before recombination,” *Phys. Rev. D* **103** no. 2, (2021) L021301, [arXiv:2008.01732](#) [[astro-ph.CO](#)].
- [1896] G. D’Amico, J. Gleyzes, N. Kokron, K. Markovic, L. Senatore, P. Zhang, F. Beutler, and H. Gil-Marín, “The cosmological analysis of the sdss/boss data from the effective field theory of large-scale structure,” *JCAP* **05** (2020) 005, [arXiv:1909.05271](#) [[astro-ph.CO](#)].
- [1897] I. Banik and H. Zhao, “From galactic bars to the hubble tension – weighing up the astrophysical evidence for milgromian gravity,” (10, 2021) , [arXiv:2110.06936](#) [[astro-ph.CO](#)].
- [1898] T. Colas, G. D’Amico, L. Senatore, P. Zhang, and F. Beutler, “Efficient cosmological analysis of the sdss/boss data from the effective field theory of large-scale structure,” *JCAP* **06** (2020) 001, [arXiv:1909.07951](#) [[astro-ph.CO](#)].
- [1899] F. Niedermann and M. S. Sloth, “New early dark energy is compatible with current lss data,” *Phys. Rev. D* **103** no. 10, (2021) 103537, [arXiv:2009.00006](#) [[astro-ph.CO](#)].
- [1900] G. D’Amico, L. Senatore, and P. Zhang, “Limits on w cdm from the eftoflss with the pybird code,” *JCAP* **01** (2021) 006, [arXiv:2003.07956](#) [[astro-ph.CO](#)].
- [1901] M. Archidiacono, D. C. Hooper, R. Murgia, S. Bohr, J. Lesgourgues, and M. Viel, “Constraining dark matter-dark radiation interactions with cmb, bao, and lyman- α ,” *JCAP* **10** (2019) 055, [arXiv:1907.01496](#) [[astro-ph.CO](#)].
- [1902] S. Bansal, J. H. Kim, C. Kolda, M. Low, and Y. Tsai, “Mirror twin higgs cosmology: Constraints and a possible resolution to the h_0 and s_8 tensions,” (10, 2021) , [arXiv:2110.04317](#) [[hep-ph](#)].
- [1903] I. J. Allali, M. P. Hertzberg, and F. Rompineve, “Dark sector to restore cosmological concordance,” *Phys. Rev. D* **104** no. 8, (2021) L081303, [arXiv:2104.12798](#) [[astro-ph.CO](#)].

- [1904] K. Freese and M. W. Winkler, “Chain early dark energy: A proposal for solving the hubble tension and explaining today’s dark energy,” *Phys. Rev. D* **104** no. 8, (2021) 083533, [arXiv:2102.13655](#) [[astro-ph.CO](#)].
- [1905] H. Gil-Marín *et al.*, “The clustering of galaxies in the sdss-iii baryon oscillation spectroscopic survey: Bao measurement from the los-dependent power spectrum of dr12 boss galaxies,” *Mon. Not. Roy. Astron. Soc.* **460** no. 4, (2016) 4210–4219, [arXiv:1509.06373](#) [[astro-ph.CO](#)].
- [1906] G. Efstathiou, “To h_0 or not to h_0 ?,” *Mon. Not. Roy. Astron. Soc.* **505** no. 3, (2021) 3866–3872, [arXiv:2103.08723](#) [[astro-ph.CO](#)].
- [1907] S. Castello, M. Högbås, and E. Mörtzell, “A cosmological underdensity does not solve the hubble tension,” (10, 2021) , [arXiv:2110.04226](#) [[astro-ph.CO](#)].
- [1908] R.-G. Cai, Z.-K. Guo, S.-J. Wang, W.-W. Yu, and Y. Zhou, “No-go guide for the hubble tension: Late-time solutions,” *Phys. Rev. D* **105** no. 2, (2022) L021301, [arXiv:2107.13286](#) [[astro-ph.CO](#)].
- [1909] R.-G. Cai, Z.-K. Guo, S.-J. Wang, W.-W. Yu, and Y. Zhou, “No-go guide for the hubble tension : matter perturbations,” (2, 2022) , [arXiv:2202.12214](#) [[astro-ph.CO](#)].
- [1910] **DES** Collaboration, T. M. C. Abbott *et al.*, “Dark energy survey year 3 results: A 2.7% measurement of baryon acoustic oscillation distance scale at redshift 0.835,” (7, 2021) , [arXiv:2107.04646](#) [[astro-ph.CO](#)].
- [1911] M. Raveri, G. Zacharegkas, and W. Hu, “Quantifying concordance of correlated cosmological data sets,” *Phys. Rev. D* **101** no. 10, (2020) 103527, [arXiv:1912.04880](#) [[astro-ph.CO](#)].
- [1912] K. Dawson *et al.*, “Next-generation spectroscopic surveys with desi,” (2020) .
https://www.snowmass21.org/docs/files/summaries/CF/SNOWMASS21-CF6_CF4_Dawson-041.pdf.
- [1913] R. Caldwell *et al.*, “Detection of early-universe gravitational wave signatures and fundamental physics,” in *2022 Snowmass Summer Study*. 3, 2022. [arXiv:2203.07972](#) [[gr-qc](#)].
- [1914] K. Engel *et al.*, “Advancing the landscape of multimessenger science in the next decade,” 3, 2022. [arXiv:2203.10074](#) [[astro-ph.HE](#)].
- [1915] N. Borghi, M. Moresco, A. Cimatti, A. Huchet, S. Quai, and L. Pozzetti, “Toward a better understanding of cosmic chronometers: Stellar population properties of passive galaxies at intermediate redshift,” *Astrophys. J.* **927** no. 2, (2022) 164, [arXiv:2106.14894](#) [[astro-ph.GA](#)].
- [1916] N. Borghi, M. Moresco, and A. Cimatti, “Towards a better understanding of cosmic chronometers: A new measurement of $h(z)$ at $z \sim 0.7$,” (10, 2021) , [arXiv:2110.04304](#) [[astro-ph.CO](#)].
- [1917] R.-Y. Guo, L. Feng, T.-Y. Yao, and X.-Y. Chen, “Exploration of interacting dynamical dark energy model with interaction term including the equation-of-state parameter: alleviation of the h_0 tension,” *JCAP* **12** no. 12, (2021) 036, [arXiv:2110.02536](#) [[gr-qc](#)].
- [1918] S. Bahamonde, K. F. Dialektopoulos, C. Escamilla-Rivera, G. Farrugia, V. Gakis, M. Hendry, M. Hohmann, J. L. Said, J. Mifsud, and E. Di Valentino, “Teleparallel gravity: From theory to cosmology,” (6, 2021) , [arXiv:2106.13793](#) [[gr-qc](#)].
- [1919] C. Escamilla-Rivera and J. Levi Said, “Cosmological viable models in $f(t, b)$ theory as solutions to the h_0 tension,” *Class. Quant. Grav.* **37** no. 16, (2020) 165002, [arXiv:1909.10328](#) [[gr-qc](#)].
- [1920] L. Heisenberg, H. Villarrubia-Rojo, and J. Zosso, “Can late-time extensions solve the h_0 and σ_8 tensions?,” (2, 2022) , [arXiv:2202.01202](#) [[astro-ph.CO](#)].
- [1921] L. Heisenberg, H. Villarrubia-Rojo, and J. Zosso, “Simultaneously solving the h_0 and σ_8 tensions with late dark energy,” (1, 2022) , [arXiv:2201.11623](#) [[astro-ph.CO](#)].
- [1922] J. B. Jiménez, L. Heisenberg, and T. S. Koivisto, “The geometrical trinity of gravity,” *Universe* **5** no. 7, (2019) 173, [arXiv:1903.06830](#) [[hep-th](#)].

- [1923] N. Khosravi and M. Farhang, “Phenomenological gravitational phase transition: Early and late modifications,” (9, 2021) , [arXiv:2109.10725 \[astro-ph.CO\]](#).
- [1924] N. Schöneberg, G. Franco Abellán, A. Pérez Sánchez, S. J. Witte, V. Poulin, and J. Lesgourgues, “The h_0 olympics: A fair ranking of proposed models,” (7, 2021) , [arXiv:2107.10291 \[astro-ph.CO\]](#).
- [1925] C. Escamilla-Rivera, R. Lazkoz, V. Salzano, and I. Sendra, “Tension between sn and bao: current status and future forecasts,” *JCAP* **09** (2011) 003, [arXiv:1103.2386 \[astro-ph.CO\]](#).
- [1926] L. Perivolaropoulos and F. Skara, “Challenges for λ cdm: An update,” (5, 2021) , [arXiv:2105.05208 \[astro-ph.CO\]](#).
- [1927] H. Koo, A. Shafieloo, R. E. Keeley, and B. L’Huillier, “Model selection and parameter estimation using the iterative smoothing method,” *JCAP* **03** (2021) 034, [arXiv:2009.12045 \[astro-ph.CO\]](#).
- [1928] H. Koo, R. E. Keeley, A. Shafieloo, and B. L’Huillier, “Bayesian vs frequentist: Comparing bayesian model selection with a frequentist approach using the iterative smoothing method,” (10, 2021) , [arXiv:2110.10977 \[astro-ph.CO\]](#).
- [1929] L. Perivolaropoulos and F. Skara, “Hubble tension or a transition of the cepheid snia calibrator parameters?,” *Phys. Rev. D* **104** no. 12, (2021) 123511, [arXiv:2109.04406 \[astro-ph.CO\]](#).
- [1930] V. Marra and L. Perivolaropoulos, “Rapid transition of g_{eff} at $z_t \simeq 0.01$ as a possible solution of the hubble and growth tensions,” *Phys. Rev. D* **104** no. 2, (2021) L021303, [arXiv:2102.06012 \[astro-ph.CO\]](#).
- [1931] M. Escudero and S. J. Witte, “The hubble tension as a hint of leptogenesis and neutrino mass generation,” *Eur. Phys. J. C* **81** no. 6, (2021) 515, [arXiv:2103.03249 \[hep-ph\]](#).
- [1932] M. Escudero and S. J. Witte, “A cmb search for the neutrino mass mechanism and its relation to the hubble tension,” *Eur. Phys. J. C* **80** no. 4, (2020) 294, [arXiv:1909.04044 \[astro-ph.CO\]](#).
- [1933] G. Alestas, L. Kazantzidis, and L. Perivolaropoulos, “ $w - m$ phantom transition at $z_t < 0.1$ as a resolution of the hubble tension,” *Phys. Rev. D* **103** no. 8, (2021) 083517, [arXiv:2012.13932 \[astro-ph.CO\]](#).
- [1934] G. Alestas and L. Perivolaropoulos, “Late-time approaches to the hubble tension deforming $h(z)$, worsen the growth tension,” *Mon. Not. Roy. Astron. Soc.* **504** no. 3, (2021) 3956, [arXiv:2103.04045 \[astro-ph.CO\]](#).
- [1935] A. Theodoropoulos and L. Perivolaropoulos, “The hubble tension, the m crisis of late time $h(z)$ deformation models and the reconstruction of quintessence lagrangians,” *Universe* **7** no. 8, (2021) 300, [arXiv:2109.06256 \[astro-ph.CO\]](#).
- [1936] G. Alestas, I. Antoniou, and L. Perivolaropoulos, “Hints for a gravitational constant transition in tully-fisher data,” *Universe* **7** (2021) 366, [arXiv:2104.14481 \[astro-ph.CO\]](#).
- [1937] A. J. Cuesta, M. E. Gómez, J. I. Illana, and M. Masip, “Cosmology of an axion-like majoron,” (9, 2021) , [arXiv:2109.07336 \[hep-ph\]](#).
- [1938] J. Solà and A. Gómez-Valent, “The $\bar{\Lambda}$ cdm cosmology: From inflation to dark energy through running Λ ,” *Int. J. Mod. Phys. D* **24** (2015) 1541003, [arXiv:1501.03832 \[gr-qc\]](#).
- [1939] J. Solà, “Cosmological constant and vacuum energy: old and new ideas,” *J. Phys. Conf. Ser.* **453** (2013) 012015, [arXiv:1306.1527 \[gr-qc\]](#).
- [1940] T.-J. Wu and A. Sepulveda, “The weighted average information criterion for order selection in time series and regression models,” *Statistics & Probability Letters* **39** no. 1, (1998) 1–10.
- [1941] R. I. Anderson and A. G. Riess, “On cepheid distance scale bias due to stellar companions and cluster populations,” *Astrophys. J.* **861** no. 1, (July, 2018) 36, [arXiv:1712.01065 \[astro-ph.SR\]](#).
- [1942] R. I. Anderson, “Towards a 1% measurement of the hubble constant: Accounting for time dilation in variable star light curves,” *Astron. Astrophys.* **631** (2019) A165, [arXiv:1909.10847 \[astro-ph.CO\]](#).

- [1943] R. I. Anderson, “Relativistic corrections for measuring hubble’s constant to 1% using stellar standard candles,” *Astron. Astrophys.* **658** (2022) A148, [arXiv:2108.09067](#) [[astro-ph.CO](#)].
- [1944] B. Javanmardi, A. Merand, P. Kervella, L. Breuval, A. Gallenne, N. Nardetto, W. Gieren, G. Pietrzynski, V. Hocde, and S. Borgniet, “Inspecting the cepheid distance ladder: the hubble space telescope distance to the sn ia host galaxy ngc 5584,” *Astrophys. J.* **911** no. 1, (2021) 12, [arXiv:2102.12489](#) [[astro-ph.GA](#)].
- [1945] **KiDS, Euclid** Collaboration, A. Loureiro *et al.*, “Kids & euclid: Cosmological implications of a pseudo angular power spectrum analysis of kids-1000 cosmic shear tomography,” (10, 2021) , [arXiv:2110.06947](#) [[astro-ph.CO](#)].
- [1946] B. Joachimi, F. Köhlinger, W. Handley, and P. Lemos, “When tension is just a fluctuation: How noisy data affect model comparison,” *Astron. Astrophys.* **647** (2021) L5, [arXiv:2102.09547](#) [[astro-ph.CO](#)].
- [1947] E. J. Copeland, A. R. Liddle, and D. Wands, “Exponential potentials and cosmological scaling solutions,” *Phys. Rev. D* **57** (1998) 4686–4690, [arXiv:gr-qc/9711068](#).
- [1948] R. K. Sachs and A. M. Wolfe, “Perturbations of a cosmological model and angular variations of the microwave background,” *Astrophys. J.* **147** (1967) 73–90.
- [1949] P. Fosalba and E. Gaztañaga, “Measurement of the gravitational potential evolution from the cross-correlation between wmap and the apm galaxy survey,” *Mon. Not. Roy. Astron. Soc.* **350** (2004) L37–L41, [arXiv:astro-ph/0305468](#).
- [1950] A. Marcos-Caballero, R. Fernández-Cobos, E. Martínez-González, and P. Vielva, “The shape of cmb temperature and polarization peaks on the sphere,” *JCAP* **04** (2016) 058, [arXiv:1512.07412](#) [[astro-ph.CO](#)].
- [1951] M. Cantiello *et al.*, “A precise distance to the host galaxy of the binary neutron star merger gw170817 using surface brightness fluctuations,” *Astrophys. J. Lett.* **854** no. 2, (2018) L31, [arXiv:1801.06080](#) [[astro-ph.GA](#)].
- [1952] P. Hunt and S. Sarkar, “Constraints on large scale inhomogeneities from wmap-5 and sdss: confrontation with recent observations,” *Mon. Not. Roy. Astron. Soc.* **401** (2010) 547, [arXiv:0807.4508](#) [[astro-ph](#)].
- [1953] B. R. Granett, M. C. Neyrinck, and I. Szapudi, “Dark energy detected with supervoids and superclusters,” (5, 2008) , [arXiv:0805.2974](#) [[astro-ph](#)].
- [1954] S. Nadathur, S. Hotchkiss, and S. Sarkar, “The integrated sachs-wolfe imprints of cosmic superstructures: a problem for λ cdm,” *JCAP* **06** (2012) 042, [arXiv:1109.4126](#) [[astro-ph.CO](#)].
- [1955] S. Flender, S. Hotchkiss, and S. Nadathur, “The stacked isw signal of rare superstructures in λ cdm,” *JCAP* **02** (2013) 013, [arXiv:1212.0776](#) [[astro-ph.CO](#)].
- [1956] S. Ilic, M. Langer, and M. Douspis, “On the detection of the integrated sachs-wolfe effect with stacked voids,” *Astron. Astrophys.* **556** (2013) A51, [arXiv:1301.5849](#) [[astro-ph.CO](#)].
- [1957] Y.-C. Cai, M. Neyrinck, Q. Mao, J. A. Peacock, I. Szapudi, and A. A. Berlind, “The lensing and temperature imprints of voids on the cosmic microwave background,” *Mon. Not. Roy. Astron. Soc.* **466** no. 3, (2017) 3364–3375, [arXiv:1609.00301](#) [[astro-ph.CO](#)].
- [1958] H. Zeng and D. Yan, “Using the extragalactic gamma-ray background to constrain the hubble constant and matter density of the universe,” (7, 2019) , [arXiv:1907.10965](#) [[astro-ph.HE](#)].
- [1959] F. Gao, J. A. Braatz, M. J. Reid, K. Y. Lo, J. J. Condon, C. Henkel, C. Y. Kuo, C. M. V. Impellizzeri, D. W. Pesce, and W. Zhao, “The megamaser cosmology project viii. a geometric distance to ngc 5765b,” *Astrophys. J.* **817** no. 2, (2016) 128, [arXiv:1511.08311](#) [[astro-ph.GA](#)].
- [1960] A. Kovács, “The part and the whole: voids, supervoids, and their isw imprint,” *Mon. Not. Roy. Astron. Soc.* **475** no. 2, (2018) 1777–1790, [arXiv:1701.08583](#) [[astro-ph.CO](#)].

- [1961] F. Dong, Y. Yu, J. Zhang, X. Yang, and P. Zhang, “Measuring the integrated sachs–wolfe effect from the low-density regions of the universe,” *Mon. Not. Roy. Astron. Soc.* **500** no. 3, (2020) 3838–3853, [arXiv:2006.14202 \[astro-ph.CO\]](#).
- [1962] G. R  acz, L. Dobos, R. Beck, I. Szapudi, and I. Csabai, “Concordance cosmology without dark energy,” *Mon. Not. Roy. Astron. Soc.* **469** no. 1, (2017) L1–L5, [arXiv:1607.08797 \[astro-ph.CO\]](#).
- [1963] R. Beck, I. Csabai, G. R  acz, and I. Szapudi, “The integrated sachs–wolfe effect in the avara cosmology,” *Mon. Not. Roy. Astron. Soc.* **479** no. 3, (2018) 3582–3591, [arXiv:1801.08566 \[astro-ph.CO\]](#).
- [1964] T. Giannantonio, R. Crittenden, R. Nichol, and A. J. Ross, “The significance of the integrated sachs–wolfe effect revisited,” *Mon. Not. Roy. Astron. Soc.* **426** (2012) 2581–2599, [arXiv:1209.2125 \[astro-ph.CO\]](#).
- [1965] R. Bowen, S. H. Hansen, A. Melchiorri, J. Silk, and R. Trotta, “The impact of an extra background of relativistic particles on the cosmological parameters derived from microwave background anisotropies,” *Mon. Not. Roy. Astron. Soc.* **334** (2002) 760, [arXiv:astro-ph/0110636](#).
- [1966] S. Galli, M. Martinelli, A. Melchiorri, L. Pagano, B. D. Sherwin, and D. N. Spergel, “Constraining fundamental physics with future cmb experiments,” *Phys. Rev. D* **82** (2010) 123504, [arXiv:1005.3808 \[astro-ph.CO\]](#).
- [1967] Z. Hou, R. Keisler, L. Knox, M. Millea, and C. Reichardt, “How massless neutrinos affect the cosmic microwave background damping tail,” *Phys. Rev. D* **87** (2013) 083008, [arXiv:1104.2333 \[astro-ph.CO\]](#).
- [1968] G. Cabass, M. Gerbino, E. Giusarma, A. Melchiorri, L. Pagano, and L. Salvati, “Constraints on the early and late integrated sachs–wolfe effects from the planck 2015 cosmic microwave background anisotropies in the angular power spectra,” *Phys. Rev. D* **92** no. 6, (2015) 063534, [arXiv:1507.07586 \[astro-ph.CO\]](#).
- [1969] J. A. Kable, G. E. Addison, and C. L. Bennett, “Deconstructing the planck tt power spectrum to constrain deviations from Λ cdm,” *Astrophys. J.* **905** no. 2, (2020) 164, [arXiv:2008.01785 \[astro-ph.CO\]](#).
- [1970] **LIGO Scientific, VIRGO, KAGRA** Collaboration, R. Abbott *et al.*, “Constraints on the cosmic expansion history from gwtc-3,” (11, 2021) , [arXiv:2111.03604 \[astro-ph.CO\]](#).
- [1971] V. Bonvin *et al.*, “H0licow – v. new cosmograil time delays of he 0435–1223: h_0 to 3.8 per cent precision from strong lensing in a flat Λ cdm model,” *Mon. Not. Roy. Astron. Soc.* **465** no. 4, (2017) 4914–4930, [arXiv:1607.01790 \[astro-ph.CO\]](#).
- [1972] A. K. Singal, “Peculiar motion of the solar system derived from a dipole anisotropy in the redshift distribution of distant quasars,” *Mon. Not. Roy. Astron. Soc.* **488** no. 1, (2019) L104–L108, [arXiv:1405.4796 \[astro-ph.CO\]](#).
- [1973] P. R. M. Eisenhardt, F. Marocco, J. W. Fowler, A. M. Meisner, J. D. Kirkpatrick, N. Garcia, T. H. Jarrett, R. Koontz, E. J. Marchese, S. A. Stanford, D. Caselden, M. C. Cushing, R. M. Cutri, J. K. Faherty, C. R. Gelino, A. H. Gonzalez, A. Mainzer, B. Mobasher, D. J. Schlegel, D. Stern, H. I. Teplitz, and E. L. Wright, “The CatWISE preliminary catalog: Motions from WISE and NEOWISE data,” *The Astrophysical Journal Supplement Series* **247** no. 2, (2020) 69. <https://doi.org/10.3847/1538-4365/ab7f2a>.
- [1974] E. L. Wright *et al.*, “The wide-field infrared survey explorer (wise): Mission description and initial on-orbit performance,” *Astron. J.* **140** (2010) 1868, [arXiv:1008.0031 \[astro-ph.IM\]](#).
- [1975] A. Gruppuso, N. Kitazawa, M. Lattanzi, N. Mandolesi, P. Natoli, and A. Sagnotti, “The evens and odds of cmb anomalies,” *Phys. Dark Univ.* **20** (2018) 49–64, [arXiv:1712.03288 \[astro-ph.CO\]](#).
- [1976] M. R. Wilczynska, J. K. Webb, J. A. King, M. T. Murphy, M. B. Bainbridge, and V. V. Flambaum, “A new analysis of fine-structure constant measurements and modelling errors from quasar absorption lines,” *Mon. Not. Roy. Astron. Soc.* **454** no. 3, (2015) 3082–3093, [arXiv:1510.02536 \[astro-ph.CO\]](#).

- [1977] C. J. A. P. Martins and A. M. M. Pinho, “Stability of fundamental couplings: a global analysis,” *Phys. Rev. D* **95** no. 2, (2017) 023008, [arXiv:1701.08724 \[astro-ph.CO\]](#).
- [1978] P. Molaro *et al.*, “The uves large program for testing fundamental physics: I bounds on a change in α towards quasar he 2217-2818,” *Astron. Astrophys.* **555** (2013) A68, [arXiv:1305.1884 \[astro-ph.CO\]](#).
- [1979] A. Domínguez, R. Wojtak, J. Finke, M. Ajello, K. Helgason, F. Prada, A. Desai, V. Paliya, L. Marcotulli, and D. Hartmann, “A new measurement of the hubble constant and matter content of the universe using extragalactic background light γ -ray attenuation,” (3, 2019) , [arXiv:1903.12097 \[astro-ph.CO\]](#).
- [1980] A. Domínguez and F. Prada, “Measurement of the expansion rate of the universe from γ -ray attenuation,” *Astrophys. J. Lett.* **771** (2013) L34, [arXiv:1305.2163 \[astro-ph.CO\]](#).
- [1981] J.-P. Uzan, “Varying constants, gravitation and cosmology,” *Living Rev. Rel.* **14** (2011) 2, [arXiv:1009.5514 \[astro-ph.CO\]](#).
- [1982] T. Yang, S. Birrer, and B. Hu, “The first simultaneous measurement of hubble constant and post-newtonian parameter from time-delay strong lensing,” *Mon. Not. Roy. Astron. Soc.* **497** no. 1, (2020) L56–L61, [arXiv:2003.03277 \[astro-ph.CO\]](#).
- [1983] J.-Z. Qi, J.-W. Zhao, S. Cao, M. Biesiada, and Y. Liu, “Measurements of the hubble constant and cosmic curvature with quasars: ultracompact radio structure and strong gravitational lensing,” *Mon. Not. Roy. Astron. Soc.* **503** no. 2, (2021) 2179–2186, [arXiv:2011.00713 \[astro-ph.CO\]](#).
- [1984] J. C. Berengut, V. V. Flambaum, A. Ong, J. K. Webb, J. D. Barrow, M. A. Barstow, S. P. Preval, and J. B. Holberg, “Limits on the dependence of the fine-structure constant on gravitational potential from white-dwarf spectra,” *Phys. Rev. Lett.* **111** no. 1, (2013) 010801, [arXiv:1305.1337 \[astro-ph.CO\]](#).
- [1985] J. K. Webb, A. Wright, F. E. Koch, and M. T. Murphy, “Enhanced heavy magnesium isotopes in quasar absorption systems and varying α ,” *Mem. Soc. Ast. It.* **85** no. 1, (2014) 57–62.
- [1986] T. M. Evans *et al.*, “The uves large program for testing fundamental physics – iii. constraints on the fine-structure constant from three telescopes,” *Mon. Not. Roy. Astron. Soc.* **445** no. 1, (2014) 128–150, [arXiv:1409.1923 \[astro-ph.CO\]](#).
- [1987] M. B. Bainbridge *et al.*, “Probing the gravitational dependence of the fine-structure constant from observations of white dwarf stars,” *Universe* **3** no. 2, (2017) 32, [arXiv:1702.01757 \[astro-ph.CO\]](#).
- [1988] P. Denzel, J. P. Coles, P. Saha, and L. L. R. Williams, “The hubble constant from eight time-delay galaxy lenses,” *Mon. Not. Roy. Astron. Soc.* **501** no. 1, (2021) 784–801, [arXiv:2007.14398 \[astro-ph.CO\]](#).
- [1989] J. Hu *et al.*, “Constraining the magnetic field on white dwarf surfaces; zeeman effects and fine structure constant variation,” *Mon. Not. Roy. Astron. Soc.* **485** no. 4, (2019) 5050–5058, [arXiv:1812.11480 \[astro-ph.SR\]](#).
- [1990] M.-J. Zhang and H. Li, “Gaussian processes reconstruction of dark energy from observational data,” *Eur. Phys. J. C* **78** no. 6, (2018) 460, [arXiv:1806.02981 \[astro-ph.CO\]](#).
- [1991] D. Milaković, C.-C. Lee, R. F. Carswell, J. K. Webb, P. Molaro, and L. Pasquini, “A new era of fine structure constant measurements at high redshift,” *Mon. Not. Roy. Astron. Soc.* **500** no. 1, (2020) 1–21, [arXiv:2008.10619 \[astro-ph.CO\]](#).
- [1992] C.-C. Lee, J. K. Webb, D. Milaković, and R. F. Carswell, “Non-uniqueness in quasar absorption models and implications for measurements of the fine structure constant,” *Mon. Not. Roy. Astron. Soc.* **507** no. 1, (2021) 27–42, [arXiv:2102.11648 \[astro-ph.CO\]](#).
- [1993] J. K. Webb, V. V. Flambaum, C. W. Churchill, M. J. Drinkwater, and J. D. Barrow, “Evidence for time variation of the fine structure constant,” *Phys. Rev. Lett.* **82** (1999) 884–887, [arXiv:astro-ph/9803165](#).
- [1994] T. Harko, F. S. N. Lobo, S. Nojiri, and S. D. Odintsov, “ $f(r, t)$ gravity,” *Phys. Rev. D* **84** (2011) 024020, [arXiv:1104.2669 \[gr-qc\]](#).

- [1995] S. Capozziello and M. Francaviglia, “Extended theories of gravity and their cosmological and astrophysical applications,” *Gen. Rel. Grav.* **40** (2008) 357–420, [arXiv:0706.1146 \[astro-ph\]](#).
- [1996] S. Nojiri, S. D. Odintsov, and V. K. Oikonomou, “Modified gravity theories on a nutshell: Inflation, bounce and late-time evolution,” *Phys. Rept.* **692** (2017) 1–104, [arXiv:1705.11098 \[gr-qc\]](#).
- [1997] K. Bamba, S. Capozziello, S. Nojiri, and S. D. Odintsov, “Dark energy cosmology: the equivalent description via different theoretical models and cosmography tests,” *Astrophys. Space Sci.* **342** (2012) 155–228, [arXiv:1205.3421 \[gr-qc\]](#).
- [1998] V. A. Dzuba, V. V. Flambaum, and J. K. Webb, “Space-time variation of physical constants and relativistic corrections in atoms,” *Phys. Rev. Lett.* **82** (1999) 888–891, [arXiv:physics/9802029](#).
- [1999] J. K. Webb, M. T. Murphy, V. V. Flambaum, V. A. Dzuba, J. D. Barrow, C. W. Churchill, J. X. Prochaska, and A. M. Wolfe, “Further evidence for cosmological evolution of the fine structure constant,” *Phys. Rev. Lett.* **87** (2001) 091301, [arXiv:astro-ph/0012539](#).
- [2000] D. Milaković, L. Pasquini, J. K. Webb, and G. Lo Curto, “Precision and consistency of astrocombs,” *Mon. Not. Roy. Astron. Soc.* **493** no. 3, (2020) 3997–4011, [arXiv:2002.05182 \[astro-ph.IM\]](#).
- [2001] M. T. Murphy, J. K. Webb, V. V. Flambaum, V. A. Dzuba, C. W. Churchill, J. X. Prochaska, J. D. Barrow, and A. M. Wolfe, “Possible evidence for a variable fine structure constant from qso absorption lines: Motivations, analysis and results,” *Mon. Not. Roy. Astron. Soc.* **327** (2001) 1208, [arXiv:astro-ph/0012419](#).
- [2002] H. Dekker, S. D’Odorico, A. Kaufer, B. Delabre, and H. Kotzlowski, “Design, construction, and performance of uves, the echelle spectrograph for the ut2 kueyen telescope at the eso paranal observatory,” in *Optical and IR Telescope Instrumentation and Detectors*, M. Iye and A. F. Moorwood, eds., vol. 4008 of *Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series*, pp. 534–545. August, 2000.
- [2003] E. Cameron and T. Pettitt, “On the evidence for cosmic variation of the fine structure constant: A bayesian reanalysis of the quasar dataset,” (7, 2012) , [arXiv:1207.6223 \[astro-ph.CO\]](#).
- [2004] N. Kanekar, G. I. Langston, J. T. Stocke, C. L. Carilli, and K. M. Menten, “Constraining fundamental constant evolution with hi and oh lines,” *Astrophys. J. Lett.* **746** (2012) L16, [arXiv:1201.3372 \[astro-ph.CO\]](#).
- [2005] E. Trott and D. Huterer, “Challenges for the statistical gravitational-wave method to measure the hubble constant,” (11, 2021) , [arXiv:2112.00241 \[astro-ph.CO\]](#).
- [2006] S. A. Levshakov, F. Combes, F. Boone, I. I. Agafonova, D. Reimers, and M. G. Kozlov, “An upper limit to the variation in the fundamental constants at redshift $z = 5.2$,” *Astron. Astrophys.* **540** (2012) L9, [arXiv:1203.3649 \[astro-ph.CO\]](#).
- [2007] **Particle Data Group** Collaboration, P. A. Zyla *et al.*, “Review of particle physics,” *PTEP* **2020** no. 8, (2020) 083C01.
- [2008] C. Pitrou, A. Coc, J.-P. Uzan, and E. Vangioni, “A new tension in the cosmological model from primordial deuterium?,” *Mon. Not. Roy. Astron. Soc.* **502** no. 2, (2021) 2474–2481, [arXiv:2011.11320 \[astro-ph.CO\]](#).
- [2009] C. Pitrou, A. Coc, J.-P. Uzan, and E. Vangioni, “Precision big bang nucleosynthesis with improved helium-4 predictions,” *Phys. Rept.* **754** (2018) 1–66, [arXiv:1801.08023 \[astro-ph.CO\]](#).
- [2010] B. D. Fields, “The primordial lithium problem,” *Ann. Rev. Nucl. Part. Sci.* **61** (2011) 47–68, [arXiv:1203.3551 \[astro-ph.CO\]](#).
- [2011] **Particle Data Group** Collaboration, M. Tanabashi *et al.*, “Review of particle physics,” *Phys. Rev. D* **98** no. 3, (2018) 030001.

- [2012] D. G. Yamazaki, M. Kusakabe, T. Kajino, G. J. Mathews, and M.-K. Cheoun, “Cosmological solutions to the lithium problem: Big-bang nucleosynthesis with photon cooling, x -particle decay and a primordial magnetic field,” *Phys. Rev. D* **90** no. 2, (2014) 023001, [arXiv:1407.0021 \[astro-ph.CO\]](#).
- [2013] A. Mehrabi and M. Rezaei, “Cosmographic parameters in model-independent approaches,” *Astrophys. J.* **923** no. 2, (2021) 274, [arXiv:2110.14950 \[astro-ph.CO\]](#).
- [2014] M. Kusakabe, K. S. Kim, M.-K. Cheoun, T. Kajino, Y. Kino, and G. J. Mathews, “Revised big bang nucleosynthesis with long-lived negatively charged massive particles: updated recombination rates, primordial ^9Be nucleosynthesis, and impact of new ^6Li limits,” *Astrophys. J. Suppl.* **214** (2014) 5, [arXiv:1403.4156 \[astro-ph.CO\]](#).
- [2015] V. Poulin and P. D. Serpico, “Loophole to the universal photon spectrum in electromagnetic cascades and application to the cosmological lithium problem,” *Phys. Rev. Lett.* **114** no. 9, (2015) 091101, [arXiv:1502.01250 \[astro-ph.CO\]](#).
- [2016] J. Sato, T. Shimomura, and M. Yamanaka, “A solution to lithium problem by long-lived stau,” *Int. J. Mod. Phys. E* **26** no. 08, (2017) 1741005, [arXiv:1604.04769 \[hep-ph\]](#).
- [2017] A. Goudelis, M. Pospelov, and J. Pradler, “Light particle solution to the cosmic lithium problem,” *Phys. Rev. Lett.* **116** no. 21, (2016) 211303, [arXiv:1510.08858 \[hep-ph\]](#).
- [2018] L. Salvati, L. Pagano, M. Lattanzi, M. Gerbino, and A. Melchiorri, “Breaking be: a sterile neutrino solution to the cosmological lithium problem,” *JCAP* **08** (2016) 022, [arXiv:1606.06968 \[astro-ph.CO\]](#).
- [2019] S. Q. Hou, J. J. He, A. Parikh, D. Kahl, C. A. Bertulani, T. Kajino, G. J. Mathews, and G. Zhao, “Non-extensive statistics to the cosmological lithium problem,” *Astrophys. J.* **834** no. 2, (2017) 165, [arXiv:1701.04149 \[astro-ph.CO\]](#).
- [2020] K. Mori and M. Kusakabe, “Roles of $^7\text{Be}(n, p)^7\text{Li}$ resonances in big bang nucleosynthesis with time-dependent quark mass and Li reduction by a heavy quark mass,” *Phys. Rev. D* **99** no. 8, (2019) 083013, [arXiv:1901.03943 \[astro-ph.CO\]](#).
- [2021] S. Hayakawa *et al.*, “Experimental study on the $^7\text{Be}(n, p)^7\text{Li}$ and the $^7\text{Be}(n, \alpha)^4\text{He}$ reactions for cosmological lithium problem,” *JPS Conf. Proc.* **31** (2020) 011036.
- [2022] S. Ishikawa *et al.*, “Experimental study of the $^7\text{Be}(n, p_1)^7\text{Li}^*$ reaction for the cosmological lithium problem,” *JPS Conf. Proc.* **31** (2020) 011037.
- [2023] C. Iliadis and A. Coc, “Thermonuclear reaction rates and primordial nucleosynthesis,” *Astrophys. J.* **901** no. 2, (2020) 127, [arXiv:2008.12200 \[astro-ph.CO\]](#).
- [2024] L. Sbordone *et al.*, “The metal-poor end of the spite plateau. 1: Stellar parameters, metallicities and lithium abundances,” *Astron. Astrophys.* **522** (2010) A26, [arXiv:1003.4510 \[astro-ph.GA\]](#).
- [2025] J. Melendez, L. Casagrande, I. Ramirez, M. Asplund, and W. Schuster, “Observational evidence for a broken Li spite plateau and mass-dependent Li depletion,” *Astron. Astrophys.* **515** (2010) L3, [arXiv:1005.2944 \[astro-ph.SR\]](#).
- [2026] M. Spite, F. Spite, and P. Bonifacio, “The cosmic lithium problem: an observer’s perspective,” *Mem. Soc. Astron. Ital. Suppl.* **22** (2012) 9, [arXiv:1208.1190 \[astro-ph.CO\]](#).
- [2027] F. Iocco, G. Mangano, G. Miele, O. Pisanti, and P. D. Serpico, “Primordial nucleosynthesis: from precision cosmology to fundamental physics,” *Phys. Rept.* **472** (2009) 1–76, [arXiv:0809.0631 \[astro-ph\]](#).
- [2028] J. Larena, J.-M. Alimi, and A. Serna, “Big bang nucleosynthesis in scalar tensor gravity: The key problem of the primordial Li-7 abundance,” *Astrophys. J.* **658** (2007) 1–10, [arXiv:astro-ph/0511693](#).
- [2029] K. Kohri and F. Takayama, “Big bang nucleosynthesis with long lived charged massive particles,” *Phys. Rev. D* **76** (2007) 063507, [arXiv:hep-ph/0605243](#).

- [2030] J. C. Berengut, V. V. Flambaum, and V. F. Dmitriev, “Effect of quark-mass variation on big bang nucleosynthesis,” *Phys. Lett. B* **683** (2010) 114–118, [arXiv:0907.2288 \[nucl-th\]](#).
- [2031] G. J. Mathews, A. Kedia, N. Sasankan, M. Kusakabe, Y. Luo, T. Kajino, D. Yamazaki, T. Makki, and M. E. Eid, “Cosmological solutions to the lithium problem,” *JPS Conf. Proc.* **31** (2020) 011033, [arXiv:1909.01245 \[astro-ph.CO\]](#).
- [2032] M. Kawasaki and M. Kusakabe, “Destruction of ${}^7\text{Be}$ in big bang nucleosynthesis via long-lived sub-strongly interacting massive particles as a solution to the Li problem,” *Phys. Rev. D* **83** (2011) 055011, [arXiv:1012.0435 \[hep-ph\]](#).
- [2033] M.-K. Cheoun, T. Kajino, M. Kusakabe, and G. J. Mathews, “Time dependent quark masses and big bang nucleosynthesis revisited,” *Phys. Rev. D* **84** (2011) 043001, [arXiv:1104.5547 \[astro-ph.CO\]](#).
- [2034] A. Coc, N. J. Nunes, K. A. Olive, J.-P. Uzan, and E. Vangioni, “Coupled variations of fundamental couplings and primordial nucleosynthesis,” *Phys. Rev. D* **76** (2007) 023511, [arXiv:astro-ph/0610733](#).
- [2035] Y. Luo, T. Kajino, M. Kusakabe, and G. J. Mathews, “Big bang nucleosynthesis with an inhomogeneous primordial magnetic field strength,” *Astrophys. J.* **872** no. 2, (2019) 172, [arXiv:1810.08803 \[astro-ph.CO\]](#).
- [2036] R. H. Cyburt, B. D. Fields, and K. A. Olive, “Solar neutrino constraints on the bbn production of Li,” *Phys. Rev. D* **69** (2004) 123519, [arXiv:astro-ph/0312629](#).
- [2037] M. H. Pinsonneault, G. Steigman, T. P. Walker, and V. K. Narayanan, “Stellar mixing and the primordial lithium abundance,” *Astrophys. J.* **574** (2002) 398–411, [arXiv:astro-ph/0105439](#).
- [2038] O. Richard, G. Michaud, and J. Richer, “Implications of WMAP observations on Li abundance and stellar evolution models,” *Astrophys. J.* **619** (2005) 538–548, [arXiv:astro-ph/0409672](#).
- [2039] A. J. Korn, F. Grundahl, O. Richard, P. S. Barklem, L. Mashonkina, R. Collet, N. Piskunov, and B. Gustafsson, “A probable stellar solution to the cosmological lithium discrepancy,” *Nature* **442** (2006) 657–659, [arXiv:astro-ph/0608201](#).
- [2040] X. Fu, A. Bressan, P. Molaro, and P. Marigo, “Lithium evolution in metal-poor stars: from pre-main sequence to the Spite plateau,” *Mon. Not. Roy. Astron. Soc.* **452** no. 3, (September, 2015) 3256–3265, [arXiv:1506.05993 \[astro-ph.SR\]](#).
- [2041] D. G. Yamazaki, M. Kusakabe, T. Kajino, G. J. Mathews, and M.-K. Cheoun, “The new hybrid bbn model with the photon cooling, x particle, and the primordial magnetic field,” *Int. J. Mod. Phys. E* **26** no. 08, (2017) 1741006.
- [2042] A. D. Rider, D. C. Moore, C. P. Blakemore, M. Louis, M. Lu, and G. Gratta, “Search for screened interactions associated with dark energy below the 100 μm length scale,” *Phys. Rev. Lett.* **117** no. 10, (2016) 101101, [arXiv:1604.04908 \[hep-ex\]](#).
- [2043] D. J. Kapner, T. S. Cook, E. G. Adelberger, J. H. Gundlach, B. R. Heckel, C. D. Hoyle, and H. E. Swanson, “Tests of the gravitational inverse-square law below the dark-energy length scale,” *Phys. Rev. Lett.* **98** (2007) 021101, [arXiv:hep-ph/0611184](#).
- [2044] R. Gannouji, D. Polarski, A. Ranquet, and A. A. Starobinsky, “Scalar-tensor models of normal and phantom dark energy,” *JCAP* **09** (2006) 016, [arXiv:astro-ph/0606287](#).
- [2045] D. Benisty, “Quantifying the s_8 tension with the redshift space distortion data set,” *Phys. Dark Univ.* **31** (2021) 100766, [arXiv:2005.03751 \[astro-ph.CO\]](#).
- [2046] N. Bernal, X. Chu, C. Garcia-Cely, T. Hambye, and B. Zaldivar, “Production regimes for self-interacting dark matter,” *JCAP* **03** (2016) 018, [arXiv:1510.08063 \[hep-ph\]](#).
- [2047] X. Chu and C. Garcia-Cely, “Self-interacting spin-2 dark matter,” *Phys. Rev. D* **96** no. 10, (2017) 103519, [arXiv:1708.06764 \[hep-ph\]](#).

- [2048] N. Bernal, A. Chatterjee, and A. Paul, “Non-thermal production of dark matter after inflation,” *JCAP* **12** (2018) 020, [arXiv:1809.02338 \[hep-ph\]](#).
- [2049] S. Heeba, F. Kahlhoefer, and P. Stöcker, “Freeze-in production of decaying dark matter in five steps,” *JCAP* **11** (2018) 048, [arXiv:1809.04849 \[hep-ph\]](#).
- [2050] E. D. Carlson, M. E. Machacek, and L. J. Hall, “Self-interacting dark matter,” *Astrophys. J.* **398** (1992) 43–52.
- [2051] A. D. Dolgov, “New old mechanism of dark matter burning,” (5, 2017) , [arXiv:1705.03689 \[hep-ph\]](#).
- [2052] A. D. Dolgov, “On concentration relict theta particles. (in russian),” *Yad. Fiz.* **31** (1980) 1522–1528.
- [2053] M. Boylan-Kolchin, J. S. Bullock, and M. Kaplinghat, “Too big to fail? the puzzling darkness of massive milky way subhaloes,” *Mon. Not. Roy. Astron. Soc.* **415** (2011) L40, [arXiv:1103.0007 \[astro-ph.CO\]](#).
- [2054] Y. Hochberg, E. Kuflik, H. Murayama, T. Volansky, and J. G. Wacker, “Model for thermal relic dark matter of strongly interacting massive particles,” *Phys. Rev. Lett.* **115** no. 2, (2015) 021301, [arXiv:1411.3727 \[hep-ph\]](#).
- [2055] E. Kuflik, M. Perelstein, N. R.-L. Lorier, and Y.-D. Tsai, “Elastically decoupling dark matter,” *Phys. Rev. Lett.* **116** (Jun, 2016) 221302. <https://link.aps.org/doi/10.1103/PhysRevLett.116.221302>.
- [2056] D. Pappadopulo, J. T. Ruderman, and G. Trevisan, “Dark matter freeze-out in a nonrelativistic sector,” *Phys. Rev. D* **94** no. 3, (2016) 035005, [arXiv:1602.04219 \[hep-ph\]](#).
- [2057] M. Farina, D. Pappadopulo, J. T. Ruderman, and G. Trevisan, “Phases of cannibal dark matter,” *JHEP* **12** (2016) 039, [arXiv:1607.03108 \[hep-ph\]](#).
- [2058] A. L. Erickcek, P. Ralegankar, and J. Shelton, “Cannibal domination and the matter power spectrum,” *Phys. Rev. D* **103** no. 10, (2021) 103508, [arXiv:2008.04311 \[astro-ph.CO\]](#).
- [2059] D. N. Spergel and P. J. Steinhardt, “Observational evidence for self-interacting cold dark matter,” *Phys. Rev. Lett.* **84** (2000) 3760–3763, [arXiv:astro-ph/9909386](#).
- [2060] W. J. G. de Blok, “The core-cusp problem,” *Adv. Astron.* **2010** (2010) 789293, [arXiv:0910.3538 \[astro-ph.CO\]](#).
- [2061] P. Salucci, “The distribution of dark matter in galaxies,” *Astron. Astrophys. Rev.* **27** no. 1, (2019) 2, [arXiv:1811.08843 \[astro-ph.GA\]](#).
- [2062] M. A. Buen-Abad, R. Emami, and M. Schmaltz, “Cannibal dark matter and large scale structure,” *Phys. Rev. D* **98** no. 8, (2018) 083517, [arXiv:1803.08062 \[hep-ph\]](#).
- [2063] A. D. Dolgov, S. Pastor, and J. W. F. Valle, “Structure formation with decaying mev tau-neutrino and a kev majoron,” (6, 1995) , [arXiv:astro-ph/9506011](#).
- [2064] A. A. de Laix, R. J. Scherrer, and R. K. Schaefer, “Constraints of selfinteracting dark matter,” *Astrophys. J.* **452** (1995) 495, [arXiv:astro-ph/9502087](#).
- [2065] M. E. Machacek, “Growth of adiabatic perturbations in self-interacting dark matter,” *Astrophys. J.* **431** (August, 1994) 41.
- [2066] C. Boehm and R. Schaeffer, “Constraints on dark matter interactions from structure formation: Damping lengths,” *Astron. Astrophys.* **438** (2005) 419–442, [arXiv:astro-ph/0410591](#).
- [2067] N. Weiner and I. Yavin, “How dark are majorana wimps? signals from midm and rayleigh dark matter,” *Phys. Rev. D* **86** (2012) 075021, [arXiv:1206.2910 \[hep-ph\]](#).
- [2068] R. J. Wilkinson, J. Lesgourgues, and C. Boehm, “Using the cmb angular power spectrum to study dark matter-photon interactions,” *JCAP* **04** (2014) 026, [arXiv:1309.7588 \[astro-ph.CO\]](#).

- [2069] C. Boehm, J. A. Schewtschenko, R. J. Wilkinson, C. M. Baugh, and S. Pascoli, “Using the milky way satellites to study interactions between cold dark matter and radiation,” *Mon. Not. Roy. Astron. Soc.* **445** (2014) L31–L35, [arXiv:1404.7012 \[astro-ph.CO\]](#).
- [2070] J. A. D. Diacounis and Y. Y. Y. Wong, “On the prior dependence of cosmological constraints on some dark matter interactions,” *JCAP* **05** (2019) 025, [arXiv:1811.11408 \[astro-ph.CO\]](#).
- [2071] M. Escudero, L. Lopez-Honorez, O. Mena, S. Palomares-Ruiz, and P. Villanueva-Domingo, “A fresh look into the interacting dark matter scenario,” *JCAP* **06** (2018) 007, [arXiv:1803.08427 \[astro-ph.CO\]](#).
- [2072] S. Kumar, R. C. Nunes, and S. K. Yadav, “Cosmological bounds on dark matter-photon coupling,” *Phys. Rev. D* **98** no. 4, (2018) 043521, [arXiv:1803.10229 \[astro-ph.CO\]](#).
- [2073] T. Bringmann, J. Hasenkamp, and J. Kersten, “Tight bonds between sterile neutrinos and dark matter,” *JCAP* **07** (2014) 042, [arXiv:1312.4947 \[hep-ph\]](#).
- [2074] J. F. Cherry, A. Friedland, and I. M. Shoemaker, “Neutrino portal dark matter: From dwarf galaxies to icecube,” (11, 2014) , [arXiv:1411.1071 \[hep-ph\]](#).
- [2075] R. J. Wilkinson, C. Boehm, and J. Lesgourgues, “Constraining dark matter-neutrino interactions using the cmb and large-scale structure,” *JCAP* **05** (2014) 011, [arXiv:1401.7597 \[astro-ph.CO\]](#).
- [2076] A. Olivares-Del Campo, C. Boehm, S. Palomares-Ruiz, and S. Pascoli, “Dark matter-neutrino interactions through the lens of their cosmological implications,” *Phys. Rev. D* **97** no. 7, (2018) 075039, [arXiv:1711.05283 \[hep-ph\]](#).
- [2077] J. Stadler, C. Boehm, and O. Mena, “Comprehensive study of neutrino-dark matter mixed damping,” *JCAP* **08** (2019) 014, [arXiv:1903.00540 \[astro-ph.CO\]](#).
- [2078] F.-Y. Cyr-Racine, K. Sigurdson, J. Zavala, T. Bringmann, M. Vogelsberger, and C. Pfrommer, “Ethos—an effective theory of structure formation: From dark particle physics to the matter distribution of the universe,” *Phys. Rev. D* **93** no. 12, (2016) 123527, [arXiv:1512.05344 \[astro-ph.CO\]](#).
- [2079] F.-Y. Cyr-Racine, R. de Putter, A. Raccanelli, and K. Sigurdson, “Constraints on large-scale dark acoustic oscillations from cosmology,” *Phys. Rev. D* **89** no. 6, (2014) 063517, [arXiv:1310.3278 \[astro-ph.CO\]](#).
- [2080] X. Chu and B. Dasgupta, “Dark radiation alleviates problems with dark matter halos,” *Phys. Rev. Lett.* **113** no. 16, (2014) 161301, [arXiv:1404.6127 \[hep-ph\]](#).
- [2081] G. Rossi, C. Yèche, N. Palanque-Delabrouille, and J. Lesgourgues, “Constraints on dark radiation from cosmological probes,” *Phys. Rev. D* **92** no. 6, (2015) 063505, [arXiv:1412.6763 \[astro-ph.CO\]](#).
- [2082] J. A. Schewtschenko, C. M. Baugh, R. J. Wilkinson, C. Boehm, S. Pascoli, and T. Sawala, “Dark matter–radiation interactions: the structure of milky way satellite galaxies,” *Mon. Not. Roy. Astron. Soc.* **461** no. 3, (2016) 2282–2287, [arXiv:1512.06774 \[astro-ph.CO\]](#).
- [2083] J. Lesgourgues, G. Marques-Tavares, and M. Schmaltz, “Evidence for dark matter interactions in cosmological precision data?,” *JCAP* **02** (2016) 037, [arXiv:1507.04351 \[astro-ph.CO\]](#).
- [2084] R. Krall, F.-Y. Cyr-Racine, and C. Dvorkin, “Wandering in the lyman-alpha forest: A study of dark matter-dark radiation interactions,” *JCAP* **09** (2017) 003, [arXiv:1705.08894 \[astro-ph.CO\]](#).
- [2085] T. Holsclaw, U. Alam, B. Sanso, H. Lee, K. Heitmann, S. Habib, and D. Higdon, “Nonparametric reconstruction of the dark energy equation of state,” *Phys. Rev. D* **82** (2010) 103502, [arXiv:1009.5443 \[astro-ph.CO\]](#).
- [2086] A. Shafieloo, A. G. Kim, and E. V. Linder, “Gaussian process cosmography,” *Phys. Rev. D* **85** (2012) 123530, [arXiv:1204.2272 \[astro-ph.CO\]](#).
- [2087] P. Kroupa, “Galaxies as simple dynamical systems: observational data disfavor dark matter and stochastic star formation,” *Can. J. Phys.* **93** no. 2, (2015) 169–202, [arXiv:1406.4860 \[astro-ph.GA\]](#).

- [2088] M. Haslbauer, I. Banik, and P. Kroupa, “The kbc void and hubble tension contradict λ cdm on a gpc scale – milgromian dynamics as a possible solution,” *Mon. Not. Roy. Astron. Soc.* **499** no. 2, (2020) 2845–2883, [arXiv:2009.11292 \[astro-ph.CO\]](#).
- [2089] T. Holsclaw, U. Alam, B. Sanso, H. Lee, K. Heitmann, S. Habib, and D. Higdon, “Nonparametric dark energy reconstruction from supernova data,” *Phys. Rev. Lett.* **105** (2010) 241302, [arXiv:1011.3079 \[astro-ph.CO\]](#).
- [2090] M. Archidiacono, S. Bohr, S. Hannestad, J. H. Jørgensen, and J. Lesgourgues, “Linear scale bounds on dark matter–dark radiation interactions and connection with the small scale crisis of cold dark matter,” *JCAP* **11** (2017) 010, [arXiv:1706.06870 \[astro-ph.CO\]](#).
- [2091] M. Seikel, C. Clarkson, and M. Smith, “Reconstruction of dark energy and expansion dynamics using gaussian processes,” *JCAP* **06** (2012) 036, [arXiv:1204.2832 \[astro-ph.CO\]](#).
- [2092] M. A. Buen-Abad, M. Schmaltz, J. Lesgourgues, and T. Brinckmann, “Interacting dark sector and precision cosmology,” *JCAP* **01** (2018) 008, [arXiv:1708.09406 \[astro-ph.CO\]](#).
- [2093] **DES** Collaboration, A. Chen *et al.*, “Constraints on dark matter to dark radiation conversion in the late universe with des-y1 and external data,” *Phys. Rev. D* **103** no. 12, (2021) 123528, [arXiv:2011.04606 \[astro-ph.CO\]](#).
- [2094] M. Haslbauer, I. Banik, P. Kroupa, N. Wittenburg, and B. Javanmardi, “The high fraction of thin disk galaxies continues to challenge Λ cdm cosmology,” *Astrophys. J.* **925** no. 2, (2022) 183, [arXiv:2202.01221 \[astro-ph.GA\]](#).
- [2095] E. Asencio, I. Banik, and P. Kroupa, “A massive blow for λ cdm – the high redshift, mass, and collision velocity of the interacting galaxy cluster el gordo contradicts concordance cosmology,” *Mon. Not. Roy. Astron. Soc.* **500** no. 4, (2020) 5249–5267, [arXiv:2012.03950 \[astro-ph.CO\]](#).
- [2096] T. Karwal, M. Raveri, B. Jain, J. Khourey, and M. Trodden, “Chameleon early dark energy and the hubble tension,” (6, 2021) , [arXiv:2106.13290 \[astro-ph.CO\]](#).
- [2097] G. Alestas, D. Camarena, E. Di Valentino, L. Kazantzidis, V. Marra, S. Nesseris, and L. Perivolaropoulos, “Late-transition vs smooth $h(z)$ deformation models for the resolution of the hubble crisis,” (10, 2021) , [arXiv:2110.04336 \[astro-ph.CO\]](#).
- [2098] **CANTATA** Collaboration, E. N. Saridakis *et al.*, “Modified gravity and cosmology: An update by the cantata network,” (5, 2021) , [arXiv:2105.12582 \[gr-qc\]](#).
- [2099] E. Mortsell, A. Goobar, J. Johansson, and S. Dhawan, “The hubble tension bites the dust: Sensitivity of the hubble constant determination to cepheid color calibration,” (5, 2021) , [arXiv:2105.11461 \[astro-ph.CO\]](#).
- [2100] E. Teller, “On the change of physical constants,” *Phys. Rev.* **73** (Apr, 1948) 801–802. <https://link.aps.org/doi/10.1103/PhysRev.73.801>.
- [2101] A. Ashoorioon, C. van de Bruck, P. Millington, and S. Vu, “Effect of transitions in the planck mass during inflation on primordial power spectra,” *Phys. Rev. D* **90** (2014) 103515, [arXiv:1406.5466 \[astro-ph.CO\]](#).
- [2102] M. J. Mortonson, W. Hu, and D. Huterer, “Hiding dark energy transitions at low redshift,” *Phys. Rev. D* **80** (2009) 067301, [arXiv:0908.1408 \[astro-ph.CO\]](#).
- [2103] D. Camarena and V. Marra, “A new method to build the (inverse) distance ladder,” *Mon. Not. Roy. Astron. Soc.* **495** no. 3, (2020) 2630–2644, [arXiv:1910.14125 \[astro-ph.CO\]](#).
- [2104] D. Camarena and V. Marra, “On the use of the local prior on the absolute magnitude of type ia supernovae in cosmological inference,” *Mon. Not. Roy. Astron. Soc.* **504** (2021) 5164–5171, [arXiv:2101.08641 \[astro-ph.CO\]](#).

- [2105] A. G. Riess *et al.*, “A redetermination of the hubble constant with the hubble space telescope from a differential distance ladder,” *Astrophys. J.* **699** (2009) 539–563, [arXiv:0905.0695 \[astro-ph.CO\]](#).
- [2106] P. Lemos, E. Lee, G. Efstathiou, and S. Gratton, “Model independent $h(z)$ reconstruction using the cosmic inverse distance ladder,” *Mon. Not. Roy. Astron. Soc.* **483** no. 4, (2019) 4803–4810, [arXiv:1806.06781 \[astro-ph.CO\]](#).
- [2107] M. Doran and G. Robbers, “Early dark energy cosmologies,” *JCAP* **06** (2006) 026, [arXiv:astro-ph/0601544](#).
- [2108] C. G. Callan, Jr. and S. R. Coleman, “The fate of the false vacuum. 2. first quantum corrections,” *Phys. Rev. D* **16** (1977) 1762–1768.
- [2109] S. R. Coleman, “The fate of the false vacuum. 1. semiclassical theory,” *Phys. Rev. D* **15** (1977) 2929–2936. [Erratum: *Phys.Rev.D* 16, 1248 (1977)].
- [2110] A. V. Patwardhan and G. M. Fuller, “Late-time vacuum phase transitions: Connecting sub-ev scale physics with cosmological structure formation,” *Phys. Rev. D* **90** no. 6, (2014) 063009, [arXiv:1401.1923 \[astro-ph.CO\]](#).
- [2111] D. Benisty and E. I. Guendelman, “Interacting diffusive unified dark energy and dark matter from scalar fields,” *Eur. Phys. J. C* **77** no. 6, (2017) 396, [arXiv:1701.08667 \[gr-qc\]](#).
- [2112] D. Benisty and E. I. Guendelman, “Unified de–dm with diffusive interactions scenario from scalar fields,” *Int. J. Mod. Phys. D* **26** no. 12, (2017) 1743021.
- [2113] D. Benisty and E. I. Guendelman, “A transition between bouncing hyper-inflation to λ cdm from diffusive scalar fields,” *Int. J. Mod. Phys. A* **33** no. 20, (2018) 1850119, [arXiv:1710.10588 \[gr-qc\]](#).
- [2114] D. Benisty, E. Guendelman, and Z. Haba, “Unification of dark energy and dark matter from diffusive cosmology,” *Phys. Rev. D* **99** no. 12, (2019) 123521, [arXiv:1812.06151 \[gr-qc\]](#). [Erratum: *Phys.Rev.D* 101, 049901 (2020)].
- [2115] W. Lee, B.-H. Lee, C. H. Lee, and C. Park, “The false vacuum bubble nucleation due to a nonminimally coupled scalar field,” *Phys. Rev. D* **74** (2006) 123520, [arXiv:hep-th/0604064](#).
- [2116] F. Köhlinger *et al.*, “Kids-450: The tomographic weak lensing power spectrum and constraints on cosmological parameters,” *Mon. Not. Roy. Astron. Soc.* **471** no. 4, (2017) 4412–4435, [arXiv:1706.02892 \[astro-ph.CO\]](#).
- [2117] **DES** Collaboration, T. M. C. Abbott *et al.*, “Dark energy survey year 1 results: Cosmological constraints from galaxy clustering and weak lensing,” *Phys. Rev. D* **98** no. 4, (2018) 043526, [arXiv:1708.01530 \[astro-ph.CO\]](#).
- [2118] **DES** Collaboration, T. M. C. Abbott *et al.*, “Dark energy survey year 1 results: A precise h_0 estimate from des y1, bao, and d/h data,” *Mon. Not. Roy. Astron. Soc.* **480** no. 3, (2018) 3879–3888, [arXiv:1711.00403 \[astro-ph.CO\]](#).
- [2119] L. Perivolaropoulos and L. Kazantzidis, “Hints of modified gravity in cosmos and in the lab?,” *Int. J. Mod. Phys. D* **28** no. 05, (2019) 1942001, [arXiv:1904.09462 \[gr-qc\]](#).
- [2120] B. Boisseau, G. Esposito-Farese, D. Polarski, and A. A. Starobinsky, “Reconstruction of a scalar tensor theory of gravity in an accelerating universe,” *Phys. Rev. Lett.* **85** (2000) 2236, [arXiv:gr-qc/0001066](#).
- [2121] G. Esposito-Farese and D. Polarski, “Scalar tensor gravity in an accelerating universe,” *Phys. Rev. D* **63** (2001) 063504, [arXiv:gr-qc/0009034](#).
- [2122] S. Nesseris and L. Perivolaropoulos, “Evolving newton’s constant, extended gravity theories and snia data analysis,” *Phys. Rev. D* **73** (2006) 103511, [arXiv:astro-ph/0602053](#).
- [2123] E. V. Linder, “No slip gravity,” *JCAP* **03** (2018) 005, [arXiv:1801.01503 \[astro-ph.CO\]](#).

- [2124] J. Kennedy, L. Lombriser, and A. Taylor, “Reconstructing horndeski theories from phenomenological modified gravity and dark energy models on cosmological scales,” *Phys. Rev. D* **98** no. 4, (2018) 044051, [arXiv:1804.04582 \[astro-ph.CO\]](#).
- [2125] G. D’Amico, Z. Huang, M. Mancarella, and F. Vernizzi, “Weakening gravity on redshift-survey scales with kinetic matter mixing,” *JCAP* **02** (2017) 014, [arXiv:1609.01272 \[astro-ph.CO\]](#).
- [2126] E. V. Pitjeva, N. P. Pitjev, D. A. Pavlov, and C. C. Turygin, “Estimates of the change rate of solar mass and gravitational constant based on the dynamics of the solar system,” *Astron. Astrophys.* **647** (2021) A141.
- [2127] C. M. Will, “The confrontation between general relativity and experiment,” *Living Rev. Rel.* **9** (2006) 3, [arXiv:gr-qc/0510072](#).
- [2128] J.-P. Uzan, “The fundamental constants and their variation: Observational status and theoretical motivations,” *Rev. Mod. Phys.* **75** (2003) 403, [arXiv:hep-ph/0205340](#).
- [2129] J. Alvey, N. Sabti, M. Escudero, and M. Fairbairn, “Improved bbn constraints on the variation of the gravitational constant,” *Eur. Phys. J. C* **80** no. 2, (2020) 148, [arXiv:1910.10730 \[astro-ph.CO\]](#).
- [2130] J. Solà Peracaula, A. Gómez-Valent, and J. de Cruz Pérez, “Signs of dynamical dark energy in current observations,” *Phys. Dark Univ.* **25** (2019) 100311, [arXiv:1811.03505 \[astro-ph.CO\]](#).
- [2131] J. Solà, E. Karimkhani, and A. Khodam-Mohammadi, “Higgs potential from extended brans–dicke theory and the time-evolution of the fundamental constants,” *Class. Quant. Grav.* **34** no. 2, (2017) 025006, [arXiv:1609.00350 \[gr-qc\]](#).
- [2132] J. Solà Peracaula, A. Gómez-Valent, J. de Cruz Pérez, and C. Moreno-Pulido, “Running vacuum against the h_0 and σ_8 tensions,” *EPL* **134** no. 1, (2021) 19001, [arXiv:2102.12758 \[astro-ph.CO\]](#).
- [2133] N. E. Mavromatos and J. Solà Peracaula, “Stringy-running-vacuum-model inflation: from primordial gravitational waves and stiff axion matter to dynamical dark energy,” *Eur. Phys. J. ST* **230** no. 9, (2021) 9, [arXiv:2012.07971 \[hep-ph\]](#).
- [2134] E. N. Saridakis, K. Bamba, R. Myrzakulov, and F. K. Anagnostopoulos, “Holographic dark energy through tsallis entropy,” *JCAP* **12** (2018) 012, [arXiv:1806.01301 \[gr-qc\]](#).
- [2135] J. Solà Peracaula and H. Yu, “Particle and entropy production in the running vacuum universe,” *Gen. Rel. Grav.* **52** no. 2, (2020) 17, [arXiv:1910.01638 \[gr-qc\]](#).
- [2136] J. Solà, “The cosmological constant and entropy problems: mysteries of the present with profound roots in the past,” *Int. J. Mod. Phys. D* **24** no. 12, (2015) 1544027, [arXiv:1505.05863 \[gr-qc\]](#).
- [2137] J. Solà, “Fundamental constants in physics and their time variation: Preface,” *Mod. Phys. Lett. A* **30** no. 22, (2015) 1502004, [arXiv:1507.02229 \[hep-ph\]](#).
- [2138] J. A. S. Lima, S. Basilakos, and J. Solà, “Nonsingular decaying vacuum cosmology and entropy production,” *Gen. Rel. Grav.* **47** (2015) 40, [arXiv:1412.5196 \[gr-qc\]](#).
- [2139] S. Basilakos, N. E. Mavromatos, and J. Solà Peracaula, “Gravitational and chiral anomalies in the running vacuum universe and matter-antimatter asymmetry,” *Phys. Rev. D* **101** no. 4, (2020) 045001, [arXiv:1907.04890 \[hep-ph\]](#).
- [2140] A. Gómez-Valent and P. Hassan Puttasiddappa, “Difficulties in reconciling non-negligible differences between the local and cosmological values of the gravitational coupling in extended brans–dicke theories,” *JCAP* **09** (2021) 040, [arXiv:2105.14819 \[astro-ph.CO\]](#).
- [2141] J. Solà Peracaula, “Brans–dicke gravity: From higgs physics to (dynamical) dark energy,” *Int. J. Mod. Phys. D* **27** no. 14, (2018) 1847029, [arXiv:1805.09810 \[gr-qc\]](#).
- [2142] J. de Cruz Pérez and J. Solà Peracaula, “Brans–dicke cosmology mimicking running vacuum,” *Mod. Phys. Lett. A* **33** no. 38, (2018) 1850228, [arXiv:1809.03329 \[gr-qc\]](#).

- [2143] E. N. Saridakis, “Barrow holographic dark energy,” *Phys. Rev. D* **102** no. 12, (2020) 123525, [arXiv:2005.04115 \[gr-qc\]](#).
- [2144] S. Basilakos, N. E. Mavromatos, and J. Solà Peracaula, “Quantum anomalies in string-inspired running vacuum universe: Inflation and axion dark matter,” *Phys. Lett. B* **803** (2020) 135342, [arXiv:2001.03465 \[gr-qc\]](#).
- [2145] C. H. Brans and R. H. Dicke, “Mach’s principle and a relativistic theory of gravitation,” *Phys. Rev* **124** (1961) 925.
- [2146] R. H. Dicke, “Mach’s principle and invariance under transformation of units,” *Phys. Rev* **125** (1962) 2163.
- [2147] J. Solà, “Dark energy: A quantum fossil from the inflationary universe?,” *J. Phys. A* **41** (2008) 164066, [arXiv:0710.4151 \[hep-th\]](#).
- [2148] I. L. Shapiro and J. Solà, “On the possible running of the cosmological ‘constant’,” *Phys. Lett. B* **682** (2009) 105–113, [arXiv:0910.4925 \[hep-th\]](#).
- [2149] D. Blas, J. Lesgourgues, and T. Tram, “The cosmic linear anisotropy solving system (class) ii: Approximation schemes,” *JCAP* **1107** (2011) 034, [arXiv:1104.2933 \[astro-ph.CO\]](#). [arXiv:1104.2933](#).
- [2150] B. Audren, J. Lesgourgues, K. Benabed, and S. Prunet, “Conservative constraints on early cosmology: an illustration of the monte python cosmological parameter inference code,” *JCAP* **1302** (2013) 001, [arXiv:1210.7183 \[astro-ph.CO\]](#). [arXiv:1210.7183](#).
- [2151] C. P. Singh and J. Solà Peracaula, “Friedmann cosmology with decaying vacuum density in brans–dicke theory,” *Eur. Phys. J. C* **81** no. 10, (2021) 960, [arXiv:2110.12411 \[gr-qc\]](#).
- [2152] N. E. Mavromatos and J. Sola, “Inflationary physics and transplanckian conjecture in the stringy running-vacuum-model: from the phantom vacuum to the true vacuum,” *Eur. Phys. J. Plus* **136** (2021) 1152, [arXiv:2105.02659 \[hep-th\]](#).
- [2153] J. A. S. Lima, S. Basilakos, and J. Solà, “Expansion history with decaying vacuum: A complete cosmological scenario,” *Mon. Not. Roy. Astron. Soc.* **431** (2013) 923–929, [arXiv:1209.2802 \[gr-qc\]](#).
- [2154] J. Solà Peracaula, J. de Cruz Pérez, and A. Gómez-Valent, “Dynamical dark energy vs. $\lambda = \text{const}$ in light of observations,” *EPL* **121** no. 3, (2018) 39001, [arXiv:1606.00450 \[gr-qc\]](#).
- [2155] G. Kaniadakis, “Statistical mechanics in the context of special relativity,” *Phys. Rev. E* **66** (2002) 056125, [arXiv:cond-mat/0210467](#).
- [2156] N. Drepanou, A. Lymperis, E. N. Saridakis, and K. Yesmakhanova, “Kaniadakis holographic dark energy,” (9, 2021) , [arXiv:2109.09181 \[gr-qc\]](#).
- [2157] A. Hernández-Almada, G. Leon, J. Magaña, M. A. García-Aspeitia, V. Motta, E. N. Saridakis, and K. Yesmakhanova, “Kaniadakis holographic dark energy: observational constraints and global dynamics,” (10, 2021) , [arXiv:2111.00558 \[astro-ph.CO\]](#).
- [2158] M. Rezaei, J. Sola, and M. Malekjani, “Cosmographic approach to running vacuum dark energy models: new constraints using baos and hubble diagrams at higher redshifts,” *Mon. Not. Roy. Astron. Soc.* **509** no. 2, (2022) 2593–2608, [arXiv:2108.06255 \[astro-ph.CO\]](#).
- [2159] D. Benisty and E. I. Guendelman, “Radiation like scalar field and gauge fields in cosmology for a theory with dynamical time,” *Mod. Phys. Lett. A* **31** no. 33, (2016) 1650188, [arXiv:1609.03189 \[gr-qc\]](#).
- [2160] D. Benisty and E. I. Guendelman, “Unified dark energy and dark matter from dynamical spacetime,” *Phys. Rev. D* **98** no. 2, (2018) 023506, [arXiv:1802.07981 \[gr-qc\]](#).
- [2161] D. Benisty and E. I. Guendelman, “Inflation compactification from dynamical spacetime,” *Phys. Rev. D* **98** no. 4, (2018) 043522, [arXiv:1805.09314 \[gr-qc\]](#).

- [2162] F. K. Anagnostopoulos, D. Benisty, S. Basilakos, and E. I. Guendelman, “Dark energy and dark matter unification from dynamical space time: observational constraints and cosmological implications,” *JCAP* **06** (2019) 003, [arXiv:1904.05762 \[gr-qc\]](#).
- [2163] Z. Haba, A. Stachowski, and M. Szydlowski, “Dynamics of the diffusive dm-de interaction – dynamical system approach,” *JCAP* **07** (2016) 024, [arXiv:1603.07620 \[gr-qc\]](#).
- [2164] G. Koutsoumbas, K. Ntrekis, E. Papantonopoulos, and E. N. Saridakis, “Unification of dark matter - dark energy in generalized galileon theories,” *JCAP* **02** (2018) 003, [arXiv:1704.08640 \[gr-qc\]](#).
- [2165] S. Calogero and H. Velten, “Cosmology with matter diffusion,” *JCAP* **11** (2013) 025, [arXiv:1308.3393 \[astro-ph.CO\]](#).
- [2166] W.-T. Ni, “Equivalence principles and electromagnetism,” *Phys. Rev. Lett.* **38** (1977) 301–304.
- [2167] M. S. Turner and L. M. Widrow, “Inflation produced, large scale magnetic fields,” *Phys. Rev. D* **37** (1988) 2743.
- [2168] S. M. Carroll, G. B. Field, and R. Jackiw, “Limits on a lorentz and parity violating modification of electrodynamics,” *Phys. Rev. D* **41** (1990) 1231.
- [2169] S. M. Carroll and G. B. Field, “The einstein equivalence principle and the polarization of radio galaxies,” *Phys. Rev. D* **43** (1991) 3789.
- [2170] D. Harari and P. Sikivie, “Effects of a nambu-goldstone boson on the polarization of radio galaxies and the cosmic microwave background,” *Phys. Lett. B* **289** (1992) 67–72.
- [2171] S. M. Carroll, “Quintessence and the rest of the world,” *Phys. Rev. Lett.* **81** (1998) 3067–3070, [arXiv:astro-ph/9806099 \[astro-ph\]](#).
- [2172] A. Lue, L.-M. Wang, and M. Kamionkowski, “Cosmological signature of new parity violating interactions,” *Phys. Rev. Lett.* **83** (1999) 1506–1509, [arXiv:astro-ph/9812088](#).
- [2173] **Planck** Collaboration, N. Aghanim *et al.*, “Planck intermediate results. xlix. parity-violation constraints from polarization data,” *Astron. Astrophys.* **596** (2016) A110, [arXiv:1605.08633 \[astro-ph.CO\]](#).
- [2174] S. Dahal *et al.*, “Four-year cosmology large angular scale surveyor (class) observations: On-sky receiver performance at 40, 90, 150, and 220 ghz frequency bands,” *Astrophys. J.* **926** no. 1, (2022) 33, [arXiv:2107.08022 \[astro-ph.IM\]](#).
- [2175] Z. Xu *et al.*, “Two-year cosmology large angular scale surveyor (class) observations: 40 ghz telescope pointing, beam profile, window function, and polarization performance,” *Astrophys. J.* **891** (11, 2019) 134, [arXiv:1911.04499 \[astro-ph.IM\]](#).
- [2176] T. Buchert, H. van Elst, and A. Heinesen, “The averaging problem on the past null cone in inhomogeneous dust cosmologies,” (2, 2022) , [arXiv:2202.10798 \[gr-qc\]](#).
- [2177] E. Komatsu, “New physics from polarised light of the cosmic microwave background,” (2, 2022) , [arXiv:2202.13919 \[astro-ph.CO\]](#).
- [2178] **POLARBEAR Collaboration** Collaboration, S. Adachi *et al.*, “A measurement of the cmb *e*-mode angular power spectrum at subdegree scales from 670 square degrees of polarbear data,” *Astrophys. J.* **904** no. 1, (2020) 65, [arXiv:2005.06168 \[astro-ph.CO\]](#).
- [2179] **BICEP/Keck Collaboration** Collaboration, P. A. R. Ade *et al.*, “Improved constraints on primordial gravitational waves using planck, wmap, and bicep/keck observations through the 2018 observing season,” *Phys. Rev. Lett.* **127** no. 15, (2021) 151301, [arXiv:2110.00483 \[astro-ph.CO\]](#).
- [2180] **SPIDER** Collaboration, P. A. R. Ade *et al.*, “A constraint on primordial *b*-modes from the first flight of the spider balloon-borne telescope,” (3, 2021) , [arXiv:2103.13334 \[astro-ph.CO\]](#).
- [2181] **POLARBEAR-2 and Simons Array** Collaboration, B. Westbrook *et al.*, “The polarbear-2 and simons array focal plane fabrication status,” *J. Low Temp. Phys.* **193** no. 5-6, (2018) 758–770.

- [2182] L. Moncelsi *et al.*, “Receiver development for bicep array, a next-generation cmb polarimeter at the south pole,” *Proc. SPIE Int. Soc. Opt. Eng.* **11453** (2020) 1145314, [arXiv:2012.04047 \[astro-ph.IM\]](#).
- [2183] **BICEP Array Collaboration** Collaboration, H. Hui *et al.*, “Bicep array: a multi-frequency degree-scale cmb polarimeter,” *Proc. SPIE Int. Soc. Opt. Eng.* **10708** (2018) 1070807, [arXiv:1808.00568 \[astro-ph.IM\]](#).
- [2184] H. Sugai *et al.*, “Updated design of the cmb polarization experiment satellite litebird,” *J. Low. Temp. Phys.* **199** no. 3-4, (2020) 1107–1117, [arXiv:2001.01724 \[astro-ph.IM\]](#).
- [2185] J. Aumont, J. F. Macías-Pérez, A. Ritacco, N. Ponthieu, and A. Mangilli, “Absolute calibration of the polarisation angle for future cmb *b*-mode experiments from current and future measurements of the crab nebula,” *Astron. Astrophys.* **634** (2020) A100, [arXiv:1805.10475 \[astro-ph.CO\]](#).
- [2186] P. Fosalba and E. Gaztanaga, “Explaining cosmological anisotropy: Evidence for causal horizons from cmb data,” (11, 2020) , [arXiv:2011.00910 \[astro-ph.CO\]](#).
- [2187] E. Gaztañaga, “The size of our causal universe,” *Mon. Not. Roy. Astron. Soc.* **494** no. 2, (2020) 2766–2772, [arXiv:2003.11544 \[physics.gen-ph\]](#).
- [2188] C. Copi, D. Huterer, D. Schwarz, and G. Starkman, “The uncorrelated universe: Statistical anisotropy and the vanishing angular correlation function in wmap years 1-3,” *Phys. Rev. D* **75** (2007) 023507, [arXiv:astro-ph/0605135](#).
- [2189] C. J. Copi, D. Huterer, D. J. Schwarz, and G. D. Starkman, “Large angle anomalies in the cmb,” *Adv. Astron.* **2010** (2010) 847541, [arXiv:1004.5602 \[astro-ph.CO\]](#).
- [2190] C. J. Copi, D. Huterer, D. J. Schwarz, and G. D. Starkman, “Bias in low-multipole cmb reconstructions,” *Mon. Not. Roy. Astron. Soc.* **418** (2011) 505, [arXiv:1103.3505 \[astro-ph.CO\]](#).
- [2191] S. M. Koksang, “Searching for signals of inhomogeneity using multiple probes of the cosmic expansion rate $h(z)$,” *Phys. Rev. Lett.* **126** (2021) 231101, [arXiv:2105.11880 \[astro-ph.CO\]](#).
- [2192] C. J. Copi, D. Huterer, D. J. Schwarz, and G. D. Starkman, “Large-scale alignments from wmap and planck,” *Mon. Not. Roy. Astron. Soc.* **449** no. 4, (2015) 3458–3470, [arXiv:1311.4562 \[astro-ph.CO\]](#).
- [2193] C. J. Copi, D. Huterer, D. J. Schwarz, and G. D. Starkman, “Lack of large-angle tt correlations persists in wmap and planck,” *Mon. Not. Roy. Astron. Soc.* **451** no. 3, (2015) 2978–2985, [arXiv:1310.3831 \[astro-ph.CO\]](#).
- [2194] A. Yoho, F. Ferrer, and G. D. Starkman, “Degree-scale anomalies in the cmb: localizing the first peak dip to a small patch of the north ecliptic sky,” *Phys. Rev. D* **83** (2011) 083525, [arXiv:1005.5389 \[astro-ph.CO\]](#).
- [2195] A. Yoho, C. J. Copi, G. D. Starkman, and A. Kosowsky, “Probing large-angle correlations with the microwave background temperature and lensing cross correlation,” *Mon. Not. Roy. Astron. Soc.* **442** no. 3, (2014) 2392–2397, [arXiv:1310.7603 \[astro-ph.CO\]](#).
- [2196] C. J. Copi, J. Gurian, A. Kosowsky, G. D. Starkman, and H. Zhang, “Exploring suppressed long-distance correlations as the cause of suppressed large-angle correlations,” *Mon. Not. Roy. Astron. Soc.* **490** no. 4, (2019) 5174–5181, [arXiv:1812.03946 \[astro-ph.CO\]](#).
- [2197] K. R. Dienes, J. Kumar, B. Thomas, and D. Yaylali, “Off-diagonal dark-matter phenomenology: Exploring enhanced complementarity relations in nonminimal dark sectors,” *Phys. Rev. D* **96** (2017) 115009, [arXiv:1708.09698 \[hep-ph\]](#).
- [2198] K. R. Dienes, D. Kim, H. Song, S. Su, B. Thomas, and D. Yaylali, “Nonminimal dark sectors: Mediator-induced decay chains and multijet collider signatures,” *Phys. Rev. D* **101** no. 7, (2020) 075024, [arXiv:1910.01129 \[hep-ph\]](#).
- [2199] K. R. Dienes, D. Kim, T. Leininger, and B. Thomas, “Tumblers: A novel collider signature for long-lived particles,” (8, 2021) , [arXiv:2108.02204 \[hep-ph\]](#).

- [2200] A. Yoho, S. Aiola, C. J. Copi, A. Kosowsky, and G. D. Starkman, “Microwave background polarization as a probe of large-angle correlations,” *Phys. Rev. D* **91** no. 12, (2015) 123504, [arXiv:1503.05928 \[astro-ph.CO\]](#).
- [2201] K. R. Dienes, J. Kumar, and B. Thomas, “The positron excess as a smoking gun for dynamical dark matter?,” *AIP Conf. Proc.* **1604** no. 1, (2015) 22–33.
- [2202] G. Efstathiou, Y.-Z. Ma, and D. Hanson, “Large-angle correlations in the cosmic microwave background,” *Mon. Not. Roy. Astron. Soc.* **407** (2010) 2530, [arXiv:0911.5399 \[astro-ph.CO\]](#).
- [2203] E. Gaztañaga, J. Wagg, T. Multamaki, A. Montana, and D. H. Hughes, “2-point anisotropies in wmap and the cosmic quadrupole,” *Mon. Not. Roy. Astron. Soc.* **346** (2003) 47–57, [arXiv:astro-ph/0304178](#).
- [2204] E. Gaztañaga, “The cosmological constant as a zero action boundary,” *Mon. Not. Roy. Astron. Soc.* **502** no. 1, (2021) 436–444, [arXiv:2101.07368 \[gr-qc\]](#).
- [2205] J. P. Hu and F. Y. Wang, “High-redshift cosmography: Application and comparison with different methods,” (2, 2022) , [arXiv:2202.09075 \[astro-ph.CO\]](#).
- [2206] E. Gaztañaga, “How the big bang end up inside a black hole.” <https://www.preprints.org/manuscript/202201.0459/v2>, submitted, February, 2022.
- [2207] E. Gaztañaga, “The black hole universe (bhu).” <https://hal.archives-ouvertes.fr/hal-03344159>, submitted, February, 2021.
- [2208] B. Camacho-Quevedo and E. Gaztañaga, “A measurement of the scale of homogeneity in the early universe,” (6, 2021) , [arXiv:2106.14303 \[astro-ph.CO\]](#).
- [2209] J. Ehlers, P. Geren, and R. K. Sachs, “Isotropic solutions of the einstein-liouville equations,” *J. Math. Phys.* **9** (1968) 1344–1349.
- [2210] S. Rasanen, “On the relation between the isotropy of the cmb and the geometry of the universe,” *Phys. Rev. D* **79** (2009) 123522, [arXiv:0903.3013 \[astro-ph.CO\]](#).
- [2211] W. R. Stoeger, R. Maartens, and G. F. R. Ellis, “Proving almost-homogeneity of the universe: an almost ehlers-geren-sachs theorem,” *Astrophys. J.* **443** (April, 1995) 1.
- [2212] A. Heinesen, “Multipole decomposition of the general luminosity distance ‘hubble law’ – a new framework for observational cosmology,” *Journal of Cosmology and Astroparticle Physics* **2021** no. 05, (May, 2021) 008, [arXiv:2010.06534 \[astro-ph.CO\]](#). <https://doi.org/10.1088/1475-7516/2021/05/008>.
- [2213] C. Clarkson, G. F. R. Ellis, A. Faltenbacher, R. Maartens, O. Umeh, and J.-P. Uzan, “(mis-)interpreting supernovae observations in a lumpy universe,” *Mon. Not. Roy. Astron. Soc.* **426** (2012) 1121–1136, [arXiv:1109.2484 \[astro-ph.CO\]](#).
- [2214] O. Umeh, “*The influence of structure formation on the evolution of the universe.*”. PhD thesis, University of Cape Town, Faculty of Science, Department of Mathematics and Applied Mathematics, 2013. <https://open.uct.ac.za/handle/11427/4938>.
- [2215] M. Korzyński, J. Miśkiewicz, and J. Serbenta, “Weighing the spacetime along the line of sight using times of arrival of electromagnetic signals,” *Phys. Rev. D* **104** no. 2, (2021) 024026, [arXiv:2102.00095 \[gr-qc\]](#).
- [2216] G. F. R. Ellis, S. D. Nel, R. Maartens, W. R. Stoeger, and A. P. Whitman, “Ideal observational cosmology,” *Phys. Rep.* **124** (1985) 315–417.
- [2217] J. Kristian and R. K. Sachs, “Observations in cosmology,” *Astrophys. J.* **143** (1966) 379–399.
- [2218] A. Heinesen, “Redshift drift as a model independent probe of dark energy,” *Phys. Rev. D* **103** no. 8, (2021) L081302, [arXiv:2102.03774 \[gr-qc\]](#).
- [2219] C. Clarkson and R. Maartens, “Inhomogeneity and the foundations of concordance cosmology,” *Class. Quant. Grav.* **27** (2010) 124008, [arXiv:1005.2165 \[astro-ph.CO\]](#).

- [2220] I. Etherington, “Lx. on the definition of distance in general relativity,” *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science* **15** no. 100, (1933) 761–773, <https://doi.org/10.1080/14786443309462220>. <https://doi.org/10.1080/14786443309462220>.
- [2221] C. Cattoen and M. Visser, “The hubble series: Convergence properties and redshift variables,” *Class. Quant. Grav.* **24** (2007) 5985–5998, [arXiv:0710.1887](https://arxiv.org/abs/0710.1887) [gr-qc].
- [2222] M. Visser, “Jerk and the cosmological equation of state,” *Class. Quant. Grav.* **21** (2004) 2603–2616, [arXiv:gr-qc/0309109](https://arxiv.org/abs/gr-qc/0309109).
- [2223] H. J. Macpherson and A. Heinesen, “Luminosity distance and anisotropic sky-sampling at low redshifts: A numerical relativity study,” *Phys. Rev. D* **104** (2021) 023525, [arXiv:2103.11918](https://arxiv.org/abs/2103.11918) [astro-ph.CO]. [Erratum: *Phys.Rev.D* 104, 109901 (2021)].
- [2224] A. R. Neben and M. S. Turner, “Beyond h_0 and q_0 : Cosmology is no longer just two numbers,” *Astrophys. J.* **769** (2013) 133, [arXiv:1209.0480](https://arxiv.org/abs/1209.0480) [astro-ph.CO].
- [2225] R. C. Nunes, S. Pan, and E. N. Saridakis, “New constraints on interacting dark energy from cosmic chronometers,” *Phys. Rev. D* **94** no. 2, (2016) 023508, [arXiv:1605.01712](https://arxiv.org/abs/1605.01712) [astro-ph.CO].
- [2226] F. S. N. Lobo, J. P. Mimoso, and M. Visser, “Cosmographic analysis of redshift drift,” *JCAP* **04** (2020) 043, [arXiv:2001.11964](https://arxiv.org/abs/2001.11964) [gr-qc].
- [2227] V. Marra, L. Amendola, I. Sawicki, and W. Valkenburg, “Cosmic variance and the measurement of the local hubble parameter,” *Phys. Rev. Lett.* **110** no. 24, (2013) 241305, [arXiv:1303.3121](https://arxiv.org/abs/1303.3121) [astro-ph.CO].
- [2228] R. Wojtak, A. Knebe, W. A. Watson, I. T. Iliev, S. Heß, D. Rapetti, G. Yepes, and S. Gottlöber, “Cosmic variance of the local hubble flow in large-scale cosmological simulations,” *Mon. Not. Roy. Astron. Soc.* **438** no. 2, (2014) 1805–1812, [arXiv:1312.0276](https://arxiv.org/abs/1312.0276) [astro-ph.CO].
- [2229] H. J. Macpherson, P. D. Lasky, and D. J. Price, “The trouble with hubble: Local versus global expansion rates in inhomogeneous cosmological simulations with numerical relativity,” *Astrophys. J. Lett.* **865** no. 1, (2018) L4, [arXiv:1807.01714](https://arxiv.org/abs/1807.01714) [astro-ph.CO].
- [2230] J. B. Whitmore and M. T. Murphy, “Impact of instrumental systematic errors on fine-structure constant measurements with quasar spectra,” *Mon. Not. Roy. Astron. Soc.* **447** no. 1, (2015) 446–462, [arXiv:1409.4467](https://arxiv.org/abs/1409.4467) [astro-ph.IM].
- [2231] G. W. Pratt, M. Arnaud, A. Biviano, D. Eckert, S. Ettori, D. Nagai, N. Okabe, and T. H. Reiprich, “The galaxy cluster mass scale and its impact on cosmological constraints from the cluster population,” *Space Sci. Rev.* **215** no. 2, (2019) 25, [arXiv:1902.10837](https://arxiv.org/abs/1902.10837) [astro-ph.CO].
- [2232] **SPT** Collaboration, S. Bocquet *et al.*, “Cluster cosmology constraints from the 2500 deg² spt-sz survey: Inclusion of weak gravitational lensing data from magellan and the hubble space telescope,” *Astrophys. J.* **878** no. 1, (2019) 55, [arXiv:1812.01679](https://arxiv.org/abs/1812.01679) [astro-ph.CO].
- [2233] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2015 results. xxiv. cosmology from sunyaev-zeldovich cluster counts,” *Astron. Astrophys.* **594** (2016) A24, [arXiv:1502.01597](https://arxiv.org/abs/1502.01597) [astro-ph.CO].
- [2234] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2013 results. xx. cosmology from sunyaev–zeldovich cluster counts,” *Astron. Astrophys.* **571** (2014) A20, [arXiv:1303.5080](https://arxiv.org/abs/1303.5080) [astro-ph.CO].
- [2235] S. W. Allen, A. E. Evrard, and A. B. Mantz, “Cosmological parameters from observations of galaxy clusters,” *Ann. Rev. Astron. Astrophys.* **49** (2011) 409–470, [arXiv:1103.4829](https://arxiv.org/abs/1103.4829) [astro-ph.CO].
- [2236] G. F. R. Ellis and H. van Elst, “Cosmological models: Cargese lectures 1998,” *NATO Sci. Ser. C* **541** (1999) 1–116, [arXiv:gr-qc/9812046](https://arxiv.org/abs/gr-qc/9812046).
- [2237] M. Hasselfield *et al.*, “The atacama cosmology telescope: Sunyaev-zel’dovich selected galaxy clusters at 148 ghz from three seasons of data,” *JCAP* **07** (2013) 008, [arXiv:1301.0816](https://arxiv.org/abs/1301.0816) [astro-ph.CO].
- [2238] **XXL** Collaboration, F. Pacaud *et al.*, “The xxl survey: Xxv. cosmological analysis of the c1 cluster number counts,” *Astron. Astrophys.* **620** (2018) A10, [arXiv:1810.01624](https://arxiv.org/abs/1810.01624) [astro-ph.CO].

- [2239] A. B. Mantz *et al.*, “Weighing the giants – iv. cosmology and neutrino mass,” *Mon. Not. Roy. Astron. Soc.* **446** (2015) 2205–2225, [arXiv:1407.4516 \[astro-ph.CO\]](#).
- [2240] **DES** Collaboration, M. Costanzi *et al.*, “Methods for cluster cosmology and application to the sdss in preparation for des year 1 release,” *Mon. Not. Roy. Astron. Soc.* **488** no. 4, (2019) 4779–4800, [arXiv:1810.09456 \[astro-ph.CO\]](#).
- [2241] **DES** Collaboration, T. M. C. Abbott *et al.*, “Dark energy survey year 1 results: Cosmological constraints from cluster abundances and weak lensing,” *Phys. Rev. D* **102** no. 2, (2020) 023509, [arXiv:2002.11124 \[astro-ph.CO\]](#).
- [2242] I. Odderskov, S. Hannestad, and T. Haugbølle, “On the local variation of the hubble constant,” *JCAP* **10** (2014) 028, [arXiv:1407.7364 \[astro-ph.CO\]](#).
- [2243] J. L. Tinker, A. V. Kravtsov, A. Klypin, K. Abazajian, M. S. Warren, G. Yepes, S. Gottlober, and D. E. Holz, “Toward a halo mass function for precision cosmology: The limits of universality,” *Astrophys. J.* **688** (2008) 709–728, [arXiv:0803.2706 \[astro-ph\]](#).
- [2244] M. Pierre, A. Valotti, L. Faccioli, N. Clerc, R. Gastaud, E. Koulouridis, and F. Pacaud, “The cosmological analysis of x-ray cluster surveys; iii. 4d x-ray observable diagrams,” *Astron. Astrophys.* **607** (2017) A123, [arXiv:1609.07762 \[astro-ph.CO\]](#).
- [2245] C. Garrel *et al.*, “The xxl survey: Xlvi. forward cosmological analysis of the c1 cluster sample,” (9, 2021) , [arXiv:2109.13171 \[astro-ph.CO\]](#).
- [2246] S. Grandis, J. J. Mohr, J. P. Dietrich, S. Bocquet, A. Saro, M. Klein, M. Paulus, and R. Capasso, “Impact of weak lensing mass calibration on erosita galaxy cluster cosmological studies – a forecast,” *Mon. Not. Roy. Astron. Soc.* **488** no. 2, (2019) 2041–2067, [arXiv:1810.10553 \[astro-ph.CO\]](#).
- [2247] **eROSITA** Collaboration, A. Merloni *et al.*, “erosita science book: Mapping the structure of the energetic universe,” (9, 2012) , [arXiv:1209.3114 \[astro-ph.HE\]](#).
- [2248] **SPT-3G** Collaboration, B. A. Benson *et al.*, “Spt-3g: A next-generation cosmic microwave background polarization experiment on the south pole telescope,” *Proc. SPIE Int. Soc. Opt. Eng.* **9153** (2014) 91531P, [arXiv:1407.2973 \[astro-ph.IM\]](#).
- [2249] A. Chudaykin, D. Gorbunov, and N. Nedelko, “Exploring an early dark energy solution to the hubble tension with planck and sptpol data,” *Phys. Rev. D* **103** no. 4, (2021) 043529, [arXiv:2011.04682 \[astro-ph.CO\]](#).
- [2250] J. Torrado and A. Lewis, “Cobaya: Code for bayesian analysis of hierarchical physical models,” *JCAP* **05** (2021) 057, [arXiv:2005.05290 \[astro-ph.IM\]](#).
- [2251] C. J. Copi, D. Huterer, D. J. Schwarz, and G. D. Starkman, “No large-angle correlations on the non-galactic microwave sky,” *Mon. Not. Roy. Astron. Soc.* **399** (2009) 295–303, [arXiv:0808.3767 \[astro-ph\]](#).
- [2252] D. Wang, Y.-J. Yan, and X.-H. Meng, “Constraining viscous dark energy models with the latest cosmological data,” *Eur. Phys. J. C* **77** no. 10, (2017) 660, [arXiv:2103.14788 \[astro-ph.CO\]](#).
- [2253] R. Trotta, “Bayesian methods in cosmology,” (1, 2017) , [arXiv:1701.01467 \[astro-ph.CO\]](#).
- [2254] C. Z. Munõz and C. Escamilla-Rivera, “Inverse cosmography: testing the effectiveness of cosmographic polynomials using machine learning,” *JCAP* **12** (2020) 007, [arXiv:2005.02807 \[gr-qc\]](#).
- [2255] Pearson, James, Pennock, Clara, and Robinson, Tom, “Auto-detection of strong gravitational lenses using convolutional neural networks,” *Emergent Scientist* **2** (2018) 1. <https://doi.org/10.1051/emsci/2017010>.
- [2256] S. Grandis, S. Seehars, A. Refregier, A. Amara, and A. Nicola, “Information gains from cosmological probes,” *JCAP* **05** (2016) 034, [arXiv:1510.06422 \[astro-ph.CO\]](#).

- [2257] R. Pattnaik, K. Sharma, K. Alabarta, D. Altamirano, M. Chakraborty, A. Kembhavi, M. Mendez, and J. K. Orwat-Kapola, “A machine learning approach for classifying low-mass x-ray binaries based on their compact object nature,” *Mon. Not. Roy. Astron. Soc.* **501** no. 3, (2021) 3457–3471, [arXiv:2012.06934 \[astro-ph.HE\]](#).
- [2258] M. Seikel and C. Clarkson, “Optimising gaussian processes for reconstructing dark energy dynamics from supernovae,” (11, 2013) , [arXiv:1311.6678 \[astro-ph.CO\]](#).
- [2259] M.-J. Zhang and J.-Q. Xia, “Test of the cosmic evolution using gaussian processes,” *JCAP* **12** (2016) 005, [arXiv:1606.04398 \[astro-ph.CO\]](#).
- [2260] V. C. Busti, C. Clarkson, and M. Seikel, “Evidence for a lower value for h_0 from cosmic chronometers data?,” *Mon. Not. Roy. Astron. Soc.* **441** (2014) 11, [arXiv:1402.5429 \[astro-ph.CO\]](#).
- [2261] E. Belgacem, S. Foffa, M. Maggiore, and T. Yang, “Gaussian processes reconstruction of modified gravitational wave propagation,” *Phys. Rev. D* **101** no. 6, (2020) 063505, [arXiv:1911.11497 \[astro-ph.CO\]](#).
- [2262] A. M. Pinho, S. Casas, and L. Amendola, “Model-independent reconstruction of the linear anisotropic stress η ,” *JCAP* **11** (2018) 027, [arXiv:1805.00027 \[astro-ph.CO\]](#).
- [2263] R.-G. Cai, N. Tamanini, and T. Yang, “Reconstructing the dark sector interaction with lisa,” *JCAP* **05** (2017) 031, [arXiv:1703.07323 \[astro-ph.CO\]](#).
- [2264] B. S. Haridasu, V. V. Luković, M. Moresco, and N. Vittorio, “An improved model-independent assessment of the late-time cosmic expansion,” *JCAP* **10** (2018) 015, [arXiv:1805.03595 \[astro-ph.CO\]](#).
- [2265] D. Wang and X.-H. Meng, “Improved constraints on the dark energy equation of state using gaussian processes,” *Phys. Rev. D* **95** no. 2, (2017) 023508, [arXiv:1708.07750 \[astro-ph.CO\]](#).
- [2266] C. A. P. Bengaly, C. Clarkson, and R. Maartens, “The hubble constant tension with next-generation galaxy surveys,” *JCAP* **05** (2020) 053, [arXiv:1908.04619 \[astro-ph.CO\]](#).
- [2267] C. A. P. Bengaly, “Evidence for cosmic acceleration with next-generation surveys: A model-independent approach,” *Mon. Not. Roy. Astron. Soc.* **499** no. 1, (2020) L6–L10, [arXiv:1912.05528 \[astro-ph.CO\]](#).
- [2268] R. Sharma, A. Mukherjee, and H. K. Jassal, “Reconstruction of late-time cosmology using principal component analysis,” (4, 2020) , [arXiv:2004.01393 \[astro-ph.CO\]](#).
- [2269] R. C. Nunes, S. K. Yadav, J. F. Jesus, and A. Bernui, “Cosmological parameter analyses using transversal bao data,” *Mon. Not. Roy. Astron. Soc.* **497** no. 2, (2020) 2133–2141, [arXiv:2002.09293 \[astro-ph.CO\]](#).
- [2270] J. Burns *et al.*, “A lunar farside low radio frequency array for dark ages 21-cm cosmology,” (3, 2021) , [arXiv:2103.08623 \[astro-ph.IM\]](#).
- [2271] J. T. Wan, A. B. Mantz, J. Sayers, S. W. Allen, R. Glenn Morris, and S. R. Golwala, “Measuring h_0 using x-ray and sz effect observations of dynamically relaxed galaxy clusters,” *Mon. Not. Roy. Astron. Soc.* **504** no. 1, (2021) 1062–1076, [arXiv:2101.09389 \[astro-ph.CO\]](#).
- [2272] R. Briffa, S. Capozziello, J. Levi Said, J. Mifsud, and E. N. Saridakis, “Constraining teleparallel gravity through gaussian processes,” *Class. Quant. Grav.* **38** no. 5, (2020) 055007, [arXiv:2009.14582 \[gr-qc\]](#).
- [2273] A. Bonilla, S. Kumar, and R. C. Nunes, “Measurements of h_0 and reconstruction of the dark energy properties from a model-independent joint analysis,” *Eur. Phys. J. C* **81** no. 2, (2021) 127, [arXiv:2011.07140 \[astro-ph.CO\]](#).
- [2274] A. B. Mantz *et al.*, “Cosmological constraints from gas mass fractions of massive, relaxed galaxy clusters,” *Mon. Not. Roy. Astron. Soc.* **510** no. 1, (2021) 131–145, [arXiv:2111.09343 \[astro-ph.CO\]](#).

- [2275] A. Bonilla, S. Kumar, R. C. Nunes, and S. Pan, “Reconstruction of the dark sectors’ interaction: A model-independent inference and forecast from gw standard sirens,” (2, 2021) , [arXiv:2102.06149 \[astro-ph.CO\]](#).
- [2276] N. Arkani-Hamed, S. Dimopoulos, and G. R. Dvali, “The hierarchy problem and new dimensions at a millimeter,” *Phys. Lett. B* **429** (1998) 263–272, [arXiv:hep-ph/9803315](#).
- [2277] S. Gariazzo, E. Di Valentino, O. Mena, and R. C. Nunes, “Robustness of non-standard cosmologies solving the hubble constant tension,” (11, 2021) , [arXiv:2111.03152 \[astro-ph.CO\]](#).
- [2278] N. Arkani-Hamed, S. Dimopoulos, and G. R. Dvali, “Phenomenology, astrophysics and cosmology of theories with submillimeter dimensions and tev scale quantum gravity,” *Phys. Rev. D* **59** (1999) 086004, [arXiv:hep-ph/9807344](#).
- [2279] I. Antoniadis, N. Arkani-Hamed, S. Dimopoulos, and G. R. Dvali, “New dimensions at a millimeter to a fermi and superstrings at a tev,” *Phys. Lett. B* **436** (1998) 257–263, [arXiv:hep-ph/9804398](#).
- [2280] L. Perivolaropoulos and C. Sourdis, “Cosmological effects of radion oscillations,” *Phys. Rev. D* **66** (2002) 084018, [arXiv:hep-ph/0204155](#).
- [2281] L. Perivolaropoulos, “Equation of state of oscillating brans-dicke scalar and extra dimensions,” *Phys. Rev. D* **67** (2003) 123516, [arXiv:hep-ph/0301237](#).
- [2282] J. Burns *et al.*, “Global 21-cm cosmology from the farside of the moon,” (3, 2021) , [arXiv:2103.05085 \[astro-ph.CO\]](#).
- [2283] **LGWA** Collaboration, J. Harms *et al.*, “Lunar gravitational-wave antenna,” *Astrophys. J.* **910** no. 1, (2021) 1, [arXiv:2010.13726 \[gr-qc\]](#).
- [2284] Review, “Esa voyage 2050 senior committee.” <https://www.cosmos.esa.int/documents/1866264/1866292/Voyage2050-Senior-Committee-report-public.pdf/e2b2631e-5348-5d2d-60c1-437225981b6b?t=1623427287109>.
- [2285] J. Silk, I. Crawford, M. Elvis, and J. Zarnecki, “Astronomy from the moon: the next decades,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190560.
- [2286] J. O. Burns, “Transformative science from the lunar farside: observations of the dark ages and exoplanetary systems at low radio frequencies,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190564.
- [2287] X. Chen, J. Yan, L. Deng, F. Wu, L. Wu, Y. Xu, and L. Zhou, “Discovering the sky at the longest wavelengths with a lunar orbit array,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190566.
- [2288] J. Silk, “The limits of cosmology: role of the moon,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190561.
- [2289] L. K. Morabito and J. Silk, “Reaching small scales with low-frequency imaging: applications to the dark ages,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190571.
- [2290] K. Z. Adami and I. O. Farhat, “Low-frequency technology for a lunar interferometer,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190575.
- [2291] J.-P. Maillard, “Is the moon the future of infrared astronomy?,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20200212.
- [2292] A. Labeyrie, “Lunar optical interferometry and hypertelescope for direct imaging at high resolution,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190570.
- [2293] J. Schneider, J. Silk, and F. Vakili, “Owl-moon in 2050 and beyond,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20200187.
- [2294] N. Woolf and R. Angel, “Pantheon habitat made from regolith, with a focusing solar reflector,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20200142.

- [2295] R. W. Eads and R. Angel, “A 20 m wide-field diffraction-limited telescope,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20200141.
- [2296] I. A. Crawford, K. H. Joy, J. H. Pasckert, and H. Hiesinger, “The lunar surface as a recorder of astrophysical processes,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190562.
- [2297] A. Wedler and other, “German aerospace center’s advanced robotic technology for future lunar scientific missions,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190574.
- [2298] C. Heinicke and B. Foing, “Human habitats: prospects for infrastructure supporting astronomy from the moon,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190568.
- [2299] D. Klindzic and other, “Loupe: observing earth from the moon to prepare for detecting life on earth-like exoplanets,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190577.
- [2300] A. Krolewski, S. Ferraro, and M. White, “Cosmological constraints from unwise and planck cmb lensing tomography,” *JCAP* **12** no. 12, (2021) 028, [arXiv:2105.03421](#) [[astro-ph.CO](#)].
- [2301] C. García-García, J. R. Zapatero, D. Alonso, E. Bellini, P. G. Ferreira, E.-M. Mueller, A. Nicola, and P. Ruiz-Lapuente, “The growth of density perturbations in the last ~ 10 billion years from tomographic large-scale structure data,” *JCAP* **10** (2021) 030, [arXiv:2105.12108](#) [[astro-ph.CO](#)].
- [2302] A. K. Martin Elvis and T. Milligan, “Concentrated lunar resources: imminent implications for governance and justice,” *Phil. Trans. R. Soc. A.* **379** no. 2188, (2021) 20190563.
- [2303] E. G. Floratos and G. K. Leontaris, “Low scale unification, newton’s law and extra dimensions,” *Phys. Lett. B* **465** (1999) 95–100, [arXiv:hep-ph/9906238](#).
- [2304] A. Kehagias and K. Sfetsos, “Deviations from the $1/r^{**2}$ newton law due to extra dimensions,” *Phys. Lett. B* **472** (2000) 39–44, [arXiv:hep-ph/9905417](#).
- [2305] A. Donini and S. G. Marimón, “Micro-orbits in a many-brane model and deviations from newton’s $1/r^2$ law,” *Eur. Phys. J. C* **76** no. 12, (2016) 696, [arXiv:1609.05654](#) [[hep-ph](#)].
- [2306] R. Benichou and J. Estes, “The fate of newton’s law in brane-world scenarios,” *Phys. Lett. B* **712** (2012) 456–459, [arXiv:1112.0565](#) [[hep-th](#)].
- [2307] K. A. Bronnikov, S. A. Kononogov, and V. N. Melnikov, “Brane world corrections to newton’s law,” *Gen. Rel. Grav.* **38** (2006) 1215–1232, [arXiv:gr-qc/0601114](#).
- [2308] S. Nojiri and S. D. Odintsov, “Newton potential in desitter brane world,” *Phys. Lett. B* **548** (2002) 215–223, [arXiv:hep-th/0209066](#).
- [2309] J. Edholm, A. S. Koshelev, and A. Mazumdar, “Behavior of the newtonian potential for ghost-free gravity and singularity-free gravity,” *Phys. Rev. D* **94** no. 10, (2016) 104033, [arXiv:1604.01989](#) [[gr-qc](#)].
- [2310] A. Kehagias and M. Maggiore, “Spherically symmetric static solutions in a nonlocal infrared modification of general relativity,” *JHEP* **08** (2014) 029, [arXiv:1401.8289](#) [[hep-th](#)].
- [2311] V. P. Frolov and A. Zelnikov, “Head-on collision of ultrarelativistic particles in ghost-free theories of gravity,” *Phys. Rev. D* **93** no. 6, (2016) 064048, [arXiv:1509.03336](#) [[hep-th](#)].
- [2312] E. T. Tomboulis, “Superrenormalizable gauge and gravitational theories,” (2, 1997) , [arXiv:hep-th/9702146](#).
- [2313] T. Biswas, A. Conroy, A. S. Koshelev, and A. Mazumdar, “Generalized ghost-free quadratic curvature gravity,” *Class. Quant. Grav.* **31** (2014) 015022, [arXiv:1308.2319](#) [[hep-th](#)]. [Erratum: *Class.Quant.Grav.* **31**, 159501 (2014)].
- [2314] C. Escamilla-Rivera, M. A. C. Quintero, and S. Capozziello, “A deep learning approach to cosmological dark energy models,” *JCAP* **03** (2020) 008, [arXiv:1910.02788](#) [[astro-ph.CO](#)].

- [2315] C. Escamilla-Rivera, M. Carvajal, C. Zamora, and M. Hendry, “Neural networks and standard cosmography with newly calibrated high redshift grb observations,” (9, 2021) , [arXiv:2109.00636 \[astro-ph.CO\]](#).
- [2316] H. J. Hortúa, R. Volpi, and L. Malagó, “Parameters estimation from the 21 cm signal using variational inference,” (5, 2020) , [arXiv:2005.02299 \[astro-ph.CO\]](#).
- [2317] H. J. Hortúa, L. Malagó, and R. Volpi, “Constraining the reionization history using bayesian normalizing flows,” *Mach. Learn. Sci. Tech.* **1** (2020) 035014, [arXiv:2005.07694 \[astro-ph.CO\]](#).
- [2318] C. Escamilla-Rivera, “Bayesian deep learning for dark energy,” (5, 2020) , [arXiv:2005.06412 \[astro-ph.CO\]](#).
- [2319] J. A. King, *Searching for variations in the fine-structure constant and the proton-to-electron mass ratio using quasar absorption lines*. PhD thesis, School of Physics, UNSW Sydney, December, 2010. <http://handle.unsw.edu.au/1959.4/50886>.
- [2320] M. T. Murphy, *Probing variations in the fundamental constants with quasar absorption lines*. PhD thesis, School of Physics, UNSW Sydney, December, 2002. <http://handle.unsw.edu.au/1959.4/19062>.
- [2321] J. K. Webb, M. T. Murphy, V. V. Flambaum, and S. J. Curran, “Does the fine structure constant vary? a third quasar absorption sample consistent with varying alpha,” *Astrophys. Space Sci.* **283** (2003) 565, [arXiv:astro-ph/0210531](#).
- [2322] L. Feng, R.-Y. Guo, J.-F. Zhang, and X. Zhang, “Cosmological search for sterile neutrinos after planck 2018,” *Phys. Lett. B* **827** (2022) 136940, [arXiv:2109.06111 \[astro-ph.CO\]](#).
- [2323] M. T. Murphy, J. K. Webb, and V. V. Flambaum, “Further evidence for a variable fine-structure constant from keck/hires qso absorption spectra,” *Mon. Not. Roy. Astron. Soc.* **345** (2003) 609, [arXiv:astro-ph/0306483](#).
- [2324] J. C. Berengut, V. V. Flambaum, J. A. King, S. J. Curran, and J. K. Webb, “Is there further evidence for spatial variation of fundamental constants?,” *Phys. Rev. D* **83** (2011) 123506, [arXiv:1009.0591 \[astro-ph.CO\]](#).
- [2325] E. Mawas, L. Street, R. Gass, and L. C. R. Wijewardhana, “Interacting dark energy axions in light of the hubble tension,” (8, 2021) , [arXiv:2108.13317 \[astro-ph.CO\]](#).
- [2326] J. Hu *et al.*, “Measuring the fine-structure constant on a white dwarf surface; a detailed analysis of fe v absorption in g191–b2b,” *Mon. Not. Roy. Astron. Soc.* **500** no. 1, (2020) 1466–1475, [arXiv:2007.10905 \[astro-ph.SR\]](#).
- [2327] M. B. Bainbridge, M. A. Barstow, N. Reindl, J. D. Barrow, J. K. Webb, J. Hu, S. P. Preval, J. B. Holberg, G. Nave, L. Tchang-Brillet, and T. R. Ayres, “Fundamental physics from observations of white dwarf stars,” in *20th European White Dwarf Workshop*, P. E. Tremblay, B. Gaensicke, and T. Marsh, eds., vol. 509 of *Astronomical Society of the Pacific Conference Series*, p. 375. March, 2017.
- [2328] M. S. Martín and C. Rubio, “Hubble tension and matter inhomogeneities: a theoretical perspective,” (7, 2021) , [arXiv:2107.14377 \[astro-ph.CO\]](#).
- [2329] N. Blinov, G. Krnjaic, and S. W. Li, “Towards a realistic model of dark atoms to resolve the hubble tension,” (8, 2021) , [arXiv:2108.11386 \[hep-ph\]](#).
- [2330] K. Bamba and K. Shimizu, “Construction of energy–momentum tensor of gravitation,” *Int. J. Geom. Meth. Mod. Phys.* **13** no. 01, (2016) 1650001, [arXiv:1506.02760 \[gr-qc\]](#).
- [2331] E. Vangioni and K. A. Olive, “The cosmic evolution of magnesium isotopes,” *Mon. Not. Roy. Astron. Soc.* **484** no. 3, (2019) 3561–3572, [arXiv:1809.10514 \[astro-ph.GA\]](#).
- [2332] M. G. Kozlov, V. A. Korol, J. C. Berengut, V. A. Dzuba, and V. V. Flambaum, “Space-time variation of the fine structure constant and evolution of isotope abundances,” *Phys. Rev. A* **70** (2004) 062108, [arXiv:astro-ph/0407579](#).

- [2333] G. Ye, J. Zhang, and Y.-S. Piao, “Resolving both h_0 and s_8 tensions with ads early dark energy and ultralight axion,” (7, 2021) , [arXiv:2107.13391 \[astro-ph.CO\]](#).
- [2334] J.-Q. Jiang and Y.-S. Piao, “Testing ads early dark energy with planck, sptpol, and lss data,” *Phys. Rev. D* **104** no. 10, (2021) 103524, [arXiv:2107.07128 \[astro-ph.CO\]](#).
- [2335] M. R. Wilczynska *et al.*, “Four direct measurements of the fine-structure constant 13 billion years ago,” *Sci. Adv.* **6** no. 17, (2020) eaay9672, [arXiv:2003.07627 \[astro-ph.CO\]](#).
- [2336] Y. Fenner, M. T. Murphy, and B. K. Gibson, “On variations in the fine-structure constant and limits on agb pollution of quasar absorption systems,” *Mon. Not. Roy. Astron. Soc.* **358** (2005) 468–480, [arXiv:astro-ph/0501168](#).
- [2337] T. P. Ashenfelter, G. J. Mathews, and K. A. Olive, “The fine - structure constant as a probe of chemical evolution and agb nucleosynthesis in damped lyman-alpha systems,” *Astrophys. J.* **615** (2004) 82–97, [arXiv:astro-ph/0404257](#).
- [2338] I. I. Agafonova, P. Molaro, S. A. Levshakov, and J. L. Hou, “First measurement of mg isotope abundances at high redshifts and accurate estimate of delta alpha/alpha,” *Astron. Astrophys.* **529** (2011) A28, [arXiv:1102.2967 \[astro-ph.CO\]](#).
- [2339] S. A. Franchino-Viñas and M. E. Mosquera, “The cosmological lithium problem, varying constants and the h_0 tension,” (7, 2021) , [arXiv:2107.02243 \[astro-ph.CO\]](#).
- [2340] J. C. Berengut, V. A. Dzuba, V. V. Flambaum, J. A. King, M. G. Kozlov, M. T. Murphy, and J. K. Webb, “Atomic transition frequencies, isotope shifts, and sensitivity to variation of the fine structure constant for studies of quasar absorption spectra,” *Astrophys. Space Sci. Proc.* (2011) 9–16, [arXiv:1011.4136 \[astro-ph.CO\]](#).
- [2341] M. T. Murphy, J. K. Webb, V. V. Flambaum, and S. J. Curran, “Does the fine structure constant vary? a detailed investigation into systematic effects,” *Astrophys. Space Sci.* **283** (2003) 577, [arXiv:astro-ph/0210532](#).
- [2342] G. Choi, W. Lin, L. Visinelli, and T. T. Yanagida, “Cosmic birefringence and electroweak axion dark energy,” *Phys. Rev. D* **104** no. 10, (2021) L101302, [arXiv:2106.12602 \[hep-ph\]](#).
- [2343] J. K. Webb, C.-C. Lee, R. F. Carswell, and D. Milaković, “Getting the model right: an information criterion for spectroscopy,” *Mon. Not. Roy. Astron. Soc.* **501** no. 2, (February, 2021) 2268–2278, [arXiv:2009.08336 \[astro-ph.IM\]](#).
- [2344] T. Karwal, M. Raveri, B. Jain, J. Khoury, and M. Trodden, “Chameleon early dark energy and the hubble tension,” *Phys. Rev. D* **105** no. 6, (2022) 063535, [arXiv:2106.13290 \[astro-ph.CO\]](#).
- [2345] A. de la Macorra, J. Garrido, and E. Almaraz, “Towards a solution to the h_0 tension,” *Phys. Rev. D* **105** no. 2, (2022) 023526, [arXiv:2106.12116 \[astro-ph.CO\]](#).
- [2346] J. A. Frieman, C. T. Hill, A. Stebbins, and I. Waga, “Cosmology with ultralight pseudo nambu-goldstone bosons,” *Phys. Rev. Lett.* **75** (1995) 2077–2080, [arXiv:astro-ph/9505060](#).
- [2347] Y. Nomura, T. Watari, and T. Yanagida, “Quintessence axion potential induced by electroweak instanton effects,” *Phys. Lett. B* **484** (2000) 103–111, [arXiv:hep-ph/0004182](#).
- [2348] H. Rahmani *et al.*, “The uves large program for testing fundamental physics ii: Constraints on a change in μ towards quasar he 0027-1836,” *Mon. Not. Roy. Astron. Soc.* **435** (2013) 861–878, [arXiv:1307.5864 \[astro-ph.CO\]](#).
- [2349] J. C. N. de Araujo, A. De Felice, S. Kumar, and R. C. Nunes, “Minimal theory of massive gravity in the light of cmb data and the s_8 tension,” *Phys. Rev. D* **104** no. 10, (2021) 104057, [arXiv:2106.09595 \[astro-ph.CO\]](#).
- [2350] A. Berlin and N. Blinov, “Thermal neutrino portal to sub-mev dark matter,” *Phys. Rev. D* **99** no. 9, (2019) 095030, [arXiv:1807.04282 \[hep-ph\]](#).

- [2351] E. Fernandez-Martinez, M. Pierre, E. Pinsard, and S. Rosauro-Alcaraz, “Inverse seesaw, dark matter and the hubble tension,” *Eur. Phys. J. C* **81** no. 10, (2021) 954, [arXiv:2106.05298 \[hep-ph\]](#).
- [2352] F. Simpson, R. Jimenez, C. Pena-Garay, and L. Verde, “Dark energy from the motions of neutrinos,” *Phys. Dark Univ.* **20** (2018) 72–77, [arXiv:1607.02515 \[astro-ph.CO\]](#).
- [2353] G. B. Gelmini and M. Roncadelli, “Left-handed neutrino mass scale and spontaneously broken lepton number,” *Phys. Lett. B* **99** (1981) 411–415.
- [2354] K. Choi, “String or m theory axion as a quintessence,” *Phys. Rev. D* **62** (2000) 043509, [arXiv:hep-ph/9902292](#).
- [2355] P. Molaro, S. A. Levshakov, S. Monai, M. Centurion, P. Bonifacio, S. D’Odorico, and L. Monaco, “Uves radial velocity accuracy from asteroid observations. implications for the fine structure constant variability,” *Astron. Astrophys.* **481** (2008) 559, [arXiv:0712.3345 \[astro-ph\]](#).
- [2356] S. A. Adil, M. R. Gangopadhyay, M. Sami, and M. K. Sharma, “Late-time acceleration due to a generic modification of gravity and the hubble tension,” *Phys. Rev. D* **104** no. 10, (2021) 103534, [arXiv:2106.03093 \[astro-ph.CO\]](#).
- [2357] J. K. Webb, R. F. Carswell, and C.-C. Lee, “Precision in high resolution absorption line modelling, analytic voigt derivatives, and optimization methods,” *Mon. Not. Roy. Astron. Soc.* **508** no. 3, (December, 2021) 3620–3633, [arXiv:2108.11218 \[astro-ph.IM\]](#).
- [2358] T. M. Schmidt *et al.*, “Fundamental physics with espresso: Towards an accurate wavelength calibration for a precision test of the fine-structure constant,” *Astron. Astrophys.* **646** (2021) A144, [arXiv:2011.13963 \[astro-ph.IM\]](#).
- [2359] Y. Gu, L. Wu, and B. Zhu, “Axion dark radiation and late decaying dark matter in neutrino experiment,” (5, 2021) , [arXiv:2105.07232 \[hep-ph\]](#).
- [2360] R. A. Probst, D. Milaković, B. Toledo-Padrón, G. Lo Curto, G. Avila, A. Brucalassi, B. L. Canto Martins, I. de Castro Leão, M. Esposito, J. I. González Hernández, F. Grupp, T. W. Hänsch, H. Kellermann, F. Kerber, O. Mandel, A. Manescau, E. Pozna, R. Rebolo, J. R. de Medeiros, T. Steinmetz, A. Suárez Mascareño, T. Udem, J. Urrutia, Y. Wu, L. Pasquini, and R. Holzwarth, “A crucial test for astronomical spectrograph calibration with frequency combs,” *Nature Astronomy* **4** (February, 2020) 603–608, [arXiv:2002.08868 \[astro-ph.IM\]](#).
- [2361] A. Vikhlinin *et al.*, “Chandra cluster cosmology project iii: Cosmological parameter constraints,” *Astrophys. J.* **692** (2009) 1060–1074, [arXiv:0812.2720 \[astro-ph\]](#).
- [2362] F. Zhao, G. Lo Curto, L. Pasquini, J. I. González Hernández, J. R. De Medeiros, B. L. Canto Martins, I. C. Leão, R. Rebolo, A. Suárez Mascareño, M. Esposito, A. Manescau, T. Steinmetz, T. Udem, R. Probst, R. Holzwarth, and G. Zhao, “Measuring and characterizing the line profile of harps with a laser frequency comb,” *Astron. Astrophys.* **645** (January, 2021) A23, [arXiv:2011.03391 \[astro-ph.IM\]](#).
- [2363] Y. Eroshenko, “Mergers of primordial black holes in extreme clusters and the h_0 tension,” *Phys. Dark Univ.* **32** (2021) 100833, [arXiv:2105.03704 \[astro-ph.CO\]](#).
- [2364] R. Durrer and A. Neronov, “Cosmological magnetic fields: Their generation, evolution and observation,” *Astron. Astrophys. Rev.* **21** (2013) 62, [arXiv:1303.7121 \[astro-ph.CO\]](#).
- [2365] K. Subramanian, “The origin, evolution and signatures of primordial magnetic fields,” *Rept. Prog. Phys.* **79** no. 7, (2016) 076901, [arXiv:1504.02311 \[astro-ph.CO\]](#).
- [2366] T. Vachaspati, “Progress on cosmological magnetic fields,” *Rept. Prog. Phys.* **84** no. 7, (2021) 074901, [arXiv:2010.10525 \[astro-ph.CO\]](#).
- [2367] Z. Zhou, G. Liu, Y. Mu, and L. Xu, “Can phantom transition at $z \sim 1$ restore the cosmic concordance?,” *Mon. Not. Roy. Astron. Soc.* **511** (2022) 595, [arXiv:2105.04258 \[astro-ph.CO\]](#).

- [2368] S. Galli, L. Pogosian, K. Jedamzik, and L. Balkenhol, “Consistency of planck, act, and spt constraints on magnetically assisted recombination and forecasts for future experiments,” *Phys. Rev. D* **105** no. 2, (2022) 023513, [arXiv:2109.03816 \[astro-ph.CO\]](#).
- [2369] K. Jedamzik and T. Abel, “Small-scale primordial magnetic fields and anisotropies in the cosmic microwave background radiation,” *JCAP* **1310** (2013) 050, [arXiv:1108.2517 \[astro-ph.CO\]](#).
- [2370] M. Rashkovetskyi, J. B. Muñoz, D. J. Eisenstein, and C. Dvorkin, “Small-scale clumping at recombination and the hubble tension,” *Phys. Rev. D* **104** no. 10, (2021) 103517, [arXiv:2108.02747 \[astro-ph.CO\]](#).
- [2371] D. Benisty, D. Vasak, J. Kirsch, and J. Struckmeier, “Low-redshift constraints on covariant canonical gauge theory of gravity,” *Eur. Phys. J. C* **81** no. 2, (2021) 125, [arXiv:2101.07566 \[gr-qc\]](#).
- [2372] L. Thiele, Y. Guan, J. C. Hill, A. Kosowsky, and D. N. Spergel, “Can small-scale baryon inhomogeneities resolve the hubble tension? an investigation with act dr4,” *Phys. Rev. D* **104** no. 6, (2021) 063535, [arXiv:2105.03003 \[astro-ph.CO\]](#).
- [2373] **ACT** Collaboration, S. K. Choi *et al.*, “The atacama cosmology telescope: a measurement of the cosmic microwave background power spectra at 98 and 150 ghz,” *JCAP* **12** (2020) 045, [arXiv:2007.07289 \[astro-ph.CO\]](#).
- [2374] C. Clarkson, B. Bassett, and T. H.-C. Lu, “A general test of the copernican principle,” *Phys. Rev. Lett.* **101** (2008) 011301, [arXiv:0712.3457 \[astro-ph\]](#).
- [2375] S. Räsänen, K. Bolejko, and A. Finoguenov, “New test of the friedmann-lemaître-robertson-walker metric using the distance sum rule,” *Phys. Rev. Lett.* **115** no. 10, (2015) 101301, [arXiv:1412.4976 \[astro-ph.CO\]](#).
- [2376] A. Shafieloo, B. L’Huillier, and A. A. Starobinsky, “Falsifying λ cdm: Model-independent tests of the concordance model with eboss dr14q and pantheon,” *Phys. Rev. D* **98** no. 8, (2018) 083526, [arXiv:1804.04320 \[astro-ph.CO\]](#).
- [2377] B. L’Huillier and A. Shafieloo, “Model-independent test of the flrw metric, the flatness of the universe, and non-local measurement of h_{0rd} ,” *JCAP* **01** (2017) 015, [arXiv:1606.06832 \[astro-ph.CO\]](#).
- [2378] B. L’Huillier, A. Shafieloo, and H. Kim, “Model-independent cosmological constraints from growth and expansion,” *Mon. Not. Roy. Astron. Soc.* **476** no. 3, (2018) 3263–3268, [arXiv:1712.04865 \[astro-ph.CO\]](#).
- [2379] B. L’Huillier, A. Shafieloo, D. Polarski, and A. A. Starobinsky, “Defying the laws of gravity i: Model-independent reconstruction of the universe expansion from growth data,” *Mon. Not. Roy. Astron. Soc.* **494** no. 1, (2020) 819–826, [arXiv:1906.05991 \[astro-ph.CO\]](#).
- [2380] F. Montanari and S. Rasanen, “Backreaction and frw consistency conditions,” *JCAP* **11** (2017) 032, [arXiv:1709.06022 \[astro-ph.CO\]](#).
- [2381] V. Marra and D. Sapone, “Null tests of the standard model using the linear model formalism,” *Phys. Rev. D* **97** no. 8, (2018) 083510, [arXiv:1712.09676 \[astro-ph.CO\]](#).
- [2382] M. Denissenya, E. V. Linder, and A. Shafieloo, “Cosmic curvature tested directly from observations,” *JCAP* **03** (2018) 041, [arXiv:1802.04816 \[astro-ph.CO\]](#).
- [2383] D. Benisty, E. I. Guendelman, E. Nissimov, and S. Pacheva, “ λ cdm as a noether symmetry in cosmology,” *Int. J. Mod. Phys. D* **26** (2020) 2050104, [arXiv:2003.13146 \[astro-ph.CO\]](#).
- [2384] D. Benisty, E. I. Guendelman, and E. N. Saridakis, “The scale factor potential approach to inflation,” *Eur. Phys. J. C* **80** no. 5, (2020) 480, [arXiv:1909.01982 \[gr-qc\]](#).
- [2385] D. Baumann, D. Green, J. Meyers, and B. Wallisch, “Phases of new physics in the cmb,” *JCAP* **01** (2016) 007, [arXiv:1508.06342 \[astro-ph.CO\]](#).

- [2386] C. Brust, Y. Cui, and K. Sigurdson, “Cosmological constraints on interacting light particles,” *JCAP* **08** (2017) 020, [arXiv:1703.10732 \[astro-ph.CO\]](#).
- [2387] S. Ghosh, S. Kumar, and Y. Tsai, “Free-streaming and coupled dark radiation isocurvature perturbations: Constraints and application to the hubble tension,” (7, 2021) , [arXiv:2107.09076 \[astro-ph.CO\]](#).
- [2388] D. Aloni, A. Berlin, M. Joseph, M. Schmaltz, and N. Weiner, “A step in understanding the hubble tension,” (10, 2021) , [arXiv:2111.00014 \[astro-ph.CO\]](#).
- [2389] A. Aboubrahim, M. Klasen, and P. Nath, “Resolving the hubble tension through hidden sector dynamics in the early universe,” (2, 2022) , [arXiv:2202.04453 \[astro-ph.CO\]](#).
- [2390] A. Aboubrahim, W.-Z. Feng, P. Nath, and Z.-Y. Wang, “Self-interacting hidden sector dark matter, small scale galaxy structure anomalies, and a dark force,” *Phys. Rev. D* **103** no. 7, (2021) 075014, [arXiv:2008.00529 \[hep-ph\]](#).
- [2391] S. Peery, R. Watkins, and H. A. Feldman, “Easily interpretable bulk flows: Continuing tension with the standard cosmological model,” *Mon. Not. Roy. Astron. Soc.* **481** no. 1, (2018) 1368–1375, [arXiv:1808.07772 \[astro-ph.CO\]](#).
- [2392] R. Watkins, H. A. Feldman, and M. J. Hudson, “Consistently large cosmic flows on scales of 100 mpc/h: a challenge for the standard Λ CDM cosmology,” *Mon. Not. Roy. Astron. Soc.* **392** (2009) 743–756, [arXiv:0809.4041 \[astro-ph\]](#).
- [2393] G. F. R. Ellis and M. A. H. MacCallum, “A class of homogeneous cosmological models,” *Commun. Math. Phys.* **12** (1969) 108–141.
- [2394] H. A. Feldman, R. Watkins, and M. J. Hudson, “Cosmic flows on 100 mpc/h scales: Standardized minimum variance bulk flow, shear and octupole moments,” *Mon. Not. Roy. Astron. Soc.* **407** (2010) 2328–2338, [arXiv:0911.5516 \[astro-ph.CO\]](#).
- [2395] Y. Hoffman, H. M. Courtois, and R. B. Tully, “Cosmic bulk flow and the local motion from cosmicflows-2,” *Mon. Not. Roy. Astron. Soc.* **449** no. 4, (2015) 4494–4505, [arXiv:1503.05422 \[astro-ph.CO\]](#).
- [2396] F. Qin, C. Howlett, L. Staveley-Smith, and T. Hong, “Bulk flow and shear in the local universe: 2mtf and cosmicflows-3,” *Mon. Not. Roy. Astron. Soc.* **482** no. 2, (2019) 1920–1930, [arXiv:1811.00822 \[astro-ph.CO\]](#).
- [2397] G. F. R. Ellis, “Relativistic cosmology: Its nature, aims and problems,” in *General relativity and gravitation*, B. Bertotti, F. de Felice, and A. Pascolini, eds., pp. 215–288. Reidel, Dordrecht, 1984.
- [2398] G. F. R. Ellis and W. Stoeger, “The ‘fitting problem’ in cosmology,” *Class. Quant. Grav.* **4** (1987) 1697–1729.
- [2399] I. Ben-Dayan, M. Gasperini, G. Marozzi, F. Nugier, and G. Veneziano, “Backreaction on the luminosity-redshift relation from gauge invariant light-cone averaging,” *JCAP* **04** (2012) 036, [arXiv:1202.1247 \[astro-ph.CO\]](#).
- [2400] T. Buchert, “On average properties of inhomogeneous fluids in general relativity. 1. dust cosmologies,” *Gen. Rel. Grav.* **32** (2000) 105–125, [arXiv:gr-qc/9906015](#).
- [2401] T. Buchert, “On average properties of inhomogeneous fluids in general relativity: Perfect fluid cosmologies,” *Gen. Rel. Grav.* **33** (2001) 1381–1405, [arXiv:gr-qc/0102049](#).
- [2402] S. R. Green and R. M. Wald, “How well is our universe described by an FLRW model?,” *Class. Quant. Grav.* **31** (2014) 234003, [arXiv:1407.8084 \[gr-qc\]](#).
- [2403] T. Buchert *et al.*, “Is there proof that backreaction of inhomogeneities is irrelevant in cosmology?,” *Class. Quant. Grav.* **32** (2015) 215021, [arXiv:1505.07800 \[gr-qc\]](#).

- [2404] T. Buchert, “Dark energy from structure: A status report,” *Gen. Rel. Grav.* **40** (2008) 467–527, [arXiv:0707.2153 \[gr-qc\]](#).
- [2405] R. M. Zalaletdinov, “Averaging out the einstein equations and macroscopic space-time geometry,” *Gen. Rel. Grav.* **24** (1992) 1015–1031.
- [2406] R. Zalaletdinov, “Towards a theory of macroscopic gravity,” *Gen. Rel. Grav.* **25** (1993) 673–695.
- [2407] R. M. Zalaletdinov, “Averaging problem in general relativity, macroscopic gravity and using einstein’s equations in cosmology,” *Bull. Astron. Soc. India* **25** (1997) 401–416, [arXiv:gr-qc/9703016](#).
- [2408] M. Korzynski, “Covariant coarse-graining of inhomogeneous dust flow in general relativity,” *Class. Quant. Grav.* **27** (2010) 105015, [arXiv:0908.4593 \[gr-qc\]](#).
- [2409] S. Rasanen, “Light propagation in statistically homogeneous and isotropic dust universes,” *JCAP* **02** (2009) 011, [arXiv:0812.2872 \[astro-ph\]](#).
- [2410] S. Rasanen, “Light propagation in statistically homogeneous and isotropic universes with general matter content,” *JCAP* **03** (2010) 018, [arXiv:0912.3370 \[astro-ph.CO\]](#).
- [2411] N. Uzun, “Reduced phase space optics for general relativity: Symplectic ray bundle transfer,” *Class. Quant. Grav.* **37** no. 4, (2020) 045002, [arXiv:1811.10917 \[gr-qc\]](#).
- [2412] D. L. Wiltshire, “Cosmic clocks, cosmic variance and cosmic averages,” *New J. Phys.* **9** (2007) 377, [arXiv:gr-qc/0702082](#).
- [2413] T. Buchert, P. Mourier, and X. Roy, “On average properties of inhomogeneous fluids in general relativity iii: general fluid cosmologies,” *Gen. Rel. Grav.* **52** no. 3, (2020) 27, [arXiv:1912.04213 \[gr-qc\]](#).
- [2414] M. Gasperini, G. Marozzi, and G. Veneziano, “Gauge invariant averages for the cosmological backreaction,” *JCAP* **03** (2009) 011, [arXiv:0901.1303 \[gr-qc\]](#).
- [2415] M. Gasperini, G. Marozzi, and G. Veneziano, “A covariant and gauge invariant formulation of the cosmological ‘backreaction’,” *JCAP* **02** (2010) 009, [arXiv:0912.3244 \[gr-qc\]](#).
- [2416] M. Gasperini, G. Marozzi, F. Nugier, and G. Veneziano, “Light-cone averaging in cosmology: Formalism and applications,” *JCAP* **07** (2011) 008, [arXiv:1104.1167 \[astro-ph.CO\]](#).
- [2417] T. Buchert and S. Räsänen, “Backreaction in late-time cosmology,” *Ann. Rev. Nucl. Part. Sci.* **62** (2012) 57–79, [arXiv:1112.5335 \[astro-ph.CO\]](#).
- [2418] J. A. Hodgson, B. L’Huillier, I. Liodakis, S.-S. Lee, and A. Shafieloo, “Using variability and vlbi to measure cosmological distances,” *Mon. Not. Roy. Astron. Soc.* **495** no. 1, (2020) L27–L31, [arXiv:2003.10278 \[astro-ph.CO\]](#).
- [2419] R. Calderón, R. Gannouji, B. L’Huillier, and D. Polarski, “Negative cosmological constant in the dark sector?,” *Phys. Rev. D* **103** no. 2, (2021) 023526, [arXiv:2008.10237 \[astro-ph.CO\]](#).
- [2420] H. A. Winther *et al.*, “Modified gravity n-body code comparison project,” *Mon. Not. Roy. Astron. Soc.* **454** no. 4, (2015) 4208–4234, [arXiv:1506.06384 \[astro-ph.CO\]](#).
- [2421] B. Li, G.-B. Zhao, R. Teyssier, and K. Koyama, “Ecosmog: An efficient code for simulating modified gravity,” *JCAP* **01** (2012) 051, [arXiv:1110.1379 \[astro-ph.CO\]](#).
- [2422] E. Puchwein, M. Baldi, and V. Springel, “Modified gravity-gadget: A new code for cosmological hydrodynamical simulations of modified gravity models,” *Mon. Not. Roy. Astron. Soc.* **436** (2013) 348, [arXiv:1305.2418 \[astro-ph.CO\]](#).
- [2423] C. Llinares, D. F. Mota, and H. A. Winther, “Isis: a new n-body cosmological code with scalar fields based on ramses. code presentation and application to the shapes of clusters,” *Astron. Astrophys.* **562** (2014) A78, [arXiv:1307.6748 \[astro-ph.CO\]](#).

- [2424] F. Hassani, J. Adamek, M. Kunz, and F. Vernizzi, “*k*-evolution: a relativistic n-body code for clustering dark energy,” *JCAP* **12** (2019) 011, [arXiv:1910.01104](#) [[astro-ph.CO](#)].
- [2425] F. Hassani, B. L’Huillier, A. Shafieloo, M. Kunz, and J. Adamek, “Parametrising non-linear dark energy perturbations,” *JCAP* **04** (2020) 039, [arXiv:1910.01105](#) [[astro-ph.CO](#)].
- [2426] J. Adamek, D. Daverio, R. Durrer, and M. Kunz, “gevolution: a cosmological n-body code based on general relativity,” *JCAP* **07** (2016) 053, [arXiv:1604.06065](#) [[astro-ph.CO](#)].
- [2427] C. Llinares, “Simulation techniques for modified gravity,” *Int. J. Mod. Phys. D* **27** no. 15, (2018) 1848003, [arXiv:2103.10890](#) [[astro-ph.CO](#)].
- [2428] A. Messina, L. Moscardini, F. Lucchin, and S. Matarrese, “Nongaussian initial conditions in cosmological n body simulations. 1. space uncorrelated models,” *Mon. Not. Roy. Astron. Soc.* **245** (1990) 244–254.
- [2429] B. L’Huillier, A. Shafieloo, D. K. Hazra, G. F. Smoot, and A. A. Starobinsky, “Probing features in the primordial perturbation spectrum with large-scale structure data,” *Mon. Not. Roy. Astron. Soc.* **477** no. 2, (2018) 2503–2512, [arXiv:1710.10987](#) [[astro-ph.CO](#)].
- [2430] B. L’Huillier, H. A. Winther, D. F. Mota, C. Park, and J. Kim, “Dark matter haloes in modified gravity and dark energy: interaction rate, small-, and large-scale alignment,” *Mon. Not. Roy. Astron. Soc.* **468** no. 3, (2017) 3174–3183, [arXiv:1703.07357](#) [[astro-ph.CO](#)].
- [2431] Y. Li, H.-M. Zhu, and B. Li, “Reconstructing features in the primordial power spectrum,” (2, 2021) , [arXiv:2102.09007](#) [[astro-ph.CO](#)].
- [2432] M. Ballardini, R. Murgia, M. Baldi, F. Finelli, and M. Viel, “Non-linear damping of superimposed primordial oscillations on the matter power spectrum in galaxy surveys,” *JCAP* **04** no. 04, (2020) 030, [arXiv:1912.12499](#) [[astro-ph.CO](#)].
- [2433] F. Beutler, M. Biagetti, D. Green, A. Slosar, and B. Wallisch, “Primordial features from linear to nonlinear scales,” *Phys. Rev. Res.* **1** no. 3, (2019) 033209, [arXiv:1906.08758](#) [[astro-ph.CO](#)].
- [2434] K. Heitmann *et al.*, “The mira–titan universe: Precision predictions for dark energy surveys,” *Astrophys. J.* **820** no. 2, (2016) 108, [arXiv:1508.02654](#) [[astro-ph.CO](#)].
- [2435] F. Villaescusa-Navarro *et al.*, “The quijote simulations,” *Astrophys. J. Suppl.* **250** no. 1, (2020) 2, [arXiv:1909.05273](#) [[astro-ph.CO](#)].
- [2436] A. Heinesen and T. Buchert, “Solving the curvature and hubble parameter inconsistencies through structure formation-induced curvature,” *Class. Quant. Grav.* **37** no. 16, (2020) 164001, [arXiv:2002.10831](#) [[gr-qc](#)]. [Erratum: *Class.Quant.Grav.* **37**, 229601 (2020)].
- [2437] D. L. Wiltshire, “What is dust? - physical foundations of the averaging problem in cosmology,” *Class. Quant. Grav.* **28** (2011) 164006, [arXiv:1106.1693](#) [[gr-qc](#)].
- [2438] T. Buchert and M. Carfora, “Regional averaging and scaling in relativistic cosmology,” *Class. Quant. Grav.* **19** (2002) 6109–6145, [arXiv:gr-qc/0210037](#).
- [2439] G. F. Abellán, R. Murgia, and V. Poulin, “Linear cosmological constraints on two-body decaying dark matter scenarios and the s_8 tension,” *Phys. Rev. D* **104** no. 12, (2021) 123533, [arXiv:2102.12498](#) [[astro-ph.CO](#)].
- [2440] **Pan-STARRS1** Collaboration, D. M. Scolnic *et al.*, “The complete light-curve sample of spectroscopically confirmed sne ia from pan-starrs1 and cosmological constraints from the combined pantheon sample,” *Astrophys. J.* **859** no. 2, (2018) 101, [arXiv:1710.00845](#) [[astro-ph.CO](#)].
- [2441] C.-C. Lee, J. K. Webb, R. F. Carswell, and D. Milaković, “Artificial intelligence and quasar absorption system modelling; application to fundamental constants at high redshift,” *Mon. Not. Roy. Astron. Soc.* **504** no. 2, (2021) 1787–1800, [arXiv:2008.02583](#) [[astro-ph.CO](#)].
- [2442] A. Maeder, “An alternative to the λ cdm model: The case of scale invariance,” *Astrophys. J.* **834** no. 2, (2017) 194, [arXiv:1701.03964](#) [[astro-ph.CO](#)].

- [2443] J. Liske *et al.*, “Cosmic dynamics in the era of extremely large telescopes,” *Mon. Not. Roy. Astron. Soc.* **386** (2008) 1192–1218, [arXiv:0802.1532 \[astro-ph\]](#).
- [2444] A. Sandage, “The change of redshift and apparent luminosity of galaxies due to the deceleration of selected expanding universes.,” *Astrophysical Journal* **136** (September, 1962) 319.
- [2445] G. C. McVittie, “Appendix to the change of redshift and apparent luminosity of galaxies due to the deceleration of selected expanding universes.,” *Astrophysical Journal* **136** (September, 1962) 334.
- [2446] H.-R. Klöckner, D. Obreschkow, C. Martins, A. Raccanelli, D. Champion, A. L. Roy, A. Lobanov, J. Wagner, and R. Keller, “Real time cosmology - a direct measure of the expansion rate of the universe with the ska,” *PoS AASKA14* (2015) 027, [arXiv:1501.03822 \[astro-ph.CO\]](#).
- [2447] R. Maiolino *et al.*, “A community science case for e-elt hires,” (10, 2013) , [arXiv:1310.3163 \[astro-ph.IM\]](#).
- [2448] J. Darling, “Toward a direct measurement of the cosmic acceleration,” *Astrophys. J. Lett.* **761** (2012) L26, [arXiv:1211.4585 \[astro-ph.CO\]](#).
- [2449] E. Kourkchi, R. B. Tully, H. M. Courtois, A. Dupuy, and D. Guinet, “Cosmicflows-4: The baryonic tully-fisher relation providing $\sim 10,000$ distances,” (1, 2022) , [arXiv:2201.13023 \[astro-ph.GA\]](#).
- [2450] C. J. A. P. Martins, M. Martinelli, E. Calabrese, and M. P. L. P. Ramos, “Real-time cosmography with redshift derivatives,” *Phys. Rev. D* **94** no. 4, (2016) 043001, [arXiv:1606.07261 \[astro-ph.CO\]](#).
- [2451] M. M. Davis and L. S. May, “New observations of the radio absorption line in 3c 286, with potential application to the direct measurement of cosmological deceleration.,” *Astrophys. J.* **219** (January, 1978) 1–4.
- [2452] P. Vielva, E. Martí nez González, R. Barreiro, J. Sanz, and L. Cayón, “Detection of non-gaussianity in the wmap 1 - year data using spherical wavelets,” *Astrophys. J.* **609** (2004) 22–34, [arXiv:astro-ph/0310273](#).
- [2453] M. Cruz, E. Martí nez González, P. Vielva, and L. Cayón, “Detection of a non-gaussian spot in wmap,” *Mon. Not. Roy. Astron. Soc.* **356** (2005) 29–40, [arXiv:astro-ph/0405341](#).
- [2454] M. Cruz, M. Tucci, E. Martinez-Gonzalez, and P. Vielva, “The non-gaussian cold spot in wmap: significance, morphology and foreground contribution,” *Mon. Not. Roy. Astron. Soc.* **369** (2006) 57–67, [arXiv:astro-ph/0601427](#).
- [2455] R. Zhang and D. Huterer, “Disks in the sky: A reassessment of the wmap ‘cold spot’,” *Astropart. Phys.* **33** (2010) 69–74, [arXiv:0908.3988 \[astro-ph.CO\]](#).
- [2456] S. Nadathur, M. Lavinto, S. Hotchkiss, and S. Räsänen, “Can a supervoid explain the cold spot?,” *Phys. Rev. D* **90** no. 10, (2014) 103510, [arXiv:1408.4720 \[astro-ph.CO\]](#).
- [2457] M. Cruz, E. Martinez-Gonzalez, and P. Vielva, “The wmap cold spot,” (1, 2009) , [arXiv:0901.1986 \[astro-ph.CO\]](#).
- [2458] P. Vielva, “A comprehensive overview of the cold spot,” *Adv. Astron.* **2010** (2010) 592094, [arXiv:1008.3051 \[astro-ph.CO\]](#).
- [2459] W. Valkenburg, “Perceiving the equation of state of dark energy while living in a cold spot,” *JCAP* **01** (2012) 047, [arXiv:1106.6042 \[astro-ph.CO\]](#).
- [2460] W. Zhao, “Local properties of wmap cold spot,” *Mon. Not. Roy. Astron. Soc.* **433** (2013) 3498–3505, [arXiv:1209.1174 \[astro-ph.CO\]](#).
- [2461] L. W. Fung, L. Li, T. Liu, H. N. Luu, Y.-C. Qiu, and S. H. H. Tye, “The hubble constant in the axi-higgs universe,” (5, 2021) , [arXiv:2105.01631 \[astro-ph.CO\]](#).

- [2462] T. R. Jaffe, A. J. Banday, H. K. Eriksen, K. M. Gorski, and F. K. Hansen, “Evidence of vorticity and shear at large angular scales in the wmap data: A violation of cosmological isotropy?,” *Astrophys. J. Lett.* **629** (2005) L1–L4, [arXiv:astro-ph/0503213](#).
- [2463] K. T. Inoue and J. Silk, “Local voids as the origin of large-angle cosmic microwave background anomalies i,” *Astrophys. J.* **648** (2006) 23–30, [arXiv:astro-ph/0602478](#).
- [2464] M. Hansen, W. Zhao, A. M. Frejsel, P. D. Naselsky, J. Kim, and O. V. Verkhodanov, “Faraday rotation as a diagnostic of galactic foreground contamination of cmb maps,” *Mon. Not. Roy. Astron. Soc.* **426** (2012) 57–69, [arXiv:1202.1711 \[astro-ph.CO\]](#).
- [2465] C.-Q. Geng, Y.-T. Hsu, J.-R. Lu, and L. Yin, “A dark energy model from generalized proca theory,” *Phys. Dark Univ.* **32** (2021) 100819, [arXiv:2104.06577 \[gr-qc\]](#).
- [2466] K. Naidoo, A. Benoit-Lévy, and O. Lahav, “Could multiple voids explain the cosmic microwave background cold spot anomaly?,” *Mon. Not. Roy. Astron. Soc.* **459** no. 1, (2016) L71–L75, [arXiv:1512.02694 \[astro-ph.CO\]](#).
- [2467] L. Rudnick, S. Brown, and L. R. Williams, “Extragalactic radio sources and the wmap cold spot,” *Astrophys. J.* **671** (2007) 40–44, [arXiv:0704.0908 \[astro-ph\]](#).
- [2468] K. T. Inoue and J. Silk, “Local voids as the origin of large-angle cosmic microwave background anomalies: The effect of a cosmological constant,” *Astrophys. J.* **664** (2007) 650–659, [arXiv:astro-ph/0612347](#).
- [2469] A. G. Riess *et al.*, “A comprehensive measurement of the local value of the hubble constant with 1 km/s/mpc uncertainty from the hubble space telescope and the sh0es team,” (12, 2021) , [arXiv:2112.04510 \[astro-ph.CO\]](#).
- [2470] K. Freese, J. A. Frieman, and A. V. Olinto, “Natural inflation with pseudo - nambu-goldstone bosons,” *Phys. Rev. Lett.* **65** (1990) 3233–3236.
- [2471] H. Velten, I. Costa, and W. Zimdahl, “Early-time thermalization of cosmic components? a hint for solving cosmic tensions,” *Phys. Rev. D* **104** no. 6, (2021) 063507, [arXiv:2104.05352 \[astro-ph.CO\]](#).
- [2472] **Planck** Collaboration, N. Aghanim *et al.*, “Planck 2013 results. xxvii. doppler boosting of the cmb: Eppure si muove,” *Astron. Astrophys.* **571** (2014) A27, [arXiv:1303.5087 \[astro-ph.CO\]](#).
- [2473] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2013 results. xv. cmb power spectra and likelihood,” *Astron. Astrophys.* **571** (2014) A15, [arXiv:1303.5075 \[astro-ph.CO\]](#).
- [2474] S. Das *et al.*, “The atacama cosmology telescope: temperature and gravitational lensing power spectrum measurements from three seasons of data,” *JCAP* **04** (2014) 014, [arXiv:1301.1037 \[astro-ph.CO\]](#).
- [2475] R. Keisler *et al.*, “A measurement of the damping tail of the cosmic microwave background power spectrum with the south pole telescope,” *Astrophys. J.* **743** (2011) 28, [arXiv:1105.3182 \[astro-ph.CO\]](#).
- [2476] O. Seto and Y. Toda, “Hubble tension in lepton asymmetric cosmology with an extra radiation,” *Phys. Rev. D* **104** no. 6, (2021) 063019, [arXiv:2104.04381 \[astro-ph.CO\]](#).
- [2477] G. Acquaviva, Ö. Akarsu, N. Katırcı, and J. A. Vazquez, “Simple-graduated dark energy and spatial curvature,” *Phys. Rev. D* **104** no. 2, (2021) 023505, [arXiv:2104.02623 \[astro-ph.CO\]](#).
- [2478] A. Hernández-Almada, M. A. García-Aspeitia, M. A. Rodríguez-Meza, and V. Motta, “A hybrid model of viscous and chaplygin gas to tackle the universe acceleration,” *Eur. Phys. J. C* **81** no. 4, (2021) 295, [arXiv:2103.16733 \[astro-ph.CO\]](#).
- [2479] C. L. Reichardt *et al.*, “A measurement of secondary cosmic microwave background anisotropies with two years of south pole telescope observations,” *Astrophys. J.* **755** (2012) 70, [arXiv:1111.0932 \[astro-ph.CO\]](#).
- [2480] **BICEP2** Collaboration, P. A. R. Ade *et al.*, “Detection of *b*-mode polarization at degree angular scales by bicep2,” *Phys. Rev. Lett.* **112** no. 24, (2014) 241101, [arXiv:1403.3985 \[astro-ph.CO\]](#).

- [2481] M. Davis, G. Efstathiou, C. S. Frenk, and S. D. M. White, “The end of cold dark matter?,” *Nature* **356** (1992) 489.
- [2482] M. Davis, G. Efstathiou, C. S. Frenk, and S. D. M. White, “The evolution of large scale structure in a universe dominated by cold dark matter,” *Astrophys. J.* **292** (1985) 371–394.
- [2483] D. Wang and X.-H. Meng, “First comprehensive constraints on the finslerian models using cosmological observations,” *Phys. Dark Univ.* **21** (2018) 55–60, [arXiv:2103.14790 \[astro-ph.CO\]](#).
- [2484] K. Janes and P. Demarque, “The ages and compositions of old clusters,” *Astrophys. J.* **264** (1983) 206–215.
- [2485] J. G. Bartlett and J. Silk, “Galaxy clusters and the coBE result,” *Astrophys. J. Lett.* **407** (1993) L45.
- [2486] **Supernova Cosmology Project** Collaboration, S. Perlmutter *et al.*, “Measurements of the cosmological parameters ω and λ from the first 7 supernovae at $z \geq 0.35$,” *Astrophys. J.* **483** (1997) 565, [arXiv:astro-ph/9608192](#).
- [2487] J. Murata and S. Tanaka, “A review of short-range gravity experiments in the LHC era,” *Class. Quant. Grav.* **32** no. 3, (2015) 033001, [arXiv:1408.3588 \[hep-ex\]](#).
- [2488] C. D. Hoyle, D. J. Kapner, B. R. Heckel, E. G. Adelberger, J. H. Gundlach, U. Schmidt, and H. E. Swanson, “Sub-millimeter tests of the gravitational inverse-square law,” *Phys. Rev. D* **70** (2004) 042004, [arXiv:hep-ph/0405262](#).
- [2489] C. D. Hoyle, U. Schmidt, B. R. Heckel, E. G. Adelberger, J. H. Gundlach, D. J. Kapner, and H. E. Swanson, “Submillimeter tests of the gravitational inverse square law: a search for ‘large’ extra dimensions,” *Phys. Rev. Lett.* **86** (2001) 1418–1421, [arXiv:hep-ph/0011014](#).
- [2490] S. Qvarfort, D. Rätzel, and S. Stopyra, “Constraining modified gravity with quantum optomechanics,” (8, 2021) , [arXiv:2108.00742 \[quant-ph\]](#).
- [2491] S. Nesseris and J. Garcia-Bellido, “Is the jeffreys’ scale a reliable tool for bayesian model comparison in cosmology?,” *JCAP* **08** (2013) 036, [arXiv:1210.7652 \[astro-ph.CO\]](#).
- [2492] P. Mukherjee, D. Parkinson, and A. R. Liddle, “A nested sampling algorithm for cosmological model selection,” *Astrophys. J. Lett.* **638** (2006) L51–L54, [arXiv:astro-ph/0508461](#).
- [2493] V. C. Rubin, N. Thonnard, and W. K. Ford, Jr., “Rotational properties of 21 sc galaxies with a large range of luminosities and radii, from NGC 4605 / $r = 4$ kpc/ to UGC 2885 / $r = 122$ kpc/,” *Astrophys. J.* **238** (1980) 471.
- [2494] P. Salucci, N. Turini, and C. Di Paolo, “Paradigms and scenarios for the dark matter phenomenon,” *Universe* **6** no. 8, (2020) 118, [arXiv:2008.04052 \[astro-ph.CO\]](#).
- [2495] K. Freese, “Status of dark matter in the universe,” *Int. J. Mod. Phys.* **1** no. 06, (2017) 325–355, [arXiv:1701.01840 \[astro-ph.CO\]](#).
- [2496] G. Gentile, P. Salucci, U. Klein, and G. L. Granato, “NGC 3741: Dark halo profile from the most extended rotation curve,” *Mon. Not. Roy. Astron. Soc.* **375** (2007) 199–212, [arXiv:astro-ph/0611355](#).
- [2497] M. Persic, P. Salucci, and F. Stel, “The universal rotation curve of spiral galaxies: 1. the dark matter connection,” *Mon. Not. Roy. Astron. Soc.* **281** (1996) 27, [arXiv:astro-ph/9506004](#).
- [2498] S. Profumo, *An Introduction to Particle Dark Matter*. World Scientific, 2017.
- [2499] J. F. Navarro, C. S. Frenk, and S. D. M. White, “A universal density profile from hierarchical clustering,” *Astrophys. J.* **490** (1997) 493–508, [arXiv:astro-ph/9611107](#).
- [2500] A. Klypin, S. Trujillo-Gomez, and J. Primack, “Halos and galaxies in the standard cosmological model: results from the Bolshoi simulation,” *Astrophys. J.* **740** (2011) 102, [arXiv:1002.3660 \[astro-ph.CO\]](#).

- [2501] W. J. G. de Blok and A. Bosma, “High-resolution rotation curves of low surface brightness galaxies,” *Astron. Astrophys.* **385** (2002) 816, [arXiv:astro-ph/0201276](#).
- [2502] J. S. Bullock and M. Boylan-Kolchin, “Small-scale challenges to the Λ cdm paradigm,” *Ann. Rev. Astron. Astrophys.* **55** (2017) 343–387, [arXiv:1707.04256](#) [astro-ph.CO].
- [2503] P. Salucci, “The constant density region of the dark halos of spiral galaxies,” *Mon. Not. Roy. Astron. Soc.* **320** (2001) L1, [arXiv:astro-ph/0007389](#).
- [2504] G. Gentile, P. Salucci, U. Klein, D. Vergani, and P. Kalberla, “The cored distribution of dark matter in spiral galaxies,” *Mon. Not. Roy. Astron. Soc.* **351** (2004) 903, [arXiv:astro-ph/0403154](#).
- [2505] S.-H. Oh, W. J. G. de Blok, E. Brinks, F. Walter, and R. C. Kennicutt, Jr, “Dark and luminous matter in things dwarf galaxies,” *Astron. J.* **141** (2011) 193, [arXiv:1011.0899](#) [astro-ph.CO].
- [2506] F. Donato, G. Gentile, P. Salucci, C. F. Martins, M. I. Wilkinson, G. Gilmore, E. K. Grebel, A. Koch, and R. Wyse, “A constant dark matter halo surface density in galaxies,” *Mon. Not. Roy. Astron. Soc.* **397** (2009) 1169–1176, [arXiv:0904.4054](#) [astro-ph.CO].
- [2507] R. Dehghani, P. Salucci, and H. Ghaffarnejad, “Navarro-frenk-white dark matter profile and the dark halos around disk systems,” *Astron. Astrophys.* **643** (2020) A161, [arXiv:2008.04732](#) [astro-ph.CO].
- [2508] T. Papanikolaou, C. Tzerefos, S. Basilakos, and E. N. Saridakis, “Scalar induced gravitational waves from primordial black hole poisson fluctuations in starobinsky inflation,” (12, 2021) , [arXiv:2112.15059](#) [astro-ph.CO].
- [2509] A. Burkert, “The structure of dark matter halos in dwarf galaxies,” *Astrophys. J. Lett.* **447** (1995) L25, [arXiv:astro-ph/9504041](#).
- [2510] P. Salucci and A. Burkert, “Dark matter scaling relations,” *Astrophys. J. Lett.* **537** (2000) L9–L12, [arXiv:astro-ph/0004397](#).
- [2511] A. Pontzen and F. Governato, “Cold dark matter heats up,” *Nature* **506** (2014) 171–178, [arXiv:1402.1764](#) [astro-ph.CO].
- [2512] A. Di Cintio, C. B. Brook, A. V. Macciò, G. S. Stinson, A. Knebe, A. A. Dutton, and J. Wadsley, “The dependence of dark matter profiles on the stellar-to-halo mass ratio: a prediction for cusps versus cores,” *Mon. Not. Roy. Astron. Soc.* **437** no. 1, (2014) 415–423, [arXiv:1306.0898](#) [astro-ph.CO].
- [2513] E. V. Karukes and P. Salucci, “The universal rotation curve of dwarf disc galaxies,” *Mon. Not. Roy. Astron. Soc.* **465** no. 4, (2017) 4703–4722, [arXiv:1609.06903](#) [astro-ph.GA].
- [2514] C. Di Paolo, P. Salucci, and A. Erkurt, “The universal rotation curve of low surface brightness galaxies – iv. the interrelation between dark and luminous matter,” *Mon. Not. Roy. Astron. Soc.* **490** no. 4, (2019) 5451–5477, [arXiv:1805.07165](#).
- [2515] M. H. P. M. van Putten, “Evidence for galaxy dynamics tracing background cosmology below the de sitter scale of acceleration,” *Astrophys. J.* **848** no. 1, (2017) 28, [arXiv:1709.05944](#) [astro-ph.GA].
- [2516] E. Ó Colgáin, M. H. P. M. van Putten, and H. Yavartanoo, “de sitter swampland, h_0 tension & observation,” *Phys. Lett. B* **793** (2019) 126–129, [arXiv:1807.07451](#) [hep-th].
- [2517] P. Salucci, M. I. Wilkinson, M. G. Walker, G. F. Gilmore, E. K. Grebel, A. Koch, C. F. Martins, and R. F. G. Wyse, “Dwarf spheroidal galaxy kinematics and spiral galaxy scaling laws,” *Mon. Not. Roy. Astron. Soc.* **420** (2012) 2034, [arXiv:1111.1165](#) [astro-ph.CO].
- [2518] G. Arcadi, M. Dutra, P. Ghosh, M. Lindner, Y. Mambrini, M. Pierre, S. Profumo, and F. S. Queiroz, “The waning of the wimp? a review of models, searches, and constraints,” *Eur. Phys. J. C* **78** no. 3, (2018) 203, [arXiv:1703.07364](#) [hep-ph].
- [2519] L. Hui, J. P. Ostriker, S. Tremaine, and E. Witten, “Ultralight scalars as cosmological dark matter,” *Phys. Rev. D* **95** no. 4, (2017) 043541, [arXiv:1610.08297](#) [astro-ph.CO].

- [2520] S. Bahamonde, K. F. Dialektopoulos, M. Hohmann, J. L. Said, C. Pfeifer, and E. N. Saridakis, “No strong coupling in non-flat flrw $f(t)$ cosmology,” (3, 2022) , [arXiv:2203.00619 \[gr-qc\]](#).
- [2521] P. Salucci, A. Lapi, C. Tonini, G. Gentile, I. Yegorova, and U. Klein, “The universal rotation curve of spiral galaxies. 2. the dark matter distribution out to the virial radius,” *Mon. Not. Roy. Astron. Soc.* **378** (2007) 41–47, [arXiv:astro-ph/0703115](#).
- [2522] M. Drewes *et al.*, “A white paper on kev sterile neutrino dark matter,” *JCAP* **01** (2017) 025, [arXiv:1602.04816 \[hep-ph\]](#).
- [2523] N. Sehgal *et al.*, “Science from an ultra-deep, high-resolution millimeter-wave survey,” (3, 2019) , [arXiv:1903.03263 \[astro-ph.CO\]](#).
- [2524] N. Sehgal *et al.*, “Cmb-hd: An ultra-deep, high-resolution millimeter-wave survey over half the sky,” (6, 2019) , [arXiv:1906.10134 \[astro-ph.CO\]](#).
- [2525] N. Sehgal *et al.*, “Cmb-hd: Astro2020 rfi response,” (2, 2020) , [arXiv:2002.12714 \[astro-ph.CO\]](#).
- [2526] C. M. Hirata, “Tidal alignments as a contaminant of redshift space distortions,” *Mon. Not. Roy. Astron. Soc.* **399** (2009) 1074, [arXiv:0903.4929 \[astro-ph.CO\]](#).
- [2527] A. Obuljen, W. J. Percival, and N. Dalal, “Detection of anisotropic galaxy assembly bias in boss dr12,” *JCAP* **10** (2020) 058, [arXiv:2004.07240 \[astro-ph.CO\]](#).
- [2528] S. Singh, B. Yu, and U. Seljak, “Fundamental plane of boss galaxies: Correlations with galaxy properties, density field and impact on rsd measurements,” *Mon. Not. Roy. Astron. Soc.* **501** no. 3, (2021) 4167–4183, [arXiv:2001.07700 \[astro-ph.CO\]](#).
- [2529] A. de Mattia and V. Ruhlmann-Kleider, “Integral constraints in spectroscopic surveys,” *JCAP* **08** (2019) 036, [arXiv:1904.08851 \[astro-ph.CO\]](#).
- [2530] X. Ren, S.-F. Yan, Y. Zhao, Y.-F. Cai, and E. N. Saridakis, “Gaussian processes and effective field theory of $f(t)$ gravity under the h_0 tension,” (3, 2022) , [arXiv:2203.01926 \[astro-ph.CO\]](#).
- [2531] C. Hahn, R. Scoccimarro, M. R. Blanton, J. L. Tinker, and S. A. Rodríguez-Torres, “The effect of fibre collisions on the galaxy power spectrum multipoles,” *Mon. Not. Roy. Astron. Soc.* **467** no. 2, (2017) 1940–1956, [arXiv:1609.01714 \[astro-ph.CO\]](#).
- [2532] **BOSS** Collaboration, A. J. Ross *et al.*, “The clustering of galaxies in the sdss-iii baryon oscillation spectroscopic survey: Analysis of potential systematics,” *Mon. Not. Roy. Astron. Soc.* **424** (2012) 564, [arXiv:1203.6499 \[astro-ph.CO\]](#).
- [2533] D. Blas, M. Garny, M. M. Ivanov, and S. Sibiryakov, “Time-sliced perturbation theory for large scale structure i: General formalism,” *JCAP* **07** (2016) 052, [arXiv:1512.05807 \[astro-ph.CO\]](#).
- [2534] W. El Hanafy and E. N. Saridakis, “ $f(t)$ cosmology: from pseudo-bang to pseudo-rip,” *JCAP* **09** (2021) 019, [arXiv:2011.15070 \[gr-qc\]](#).
- [2535] D. Blas, M. Garny, M. M. Ivanov, and S. Sibiryakov, “Time-sliced perturbation theory ii: Baryon acoustic oscillations and infrared resummation,” *JCAP* **07** (2016) 028, [arXiv:1605.02149 \[astro-ph.CO\]](#).
- [2536] D. Baumann, A. Nicolis, L. Senatore, and M. Zaldarriaga, “Cosmological non-linearities as an effective fluid,” *JCAP* **07** (2012) 051, [arXiv:1004.2488 \[astro-ph.CO\]](#).
- [2537] Y. Kobayashi, T. Nishimichi, M. Takada, R. Takahashi, and K. Osato, “Accurate emulator for the redshift-space power spectrum of dark matter halos and its application to galaxy power spectrum,” *Phys. Rev. D* **102** no. 6, (2020) 063504, [arXiv:2005.06122 \[astro-ph.CO\]](#).
- [2538] C. Hahn, F. Villaescusa-Navarro, E. Castorina, and R. Scoccimarro, “Constraining m_ν with the bispectrum. part i. breaking parameter degeneracies,” *JCAP* **03** (2020) 040, [arXiv:1909.11107 \[astro-ph.CO\]](#).

- [2539] K. Heitmann, D. Higdon, M. White, S. Habib, B. J. Williams, and C. Wagner, “The coyote universe ii: Cosmological models and precision emulation of the nonlinear matter power spectrum,” *Astrophys. J.* **705** (2009) 156–174, [arXiv:0902.0429 \[astro-ph.CO\]](#).
- [2540] O. H. E. Philcox, M. M. Ivanov, M. Zaldarriaga, M. Simonovic, and M. Schmittfull, “Fewer mocks and less noise: Reducing the dimensionality of cosmological observables with subspace projections,” *Phys. Rev. D* **103** no. 4, (2021) 043508, [arXiv:2009.03311 \[astro-ph.CO\]](#).
- [2541] A. Laguë, J. R. Bond, R. Hložek, K. K. Rogers, D. J. E. Marsh, and D. Grin, “Constraining ultralight axions with galaxy surveys,” (4, 2021) , [arXiv:2104.07802 \[astro-ph.CO\]](#).
- [2542] W. L. Xu, J. B. Muñoz, and C. Dvorkin, “Cosmological constraints on light (but massive) relics,” (7, 2021) , [arXiv:2107.09664 \[astro-ph.CO\]](#).
- [2543] A. Chudaykin, M. M. Ivanov, O. H. E. Philcox, and M. Simonović, “Nonlinear perturbation theory extension of the boltzmann code class,” *Phys. Rev. D* **102** no. 6, (2020) 063533, [arXiv:2004.10607 \[astro-ph.CO\]](#).
- [2544] M. M. Ivanov, M. Simonović, and M. Zaldarriaga, “Cosmological parameters and neutrino masses from the final planck and full-shape boss data,” *Phys. Rev. D* **101** no. 8, (2020) 083504, [arXiv:1912.08208 \[astro-ph.CO\]](#).
- [2545] E. Mortsell, A. Goobar, J. Johansson, and S. Dhawan, “The hubble tension revisited: Additional local distance ladder uncertainties,” (6, 2021) , [arXiv:2106.09400 \[astro-ph.CO\]](#).
- [2546] A. Chudaykin, K. Dolgikh, and M. M. Ivanov, “Constraints on the curvature of the universe and dynamical dark energy from the full-shape and bao data,” *Phys. Rev. D* **103** no. 2, (2021) 023507, [arXiv:2009.10106 \[astro-ph.CO\]](#).
- [2547] S.-F. Chen, Z. Vlah, and M. White, “Consistent modeling of velocity statistics and redshift-space distortions in one-loop perturbation theory,” *JCAP* **07** (2020) 062, [arXiv:2005.00523 \[astro-ph.CO\]](#).
- [2548] V. Desjacques, D. Jeong, and F. Schmidt, “Large-scale galaxy bias,” *Phys. Rept.* **733** (2018) 1–193, [arXiv:1611.09787 \[astro-ph.CO\]](#).
- [2549] M. Lewandowski, L. Senatore, F. Prada, C. Zhao, and C.-H. Chuang, “Eft of large scale structures in redshift space,” *Phys. Rev. D* **97** no. 6, (2018) 063526, [arXiv:1512.06831 \[astro-ph.CO\]](#).
- [2550] A. Perko, L. Senatore, E. Jennings, and R. H. Wechsler, “Biased tracers in redshift space in the eft of large-scale structure,” (10, 2016) , [arXiv:1610.09321 \[astro-ph.CO\]](#).
- [2551] L. Senatore and M. Zaldarriaga, “Redshift space distortions in the effective field theory of large scale structures,” (9, 2014) , [arXiv:1409.1225 \[astro-ph.CO\]](#).
- [2552] L. Senatore and M. Zaldarriaga, “The ir-resummed effective field theory of large scale structures,” *JCAP* **02** (2015) 013, [arXiv:1404.5954 \[astro-ph.CO\]](#).
- [2553] R. A. Porto, L. Senatore, and M. Zaldarriaga, “The lagrangian-space effective field theory of large scale structures,” *JCAP* **05** (2014) 022, [arXiv:1311.2168 \[astro-ph.CO\]](#).
- [2554] J. J. M. Carrasco, M. P. Hertzberg, and L. Senatore, “The effective field theory of cosmological large scale structures,” *JHEP* **09** (2012) 082, [arXiv:1206.2926 \[astro-ph.CO\]](#).
- [2555] M. M. Ivanov and S. Sibiryakov, “Infrared resummation for biased tracers in redshift space,” *JCAP* **07** (2018) 053, [arXiv:1804.05080 \[astro-ph.CO\]](#).
- [2556] D. Wadekar, M. M. Ivanov, and R. Scoccimarro, “Cosmological constraints from boss with analytic covariance matrices,” *Phys. Rev. D* **102** (2020) 123521, [arXiv:2009.00622 \[astro-ph.CO\]](#).
- [2557] A. Smith *et al.*, “The completed sdss-iv extended baryon oscillation spectroscopic survey: N-body mock challenge for the quasar sample,” *Mon. Not. Roy. Astron. Soc.* **499** no. 1, (2020) 269–291, [arXiv:2007.09003 \[astro-ph.CO\]](#).

- [2558] A. de Mattia *et al.*, “The completed sdss-iv extended baryon oscillation spectroscopic survey: measurement of the bao and growth rate of structure of the emission line galaxy sample from the anisotropic power spectrum between redshift 0.6 and 1.1,” *Mon. Not. Roy. Astron. Soc.* **501** no. 4, (2021) 5616–5645, [arXiv:2007.09008 \[astro-ph.CO\]](#).
- [2559] Y. Kobayashi, T. Nishimichi, M. Takada, and H. Miyatake, “Full-shape cosmology analysis of sdss-iii boss galaxy power spectrum using emulator-based halo model: a 5% determination of σ_8 ,” (10, 2021) , [arXiv:2110.06969 \[astro-ph.CO\]](#).
- [2560] J. U. Lange, A. P. Hearin, A. Leauthaud, F. C. van den Bosch, H. Guo, and J. DeRose, “Five-percent measurements of the growth rate from simulation-based modelling of redshift-space clustering in boss lowz,” (1, 2021) , [arXiv:2101.12261 \[astro-ph.CO\]](#).
- [2561] M. J. Chapman *et al.*, “The completed sdss-iv extended baryon oscillation spectroscopic survey: measurement of the growth rate of structure from the small-scale clustering of the luminous red galaxy sample,” (6, 2021) , [arXiv:2106.14961 \[astro-ph.CO\]](#).
- [2562] A. Gelman, J. Hwang, and A. Vehtari, “Understanding predictive information criteria for bayesian models,” *arXiv e-prints* (July, 2013) [arXiv:1307.5928](#), [arXiv:1307.5928 \[stat.ME\]](#).
- [2563] D. J. Spiegelhalter, N. G. Best, B. P. Carlin, and A. van der Linde, “Bayesian measures of model complexity and fit,” *J. Roy. Statist. Soc. B* **64** no. 4, (2002) 583–639.
- [2564] C. Leng, “The residual information criterion, corrected,” (11, 2007) , [arXiv:0711.1918 \[stat.ME\]](#).
- [2565] J. Skilling, “Nested sampling for general bayesian computation,” *Bayesian Analysis* **1** no. 4, (2006) 833 – 859. <https://doi.org/10.1214/06-BA127>.
- [2566] **SDSS** Collaboration, D. J. Eisenstein *et al.*, “Detection of the baryon acoustic peak in the large-scale correlation function of sdss luminous red galaxies,” *Astrophys. J.* **633** (2005) 560–574, [arXiv:astro-ph/0501171](#).
- [2567] **BOSS** Collaboration, S. Salazar-Albornoz *et al.*, “The clustering of galaxies in the completed sdss-iii baryon oscillation spectroscopic survey: Angular clustering tomography and its cosmological implications,” *Mon. Not. Roy. Astron. Soc.* **468** no. 3, (2017) 2938–2956, [arXiv:1607.03144 \[astro-ph.CO\]](#).
- [2568] G. C. Carvalho, A. Bernui, M. Benetti, J. C. Carvalho, and J. S. Alcaniz, “Baryon acoustic oscillations from the sdss dr10 galaxies angular correlation function,” *Phys. Rev. D* **93** no. 2, (2016) 023530, [arXiv:1507.08972 \[astro-ph.CO\]](#).
- [2569] J. S. Alcaniz, G. C. Carvalho, A. Bernui, J. C. Carvalho, and M. Benetti, “Measuring baryon acoustic oscillations with angular two-point correlation function,” *Fundam. Theor. Phys.* **187** (2017) 11–19, [arXiv:1611.08458 \[astro-ph.CO\]](#).
- [2570] G. C. Carvalho, A. Bernui, M. Benetti, J. C. Carvalho, E. de Carvalho, and J. S. Alcaniz, “The transverse baryonic acoustic scale from the sdss dr11 galaxies,” *Astropart. Phys.* **119** (2020) 102432, [arXiv:1709.00271 \[astro-ph.CO\]](#).
- [2571] M. Benetti, L. L. Graef, and J. S. Alcaniz, “The h_0 and σ_8 tensions and the scale invariant spectrum,” *JCAP* **07** (2018) 066, [arXiv:1712.00677 \[astro-ph.CO\]](#).
- [2572] F. B. M. d. Santos, J. E. Gonzalez, and R. Silva, “Observational constraints on $f(t)$ gravity from model-independent data,” (12, 2021) , [arXiv:2112.15249 \[astro-ph.CO\]](#).
- [2573] E. de Carvalho, A. Bernui, H. S. Xavier, and C. P. Novaes, “Baryon acoustic oscillations signature in the three-point angular correlation function from the sdss-dr12 quasar survey,” *Mon. Not. Roy. Astron. Soc.* **492** no. 3, (2020) 4469–4476, [arXiv:2002.01109 \[astro-ph.CO\]](#).
- [2574] R. Menote and V. Marra, “Baryon acoustic oscillations in thin redshift shells from boss dr12 and eboss dr16 galaxies,” (12, 2021) , [arXiv:2112.10000 \[astro-ph.CO\]](#).

- [2575] C. Bengaly, “A null test of the cosmological principle with bao measurements,” (11, 2021) , [arXiv:2111.06869 \[gr-qc\]](#).
- [2576] T. Ferreira, C. Pigozzo, S. Carneiro, and J. S. Alcaniz, “Interaction in the dark sector: a bayesian analysis with latest observations,” (12, 2017) , [arXiv:1712.05428 \[astro-ph.CO\]](#).
- [2577] T. Brinckmann and J. Lesgourgues, “Montepython 3: boosted mcmc sampler and other features,” *Phys. Dark Univ.* **24** (2019) 100260, [arXiv:1804.07261 \[astro-ph.CO\]](#).
- [2578] A. Cid, B. Santos, C. Pigozzo, T. Ferreira, and J. Alcaniz, “Bayesian comparison of interacting scenarios,” *JCAP* **03** (2019) 030, [arXiv:1805.02107 \[astro-ph.CO\]](#).
- [2579] K. Dutta, Ruchika, A. Roy, A. A. Sen, and M. M. Sheikh-Jabbari, “Beyond λ cdm with low and high redshift data: implications for dark energy,” *Gen. Rel. Grav.* **52** no. 2, (2020) 15, [arXiv:1808.06623 \[astro-ph.CO\]](#).
- [2580] R. von Marttens, V. Marra, L. Casarini, J. E. Gonzalez, and J. Alcaniz, “Null test for interactions in the dark sector,” *Phys. Rev. D* **99** no. 4, (2019) 043521, [arXiv:1812.02333 \[astro-ph.CO\]](#).
- [2581] J. E. Gonzalez, H. H. B. Silva, R. Silva, and J. S. Alcaniz, “Physical constraints on interacting dark energy models,” *Eur. Phys. J. C* **78** no. 9, (2018) 730, [arXiv:1809.00439 \[astro-ph.CO\]](#).
- [2582] Z. Yu *et al.*, “Quasar accretion disk sizes from continuum reverberation mapping in the des standard-star fields,” *Astrophys. J. Suppl.* **246** no. 1, (January, 2020) 16, [arXiv:1811.03638 \[astro-ph.GA\]](#).
- [2583] B. J. Shappee *et al.*, “The man behind the curtain: X-rays drive the uv through nir variability in the 2013 agn outburst in ngc 2617,” *Astrophys. J.* **788** (2014) 48, [arXiv:1310.2241 \[astro-ph.HE\]](#).
- [2584] E. M. Cackett, K. Horne, and H. Winkler, “Testing thermal reprocessing in agn accretion discs,” *Mon. Not. Roy. Astron. Soc.* **380** (2007) 669, [arXiv:0706.1464 \[astro-ph\]](#).
- [2585] Y. Homayouni *et al.*, “The sloan digital sky survey reverberation mapping project: Accretion disk sizes from continuum lags,” *Astrophys. J.* **880** no. 2, (August, 2019) 126, [arXiv:1806.08360 \[astro-ph.GA\]](#).
- [2586] M. M. Fausnaugh *et al.*, “Space telescope and optical reverberation mapping project. iii. optical continuum emission and broadband time delays in ngc 5548,” *Astrophys. J.* **821** no. 1, (April, 2016) 56, [arXiv:1510.05648 \[astro-ph.GA\]](#).
- [2587] Y.-F. Jiang *et al.*, “Detection of time lags between quasar continuum emission bands based on pan-starrs light-curves,” *Astrophys. J.* **836** no. 2, (2017) 186, [arXiv:1612.08747 \[astro-ph.HE\]](#).
- [2588] **DES** Collaboration, D. Mudd *et al.*, “Quasar accretion disk sizes from continuum reverberation mapping from the dark energy survey,” *Astrophys. J.* **862** no. 2, (2018) 123, [arXiv:1711.11588 \[astro-ph.GA\]](#).
- [2589] C. Fian, D. Chelouche, S. Kaspi, C. Sobrino Figaredo, S. Catalan, and T. Lewis, “Continuum reverberation mapping of the quasar pg 2130+099,” *arXiv e-prints* (November, 2021) [arXiv:2111.07385](#), [arXiv:2111.07385 \[astro-ph.GA\]](#).
- [2590] A. D. A. M. Spallicci, M. Benetti, and S. Capozziello, “The heisenberg limit at cosmological scales,” *Found. Phys.* **52** no. 1, (2022) 23, [arXiv:2112.07359 \[physics.gen-ph\]](#).
- [2591] M. Benetti, L. L. Graef, and S. Vagnozzi, “Primordial gravitational waves from nanograv: a broken power-law approach,” (11, 2021) , [arXiv:2111.04758 \[astro-ph.CO\]](#).
- [2592] M. V. Sazhin, “Opportunities for detecting ultralong gravitational waves,” *Soviet Ast.* **22** (February, 1978) 36–38.
- [2593] S. L. Detweiler, “Pulsar timing measurements and the search for gravitational waves,” *Astrophys. J.* **234** (1979) 1100–1104.
- [2594] R. S. Foster and D. C. Backer, “Constructing a pulsar timing array,” *Astrophys. J.* **361** (Sep, 1990) 300.

- [2595] Z. Ding, H.-J. Seo, Z. Vlah, Y. Feng, M. Schmittfull, and F. Beutler, “Theoretical systematics of future baryon acoustic oscillation surveys,” *Mon. Not. Roy. Astron. Soc.* **479** no. 1, (2018) 1021–1054, [arXiv:1708.01297 \[astro-ph.CO\]](#).
- [2596] D. Spergel *et al.*, “Wide-field infrared survey telescope-astrophysics focused telescope assets wfirst-afta 2015 report,” (3, 2015) , [arXiv:1503.03757 \[astro-ph.IM\]](#).
- [2597] **BOSS** Collaboration, K. S. Dawson *et al.*, “The baryon oscillation spectroscopic survey of sdss-iii,” *Astron. J.* **145** (2013) 10, [arXiv:1208.0022 \[astro-ph.CO\]](#).
- [2598] **LSST Science, LSST Project** Collaboration, P. A. Abell *et al.*, “Lsst science book, version 2.0,” (12, 2009) , [arXiv:0912.0201 \[astro-ph.IM\]](#).
- [2599] K. S. Dawson *et al.*, “The sdss-iv extended baryon oscillation spectroscopic survey: Overview and early data,” *Astron. J.* **151** (2016) 44, [arXiv:1508.04473 \[astro-ph.CO\]](#).
- [2600] **BOSS** Collaboration, A. J. Ross *et al.*, “The clustering of galaxies in the completed sdss-iii baryon oscillation spectroscopic survey: Observational systematics and baryon acoustic oscillations in the correlation function,” *Mon. Not. Roy. Astron. Soc.* **464** no. 1, (2017) 1168–1191, [arXiv:1607.03145 \[astro-ph.CO\]](#).
- [2601] M. Maggiore, “Gravitational wave experiments and early universe cosmology,” *Phys. Rept.* **331** (2000) 283–367, [arXiv:gr-qc/9909001](#).
- [2602] C. Caprini and D. G. Figueroa, “Cosmological backgrounds of gravitational waves,” *Class. Quant. Grav.* **35** no. 16, (2018) 163001, [arXiv:1801.04268 \[astro-ph.CO\]](#).
- [2603] M. Giovannini, “Primordial backgrounds of relic gravitons,” *Prog. Part. Nucl. Phys.* **112** (2020) 103774, [arXiv:1912.07065 \[astro-ph.CO\]](#).
- [2604] **NANOGrav** Collaboration, M. F. Alam *et al.*, “The nanograv 12.5 yr data set: Observations and narrowband timing of 47 millisecond pulsars,” *Astrophys. J. Suppl.* **252** no. 1, (2021) 4, [arXiv:2005.06490 \[astro-ph.HE\]](#).
- [2605] R. Myrzakulov, L. Sebastiani, and S. Vagnozzi, “Inflation in $f(r, \phi)$ -theories and mimetic gravity scenario,” *Eur. Phys. J. C* **75** (2015) 444, [arXiv:1504.07984 \[gr-qc\]](#).
- [2606] S. D. Odintsov, V. K. Oikonomou, and F. P. Fronimos, “Quantitative predictions for $f(r)$ gravity primordial gravitational waves,” *Phys. Dark Univ.* **35** (2022) 100950, [arXiv:2108.11231 \[gr-qc\]](#).
- [2607] D. Cannone, G. Tasinato, and D. Wands, “Generalised tensor fluctuations and inflation,” *JCAP* **01** (2015) 029, [arXiv:1409.6568 \[astro-ph.CO\]](#).
- [2608] L. Graef and R. Brandenberger, “Breaking of spatial diffeomorphism invariance, inflation and the spectrum of cosmological perturbations,” *JCAP* **10** (2015) 009, [arXiv:1506.00896 \[astro-ph.CO\]](#).
- [2609] A. Ricciardone and G. Tasinato, “Primordial gravitational waves in supersolid inflation,” *Phys. Rev. D* **96** no. 2, (2017) 023508, [arXiv:1611.04516 \[astro-ph.CO\]](#).
- [2610] L. L. Graef, M. Benetti, and J. S. Alcaniz, “Constraining the break of spatial diffeomorphism invariance with planck data,” *JCAP* **07** (2017) 013, [arXiv:1705.01961 \[astro-ph.CO\]](#).
- [2611] M. Baldi, F. Finelli, and S. Matarrese, “Inflation with violation of the null energy condition,” *Phys. Rev. D* **72** (2005) 083504, [arXiv:astro-ph/0505552](#).
- [2612] E. Dimastrogiovanni, M. Fasiello, and T. Fujita, “Primordial gravitational waves from axion-gauge fields dynamics,” *JCAP* **01** (2017) 019, [arXiv:1608.04216 \[astro-ph.CO\]](#).
- [2613] I. Obata, “Chiral primordial blue tensor spectra from the axion-gauge couplings,” *JCAP* **06** (2017) 050, [arXiv:1612.08817 \[astro-ph.CO\]](#).

- [2614] J. L. Cook and L. Sorbo, “Particle production during inflation and gravitational waves detectable by ground-based interferometers,” *Phys. Rev. D* **85** (2012) 023534, [arXiv:1109.0022 \[astro-ph.CO\]](#). [Erratum: *Phys.Rev.D* 86, 069901 (2012)].
- [2615] S. Mukohyama, R. Namba, M. Peloso, and G. Shiu, “Blue tensor spectrum from particle production during inflation,” *JCAP* **08** (2014) 036, [arXiv:1405.0346 \[astro-ph.CO\]](#).
- [2616] Y. Cai, Y.-T. Wang, and Y.-S. Piao, “Propagating speed of primordial gravitational waves and inflation,” *Phys. Rev. D* **94** no. 4, (2016) 043002, [arXiv:1602.05431 \[astro-ph.CO\]](#).
- [2617] Y.-F. Cai, C. Lin, B. Wang, and S.-F. Yan, “Sound speed resonance of the stochastic gravitational wave background,” *Phys. Rev. Lett.* **126** no. 7, (2021) 071303, [arXiv:2009.09833 \[gr-qc\]](#).
- [2618] A. Stewart and R. Brandenberger, “Observational constraints on theories with a blue spectrum of tensor modes,” *JCAP* **08** (2008) 012, [arXiv:0711.4602 \[astro-ph\]](#).
- [2619] R. H. Brandenberger, A. Nayeri, and S. P. Patil, “Closed string thermodynamics and a blue tensor spectrum,” *Phys. Rev. D* **90** no. 6, (2014) 067301, [arXiv:1403.4927 \[astro-ph.CO\]](#).
- [2620] W. S. Hipolito-Ricaldi, R. Brandenberger, E. G. M. Ferreira, and L. L. Graef, “Particle production in ekpyrotic scenarios,” *JCAP* **11** (2016) 024, [arXiv:1605.04670 \[hep-th\]](#).
- [2621] S. D. Odintsov, V. K. Oikonomou, and F. P. Fronimos, “Rectifying einstein-gauss-bonnet inflation in view of gw170817,” *Nucl. Phys. B* **958** (2020) 115135, [arXiv:2003.13724 \[gr-qc\]](#).
- [2622] S. D. Odintsov and V. K. Oikonomou, “Swampland implications of gw170817-compatible einstein-gauss-bonnet gravity,” *Phys. Lett. B* **805** (2020) 135437, [arXiv:2004.00479 \[gr-qc\]](#).
- [2623] O. Trivedi, “Swampland conjectures and single field inflation in modified cosmological scenarios,” (8, 2020) , [arXiv:2008.05474 \[hep-th\]](#).
- [2624] V. K. Oikonomou, “Rescaled einstein-hilbert gravity from $f(r)$ gravity: Inflation, dark energy and the swampland criteria,” *Phys. Rev. D* **103** no. 12, (2021) 124028, [arXiv:2012.01312 \[gr-qc\]](#).
- [2625] M. Moresco *et al.*, “Unveiling the universe with emerging cosmological probes,” (1, 2022) , [arXiv:2201.07241 \[astro-ph.CO\]](#).
- [2626] M. Moresco, R. Jimenez, A. Cimatti, and L. Pozzetti, “Constraining the expansion rate of the universe using low-redshift ellipticals as cosmic chronometers,” *JCAP* **03** (2011) 045, [arXiv:1010.0831 \[astro-ph.CO\]](#).
- [2627] E. Lawrence, K. Heitmann, J. Kwan, A. Upadhye, D. Bingham, S. Habib, D. Higdon, A. Pope, H. Finkel, and N. Frontiere, “The mira-titan universe ii: Matter power spectrum emulation,” *Astrophys. J.* **847** no. 1, (2017) 50, [arXiv:1705.03388 \[astro-ph.CO\]](#).
- [2628] **VIRGO Consortium** Collaboration, R. E. Smith, J. A. Peacock, A. Jenkins, S. D. M. White, C. S. Frenk, F. R. Pearce, P. A. Thomas, G. Efstathiou, and H. M. P. Couchmann, “Stable clustering, the halo model and nonlinear cosmological power spectra,” *Mon. Not. Roy. Astron. Soc.* **341** (2003) 1311, [arXiv:astro-ph/0207664](#).
- [2629] R. Takahashi, M. Sato, T. Nishimichi, A. Taruya, and M. Oguri, “Revising the halofit model for the nonlinear matter power spectrum,” *Astrophys. J.* **761** (2012) 152, [arXiv:1208.2701 \[astro-ph.CO\]](#).
- [2630] A. Mead, J. Peacock, C. Heymans, S. Joudaki, and A. Heavens, “An accurate halo model for fitting non-linear cosmological power spectra and baryonic feedback models,” *Mon. Not. Roy. Astron. Soc.* **454** no. 2, (2015) 1958–1975, [arXiv:1505.07833 \[astro-ph.CO\]](#).
- [2631] A. Mead, C. Heymans, L. Lombriser, J. Peacock, O. Steele, and H. Winther, “Accurate halo-model matter power spectra with dark energy, massive neutrinos and modified gravitational forces,” *Mon. Not. Roy. Astron. Soc.* **459** no. 2, (2016) 1468–1488, [arXiv:1602.02154 \[astro-ph.CO\]](#).
- [2632] A. Mead, S. Brieden, T. Tröster, and C. Heymans, “Hmcode-2020: Improved modelling of non-linear cosmological power spectra with baryonic feedback,” (9, 2020) , [arXiv:2009.01858 \[astro-ph.CO\]](#).

- [2633] **Euclid** Collaboration, M. Knabenhans *et al.*, “Euclid preparation: Ii. the euclidemulator – a tool to compute the cosmology dependence of the nonlinear matter power spectrum,” *Mon. Not. Roy. Astron. Soc.* **484** (2019) 5509–5529, [arXiv:1809.04695 \[astro-ph.CO\]](#).
- [2634] **Euclid** Collaboration, M. Knabenhans *et al.*, “Euclid preparation: Ix. euclidemulator2 – power spectrum emulation with massive neutrinos and self-consistent dark energy perturbations,” *Mon. Not. Roy. Astron. Soc.* **505** no. 2, (2021) 2840–2869, [arXiv:2010.11288 \[astro-ph.CO\]](#).
- [2635] K. Heitmann, E. Lawrence, J. Kwan, S. Habib, and D. Higdon, “The coyote universe extended: Precision emulation of the matter power spectrum,” *Astrophys. J.* **780** (2014) 111, [arXiv:1304.7849 \[astro-ph.CO\]](#).
- [2636] R. Arjona, A. Melchiorri, and S. Nesseris, “Testing the Λ cdm paradigm with growth rate data and machine learning,” (7, 2021) , [arXiv:2107.04343 \[astro-ph.CO\]](#).
- [2637] **Euclid** Collaboration, M. Martinelli *et al.*, “Euclid: Forecast constraints on the cosmic distance duality relation with complementary external probes,” *Astron. Astrophys.* **644** (2020) A80, [arXiv:2007.16153 \[astro-ph.CO\]](#).
- [2638] **Euclid** Collaboration, M. Martinelli *et al.*, “Euclid: Constraining dark energy coupled to electromagnetism using astrophysical and laboratory data,” *Astron. Astrophys.* **654** (2021) A148, [arXiv:2105.09746 \[astro-ph.CO\]](#).
- [2639] **Euclid** Collaboration, S. Nesseris *et al.*, “Euclid: Forecast constraints on consistency tests of the Λ cdm model,” (10, 2021) , [arXiv:2110.11421 \[astro-ph.CO\]](#).
- [2640] C. Giunti and T. Lasserre, “ev-scale sterile neutrinos,” *Ann. Rev. Nucl. Part. Sci.* **69** (2019) 163–190, [arXiv:1901.08330 \[hep-ph\]](#).
- [2641] S. Nesseris and A. Shafieloo, “A model independent null test on the cosmological constant,” *Mon. Not. Roy. Astron. Soc.* **408** (2010) 1879–1885, [arXiv:1004.0960 \[astro-ph.CO\]](#).
- [2642] S. Nesseris and J. Garcia-Bellido, “A new perspective on dark energy modeling via genetic algorithms,” *JCAP* **11** (2012) 033, [arXiv:1205.0364 \[astro-ph.CO\]](#).
- [2643] S. Nesseris and J. García-Bellido, “Comparative analysis of model-independent methods for exploring the nature of dark energy,” *Phys. Rev. D* **88** no. 6, (2013) 063521, [arXiv:1306.4885 \[astro-ph.CO\]](#).
- [2644] D. Sapone, E. Majerotto, and S. Nesseris, “Curvature versus distances: Testing the flrw cosmology,” *Phys. Rev. D* **90** no. 2, (2014) 023012, [arXiv:1402.2236 \[astro-ph.CO\]](#).
- [2645] R. Arjona and S. Nesseris, “What can machine learning tell us about the background expansion of the universe?,” *Phys. Rev. D* **101** no. 12, (2020) 123525, [arXiv:1910.01529 \[astro-ph.CO\]](#).
- [2646] R. Arjona and S. Nesseris, “Hints of dark energy anisotropic stress using machine learning,” *JCAP* **11** (2020) 042, [arXiv:2001.11420 \[astro-ph.CO\]](#).
- [2647] R. Arjona, “Machine learning meets the redshift evolution of the cmb temperature,” *JCAP* **08** (2020) 009, [arXiv:2002.12700 \[astro-ph.CO\]](#).
- [2648] C. Bogdanos and S. Nesseris, “Genetic algorithms and supernovae type ia analysis,” *JCAP* **0905** (2009) 006, [arXiv:0903.2805 \[astro-ph.CO\]](#).
- [2649] R. Arjona and S. Nesseris, “Novel null tests for the spatial curvature and homogeneity of the universe and their machine learning reconstructions,” *Phys. Rev. D* **103** no. 10, (2021) 103539, [arXiv:2103.06789 \[astro-ph.CO\]](#).
- [2650] R. Arjona and S. Nesseris, “Machine learning and cosmographic reconstructions of quintessence and the swampland conjectures,” *Phys. Rev. D* **103** no. 6, (2021) 063537, [arXiv:2012.12202 \[astro-ph.CO\]](#).
- [2651] R. Arjona, H.-N. Lin, S. Nesseris, and L. Tang, “Machine learning forecasts of the cosmic distance duality relation with strongly lensed gravitational wave events,” *Phys. Rev. D* **103** no. 10, (2021) 103513, [arXiv:2011.02718 \[astro-ph.CO\]](#).

- [2652] R. Arjona and S. Nesseris, “Complementary consistency test of the copernican principle via noether’s theorem and machine learning forecasts,” *Phys. Rev. D* **104** no. 10, (2021) 103532, [arXiv:2105.09049 \[astro-ph.CO\]](#).
- [2653] S. Abel, D. G. Cerdeño, and S. Robles, “The power of genetic algorithms: what remains of the pmssm?,” (5, 2018) , [arXiv:1805.03615 \[hep-ph\]](#).
- [2654] B. C. Allanach, D. Grellscheid, and F. Quevedo, “Genetic algorithms and experimental discrimination of susy models,” *JHEP* **07** (2004) 069, [arXiv:hep-ph/0406277](#).
- [2655] M. Ho, M. M. Rau, M. Ntampaka, A. Farahi, H. Trac, and B. Poczós, “A robust and efficient deep learning method for dynamical mass measurements of galaxy clusters,” *Astrophys. J.* **887** (2, 2019) 25, [arXiv:1902.05950 \[astro-ph.CO\]](#).
- [2656] V. Rajpaul, “Genetic algorithms in astronomy and astrophysics,” in *56th Annual Conference of the South African Institute of Physics*, pp. 519–524. 2, 2012. [arXiv:1202.1643 \[astro-ph.IM\]](#).
- [2657] Y. Akrami, P. Scott, J. Edsjo, J. Conrad, and L. Bergstrom, “A profile likelihood analysis of the constrained mssm with genetic algorithms,” *JHEP* **04** (2010) 057, [arXiv:0910.3950 \[hep-ph\]](#).
- [2658] M. Wahde and K. J. Donner, “Determination of the orbital parameters of the m 51 system using a genetic algorithm,” *Astron. Astrophys.* **379** (November, 2001) 115–124.
- [2659] E. Lawrence, K. Heitmann, M. White, D. Higdon, C. Wagner, S. Habib, and B. Williams, “The coyote universe iii: Simulation suite and precision emulator for the nonlinear matter power spectrum,” *Astrophys. J.* **713** (2010) 1322–1331, [arXiv:0912.4490 \[astro-ph.CO\]](#).
- [2660] J. Schaye, C. Dalla Vecchia, C. M. Booth, R. P. C. Wiersma, T. Theuns, M. R. Haas, S. Bertone, A. R. Duffy, I. G. McCarthy, and F. van de Voort, “The physics driving the cosmic star formation history,” *Mon. Not. Roy. Astron. Soc.* **402** (2010) 1536, [arXiv:0909.5196 \[astro-ph.CO\]](#).
- [2661] A. M. C. Le Brun, I. G. McCarthy, J. Schaye, and T. J. Ponman, “Towards a realistic population of simulated galaxy groups and clusters,” *Mon. Not. Roy. Astron. Soc.* **441** no. 2, (2014) 1270–1290, [arXiv:1312.5462 \[astro-ph.CO\]](#).
- [2662] I. G. McCarthy, J. Schaye, S. Bird, and A. M. C. Le Brun, “The bahamas project: Calibrated hydrodynamical simulations for large-scale structure cosmology,” *Mon. Not. Roy. Astron. Soc.* **465** no. 3, (2017) 2936–2965, [arXiv:1603.02702 \[astro-ph.CO\]](#).
- [2663] M. P. van Daalen, J. Schaye, C. M. Booth, and C. D. Vecchia, “The effects of galaxy formation on the matter power spectrum: A challenge for precision cosmology,” *Mon. Not. Roy. Astron. Soc.* **415** (2011) 3649–3665, [arXiv:1104.1174 \[astro-ph.CO\]](#).
- [2664] N. E. Chisari, M. L. A. Richardson, J. Devriendt, Y. Dubois, A. Schneider, A. L. Brun, M. C., R. S. Beckmann, S. Peirani, A. Slyz, and C. Pichon, “The impact of baryons on the matter power spectrum from the horizon-agn cosmological hydrodynamical simulation,” *Mon. Not. Roy. Astron. Soc.* **480** no. 3, (2018) 3962–3977, [arXiv:1801.08559 \[astro-ph.CO\]](#).
- [2665] C. Moreno-Pulido and J. Solà Peracaula, “Renormalizing the vacuum energy in cosmological spacetime: implications for the cosmological constant problem,” (1, 2022) , [arXiv:2201.05827 \[gr-qc\]](#).
- [2666] M. Benetti, S. Capozziello, and G. Lambiase, “Updating constraints on $f(t)$ teleparallel cosmology and the consistency with big bang nucleosynthesis,” *Mon. Not. Roy. Astron. Soc.* **500** no. 2, (2020) 1795–1805, [arXiv:2006.15335 \[astro-ph.CO\]](#).
- [2667] N. MacCrann, J. Zuntz, S. Bridle, B. Jain, and M. R. Becker, “Cosmic discordance: Are planck cmb and cfhtlens weak lensing measurements out of tune?,” *Mon. Not. Roy. Astron. Soc.* **451** no. 3, (2015) 2877–2888, [arXiv:1408.4742 \[astro-ph.CO\]](#).
- [2668] R. A. Battye, T. Charnock, and A. Moss, “Tension between the power spectrum of density perturbations measured on large and small scales,” *Phys. Rev. D* **91** no. 10, (2015) 103508, [arXiv:1409.2769 \[astro-ph.CO\]](#).

- [2669] J. G. Rodrigues, M. Benetti, and J. S. Alcaniz, “Possible discrepancies between cosmological and electroweak observables in higgs inflation,” *JHEP* **11** (2021) 091, [arXiv:2105.07009 \[hep-ph\]](#).
- [2670] J. G. Rodrigues, M. Benetti, M. Campista, and J. Alcaniz, “Probing the seesaw mechanism with cosmological data,” *JCAP* **07** (2020) 007, [arXiv:2002.05154 \[astro-ph.CO\]](#).
- [2671] M. Benetti, H. Borges, C. Pigozzo, S. Carneiro, and J. Alcaniz, “Dark sector interactions and the curvature of the universe in light of planck’s 2018 data,” *JCAP* **08** (2021) 014, [arXiv:2102.10123 \[astro-ph.CO\]](#).
- [2672] M. Benetti, W. Miranda, H. A. Borges, C. Pigozzo, S. Carneiro, and J. S. Alcaniz, “Looking for interactions in the cosmological dark sector,” *JCAP* **12** (2019) 023, [arXiv:1908.07213 \[astro-ph.CO\]](#).
- [2673] V. Salzano *et al.*, “J-pas: forecasts on interacting vacuum energy models,” *JCAP* **09** (2021) 033, [arXiv:2102.06417 \[astro-ph.CO\]](#).
- [2674] G. Bargiacchi, G. Risaliti, M. Benetti, S. Capozziello, E. Lusso, A. Saccardi, and M. Signorini, “Cosmography by orthogonalized logarithmic polynomials,” *Astron. Astrophys.* **649** (2021) A65, [arXiv:2101.08278 \[astro-ph.CO\]](#).
- [2675] M. Benetti, S. Santos da Costa, S. Capozziello, J. S. Alcaniz, and M. De Laurentis, “Observational constraints on gauss–bonnet cosmology,” *Int. J. Mod. Phys. D* **27** no. 08, (2018) 1850084, [arXiv:1803.00895 \[gr-qc\]](#).
- [2676] S. Bonoli *et al.*, “The minijpas survey: A preview of the universe in 56 colors,” *Astron. Astrophys.* **653** (2021) A31, [arXiv:2007.01910 \[astro-ph.CO\]](#).
- [2677] N. Frusciante and M. Benetti, “Cosmological constraints on horava gravity revised in light of gw170817 and grb170817a and the degeneracy with massive neutrinos,” *Phys. Rev. D* **103** no. 10, (2021) 104060, [arXiv:2005.14705 \[astro-ph.CO\]](#).
- [2678] M. Benetti, S. Capozziello, and L. L. Graef, “Swampland conjecture in $f(r)$ gravity by the noether symmetry approach,” *Phys. Rev. D* **100** no. 8, (2019) 084013, [arXiv:1905.05654 \[gr-qc\]](#).
- [2679] M. Benetti, L. L. Graef, and J. S. Alcaniz, “Do joint cmb and hst data support a scale invariant spectrum?,” *JCAP* **04** (2017) 003, [arXiv:1702.06509 \[astro-ph.CO\]](#).
- [2680] M. Benetti, M. Gerbino, W. H. Kinney, E. W. Kolb, M. Lattanzi, A. Melchiorri, L. Pagano, and A. Riotto, “Cosmological data and indications for new physics,” *JCAP* **10** (2013) 030, [arXiv:1303.4317 \[astro-ph.CO\]](#).
- [2681] Q. Vigneron, “Is backreaction in cosmology a relativistic effect? on the need for an extension of newton’s theory to non-euclidean topologies,” (9, 2021) , [arXiv:2109.10336 \[gr-qc\]](#).
- [2682] T. Buchert and J. Ehlers, “Averaging inhomogeneous newtonian cosmologies,” *Astron. Astrophys.* **320** (1997) 1–7, [arXiv:astro-ph/9510056](#).
- [2683] S. Rasanen, “Applicability of the linearly perturbed frw metric and newtonian cosmology,” *Phys. Rev. D* **81** (2010) 103512, [arXiv:1002.4779 \[astro-ph.CO\]](#).
- [2684] M. Archidiacono, S. Gariazzo, C. Giunti, S. Hannestad, R. Hansen, M. Laveder, and T. Tram, “Pseudoscalar—sterile neutrino interactions: reconciling the cosmos with neutrino oscillations,” *JCAP* **08** (2016) 067, [arXiv:1606.07673 \[astro-ph.CO\]](#).
- [2685] M. Archidiacono, S. Hannestad, R. S. Hansen, and T. Tram, “Sterile neutrinos with pseudoscalar self-interactions and cosmology,” *Phys. Rev. D* **93** no. 4, (2016) 045004, [arXiv:1508.02504 \[astro-ph.CO\]](#).
- [2686] M. Archidiacono, S. Hannestad, R. S. Hansen, and T. Tram, “Cosmology with self-interacting sterile neutrinos and dark matter - a pseudoscalar model,” *Phys. Rev. D* **91** no. 6, (2015) 065021, [arXiv:1404.5915 \[astro-ph.CO\]](#).

- [2687] T. Clifton, K. Rosquist, and R. Tavakol, “An exact quantification of backreaction in relativistic cosmology,” *Phys. Rev. D* **86** (2012) 043506, [arXiv:1203.6478 \[gr-qc\]](#).
- [2688] V. A. A. Sanghai and T. Clifton, “Post-newtonian cosmological modelling,” *Phys. Rev. D* **91** (2015) 103532, [arXiv:1503.08747 \[gr-qc\]](#). [Erratum: *Phys.Rev.D* 93, 089903 (2016)].
- [2689] R. Briffa, C. Escamilla-Rivera, J. L. Said, J. Mifsud, and N. L. Pulicino, “Impact of h_0 priors on $f(t)$ late time cosmology,” (8, 2021) , [arXiv:2108.03853 \[astro-ph.CO\]](#).
- [2690] G. F. R. Ellis and P. K. S. Dunsby, “Newtonian evolution of the weyl tensor,” *Astrophys. J.* **479** (1997) 97, [arXiv:astro-ph/9410001](#).
- [2691] J. M. M. Senovilla, C. F. Sopuerta, and P. Szekeres, “Theorems on shear free perfect fluids with their newtonian analogs,” *Gen. Rel. Grav.* **30** (1998) 389–411, [arXiv:gr-qc/9702035](#).
- [2692] T. Rainsford, “Anisotropic homogeneous cosmologies in the post-newtonian approximation,” *Gen. Rel. Grav.* **33** (2001) 1047–1076, [arXiv:gr-qc/0007061](#).
- [2693] E. Calabrese *et al.*, “Cosmological parameters from pre-planck cosmic microwave background measurements,” *Phys. Rev. D* **87** no. 10, (2013) 103012, [arXiv:1302.1841 \[astro-ph.CO\]](#).
- [2694] E. Calabrese *et al.*, “Cosmological parameters from pre-planck cmb measurements: a 2017 update,” *Phys. Rev. D* **95** no. 6, (2017) 063525, [arXiv:1702.03272 \[astro-ph.CO\]](#).
- [2695] D. Beck, G. Fabbian, and J. Errard, “Lensing reconstruction in post-born cosmic microwave background weak lensing,” *Phys. Rev. D* **98** no. 4, (2018) 043512, [arXiv:1806.01216 \[astro-ph.CO\]](#).
- [2696] **LiteBIRD** Collaboration, E. Allys *et al.*, “Probing cosmic inflation with the litebird cosmic microwave background polarization survey,” (2, 2022) , [arXiv:2202.02773 \[astro-ph.IM\]](#).
- [2697] **LiteBIRD** Collaboration, M. Hazumi *et al.*, “Litebird: Jaxa’s new strategic l-class mission for all-sky surveys of cosmic microwave background polarization,” *Proc. SPIE Int. Soc. Opt. Eng.* **11443** (2020) 114432F, [arXiv:2101.12449 \[astro-ph.IM\]](#).
- [2698] K. R. Mecke, T. Buchert, and H. Wagner, “Robust morphological measures for large scale structure in the universe,” *Astron. Astrophys.* **288** (1994) 697–704, [arXiv:astro-ph/9312028](#).
- [2699] A. Wiegand, T. Buchert, and M. Ostermann, “Direct minkowski functional analysis of large redshift surveys: a new high-speed code tested on the luminous red galaxy sloan digital sky survey-dr7 catalogue,” *Mon. Not. Roy. Astron. Soc.* **443** no. 1, (2014) 241–259, [arXiv:1311.3661 \[astro-ph.CO\]](#).
- [2700] G. F. R. Ellis and T. Buchert, “The universe seen at different scales,” *Phys. Lett. A* **347** (2005) 38–46, [arXiv:gr-qc/0506106](#).
- [2701] L. Brunswic and T. Buchert, “Gauss–bonnet–chern approach to the averaged universe,” *Class. Quant. Grav.* **37** no. 21, (2020) 215022, [arXiv:2002.08336 \[gr-qc\]](#).
- [2702] M. Korzyński, “Nonlinear effects of general relativity from multiscale structure,” *Class. Quant. Grav.* **32** no. 21, (2015) 215013, [arXiv:1412.3865 \[gr-qc\]](#).
- [2703] T. Buchert, M. J. France, and F. Steiner, “Model-independent analyses of non-gaussianity in planck cmb maps using minkowski functionals,” *Class. Quant. Grav.* **34** no. 9, (2017) 094002, [arXiv:1701.03347 \[astro-ph.CO\]](#).
- [2704] R. Aurich, T. Buchert, M. J. France, and F. Steiner, “The variance of the cmb temperature gradient: a new signature of a multiply connected universe,” *Class. Quant. Grav.* **38** no. 22, (2021) 225005, [arXiv:2106.13205 \[astro-ph.CO\]](#).
- [2705] T. Buchert, A. A. Coley, H. Kleinert, B. F. Roukema, and D. L. Wiltshire, “Observational challenges for the standard flrw model,” *Int. J. Mod. Phys. D* **25** no. 03, (2016) 1630007, [arXiv:1512.03313 \[astro-ph.CO\]](#).

- [2706] G. Alestas, L. Perivolaropoulos, and K. Tanidis, “Constraining a late time transition of g_{eff} using low- z galaxy survey data,” (1, 2022) , [arXiv:2201.05846 \[astro-ph.CO\]](#).
- [2707] L. Perivolaropoulos, “Is the hubble crisis connected with the extinction of dinosaurs?,” (1, 2022) , [arXiv:2201.08997 \[astro-ph.EP\]](#).
- [2708] M. J. Duff, “Observations on conformal anomalies,” *Nucl. Phys. B* **125** (1977) 334–348.
- [2709] N. D. Birrell and P. C. W. Davies, *Quantum Fields in Curved Space*. Cambridge Monographs on Mathematical Physics. Cambridge Univ. Press, Cambridge, UK, 2, 1984.
- [2710] E. Mottola and R. Vaulin, “Macroscopic effects of the quantum trace anomaly,” *Phys. Rev. D* **74** (2006) 064004, [arXiv:gr-qc/0604051](#).
- [2711] M. Giannotti and E. Mottola, “The trace anomaly and massless scalar degrees of freedom in gravity,” *Phys. Rev. D* **79** (2009) 045014, [arXiv:0812.0351 \[hep-th\]](#).
- [2712] E. Mottola, “New horizons in gravity: The trace anomaly, dark energy and condensate stars,” *Acta Phys. Polon. B* **41** (2010) 2031–2162, [arXiv:1008.5006 \[gr-qc\]](#).
- [2713] E. Mottola, “New horizons in gravity: Dark energy and condensate stars,” *J. Phys. Conf. Ser.* **314** (2011) 012010, [arXiv:1107.5086 \[gr-qc\]](#).
- [2714] P. O. Mazur and E. Mottola, “Weyl cohomology and the effective action for conformal anomalies,” *Phys. Rev. D* **64** (2001) 104022, [arXiv:hep-th/0106151](#).
- [2715] E. Mottola, “Scalar gravitational waves in the effective theory of gravity,” *JHEP* **07** (2017) 043, [arXiv:1606.09220 \[gr-qc\]](#). [Erratum: *JHEP* 09, 107 (2017)].
- [2716] C. Coriano, M. M. Maglio, and E. Mottola, “Ttt in cft: Trace identities and the conformal anomaly effective action,” *Nucl. Phys. B* **942** (2019) 303–328, [arXiv:1703.08860 \[hep-th\]](#).
- [2717] I. Antoniadis, P. O. Mazur, and E. Mottola, “Cosmological dark energy: Prospects for a dynamical theory,” *New J. Phys.* **9** (2007) 11, [arXiv:gr-qc/0612068](#).
- [2718] I. Antoniadis and E. Mottola, “4-d quantum gravity in the conformal sector,” *Phys. Rev. D* **45** (1992) 2013–2025.
- [2719] I. Antoniadis, P. O. Mazur, and E. Mottola, “Conformal invariance and cosmic background radiation,” *Phys. Rev. Lett.* **79** (1997) 14–17, [arXiv:astro-ph/9611208](#).
- [2720] I. Antoniadis, P. O. Mazur, and E. Mottola, “Conformal invariance, dark energy, and cmb non-gaussianity,” *JCAP* **09** (2012) 024, [arXiv:1103.4164 \[gr-qc\]](#).
- [2721] A. Aurilia, D. Christodoulou, and F. Legovini, “A classical interpretation of the bag model for hadrons,” *Phys. Lett. B* **73** (1978) 429–432.
- [2722] A. Aurilia and E. Spallucci, “Quantum fluctuations of a constant gauge field,” *Phys. Rev. D* **69** (2004) 105004, [arXiv:hep-th/0402096](#).
- [2723] J. D. Brown and C. Teitelboim, “Neutralization of the cosmological constant by membrane creation,” *Nucl. Phys. B* **297** (1988) 787–836.
- [2724] Y. Akrami, R. Kallosh, A. Linde, and V. Vardanyan, “Dark energy, α -attractors, and large-scale structure surveys,” *JCAP* **06** (2018) 041, [arXiv:1712.09693 \[hep-th\]](#).
- [2725] Y. Akrami, S. Casas, S. Deng, and V. Vardanyan, “Quintessential α -attractor inflation: forecasts for stage iv galaxy surveys,” *JCAP* **04** (2021) 006, [arXiv:2010.15822 \[astro-ph.CO\]](#).
- [2726] Y. Akrami, M. Sasaki, A. R. Solomon, and V. Vardanyan, “Multi-field dark energy: Cosmic acceleration on a steep potential,” *Phys. Lett. B* **819** (2021) 136427, [arXiv:2008.13660 \[astro-ph.CO\]](#).
- [2727] J. R. Eskilt, Y. Akrami, A. R. Solomon, and V. Vardanyan, “Cosmological dynamics of multifield dark energy,” (1, 2022) , [arXiv:2201.08841 \[astro-ph.CO\]](#).

- [2728] **DES** Collaboration, A. Amon *et al.*, “Dark energy survey year 3 results: Cosmology from cosmic shear and robustness to data calibration,” *Phys. Rev. D* **105** no. 2, (2022) 023514, [arXiv:2105.13543](#) [[astro-ph.CO](#)].
- [2729] L. M. Sagis, “Dynamic properties of interfaces in soft matter: Experiments and theory,” *Reviews of Modern Physics* **83** no. 4, (2011) 1367.
- [2730] R. A. L. Jones, R. A. Jones, R. Jones, *et al.*, *Soft condensed matter*, vol. 6. Oxford University Press, 2002.
- [2731] G. D’Amico, N. Kaloper, and A. Westphal, “Very hairy inflation,” (12, 2021) , [arXiv:2112.13861](#) [[hep-th](#)].
- [2732] E. Di Valentino, A. Melchiorri, Y. Fantaye, and A. Heavens, “Bayesian evidence against the harrison-zel’dovich spectrum in tensions with cosmological data sets,” *Phys. Rev. D* **98** no. 6, (2018) 063508, [arXiv:1808.09201](#) [[astro-ph.CO](#)].
- [2733] G. Ye, B. Hu, and Y.-S. Piao, “Implication of the hubble tension for the primordial universe in light of recent cosmological data,” *Phys. Rev. D* **104** no. 6, (2021) 063510, [arXiv:2103.09729](#) [[astro-ph.CO](#)].
- [2734] E. H. Tanin and T. Tenkanen, “Gravitational wave constraints on the observable inflation,” *JCAP* **01** (2021) 053, [arXiv:2004.10702](#) [[astro-ph.CO](#)].
- [2735] F. Takahashi and W. Yin, “Cosmological implications of $n_s \approx 1$ in light of the hubble tension,” (12, 2021) , [arXiv:2112.06710](#) [[astro-ph.CO](#)].
- [2736] A. A. Starobinsky, “A new type of isotropic cosmological models without singularity,” *Phys. Lett. B* **91** (1980) 99–102.
- [2737] **DES** Collaboration, L. F. Secco *et al.*, “Dark energy survey year 3 results: Cosmology from cosmic shear and robustness to modeling uncertainty,” *Phys. Rev. D* **105** no. 2, (2022) 023515, [arXiv:2105.13544](#) [[astro-ph.CO](#)].
- [2738] **KiDS** Collaboration, T. Tröster *et al.*, “Kids-1000 cosmology: Constraints beyond flat Λ cdm,” *Astron. Astrophys.* **649** (2021) A88, [arXiv:2010.16416](#) [[astro-ph.CO](#)].
- [2739] E. N. Saridakis, “Do we need soft cosmology?,” *Phys. Lett. B* **822** (2021) 136649, [arXiv:2105.08646](#) [[astro-ph.CO](#)].
- [2740] E. N. Saridakis, W. Yang, S. Pan, F. K. Anagnostopoulos, and S. Basilakos, “Observational constraints on soft dark energy and soft dark matter: challenging λ cdm,” (12, 2021) , [arXiv:2112.08330](#) [[astro-ph.CO](#)].
- [2741] B. Joachimi *et al.*, “Kids-1000 methodology: Modelling and inference for joint weak gravitational lensing and spectroscopic galaxy clustering analysis,” *Astron. Astrophys.* **646** (2021) A129, [arXiv:2007.01844](#) [[astro-ph.CO](#)].
- [2742] E. McDonough, M.-X. Lin, J. C. Hill, W. Hu, and S. Zhou, “The early dark sector, the hubble tension, and the swampland,” (12, 2021) , [arXiv:2112.09128](#) [[astro-ph.CO](#)].
- [2743] A. La Posta, T. Louis, X. Garrido, and J. C. Hill, “Constraints on pre-recombination early dark energy from spt-3g public data,” (12, 2021) , [arXiv:2112.10754](#) [[astro-ph.CO](#)].
- [2744] D. Kirk *et al.*, “Galaxy alignments: Observations and impact on cosmology,” *Space Sci. Rev.* **193** no. 1-4, (2015) 139–211, [arXiv:1504.05465](#) [[astro-ph.GA](#)].
- [2745] S. W. Henderson *et al.*, “Advanced actpol cryogenic detector arrays and readout,” *J. Low Temp. Phys.* **184** no. 3-4, (2016) 772–779, [arXiv:1510.02809](#) [[astro-ph.IM](#)].
- [2746] S. A. Rodney, G. B. Brammer, J. D. R. Pierel, J. Richard, S. Toft, K. F. O’Connor, M. Akhshik, and K. E. Whitaker, “A gravitationally lensed supernova with an observable two-decade time delay,” *Nature Astron.* **5** no. 11, (2021) 1118–1125, [arXiv:2106.08935](#) [[astro-ph.CO](#)].

- [2747] R. Morgan *et al.*, “Deepzipper: A novel deep learning architecture for lensed supernovae identification,” (12, 2021) , [arXiv:2112.01541](#) [[astro-ph.CO](#)].
- [2748] **Planck** Collaboration, Y. Akrami *et al.*, “Planck 2018 results. ix. constraints on primordial non-gaussianity,” *Astron. Astrophys.* **641** (2020) A9, [arXiv:1905.05697](#) [[astro-ph.CO](#)].
- [2749] E.-K. Li, M. Du, Z.-H. Zhou, H. Zhang, and L. Xu, “Testing the effect of h_0 on $f\sigma_8$ tension using a gaussian process method,” *Mon. Not. Roy. Astron. Soc.* **501** no. 3, (2021) 4452–4463, [arXiv:1911.12076](#) [[astro-ph.CO](#)].
- [2750] F. Avila, A. Bernui, A. Bonilla, and R. C. Nunes, “Inferring $s_8(z)$ and $\gamma(z)$ with cosmic growth rate measurements using machine learning,” (1, 2022) , [arXiv:2201.07829](#) [[astro-ph.CO](#)].
- [2751] X.-J. Zhu, E. J. Howell, D. G. Blair, and Z.-H. Zhu, “On the gravitational wave background from compact binary coalescences in the band of ground-based interferometers,” *Mon. Not. Roy. Astron. Soc.* **431** no. 1, (2013) 882–899, [arXiv:1209.0595](#) [[gr-qc](#)].
- [2752] C. M. F. Mingarelli, S. R. Taylor, B. S. Sathyaprakash, and W. M. Farr, “Understanding $\omega_{\text{gw}}(f)$ in gravitational wave experiments,” (11, 2019) , [arXiv:1911.09745](#) [[gr-qc](#)].
- [2753] A. C. Jenkins, M. Sakellariadou, T. Regimbau, and E. Slezak, “Anisotropies in the astrophysical gravitational-wave background: Predictions for the detection of compact binaries by ligo and virgo,” *Phys. Rev. D* **98** no. 6, (2018) 063501, [arXiv:1806.01718](#) [[astro-ph.CO](#)].
- [2754] **LIGO Scientific, Virgo** Collaboration, B. P. Abbott *et al.*, “Search for the isotropic stochastic background using data from advanced ligo’s second observing run,” *Phys. Rev. D* **100** no. 6, (2019) 061101, [arXiv:1903.02886](#) [[gr-qc](#)].
- [2755] **BICEP2, Keck Array** Collaboration, P. A. R. Ade *et al.*, “Bicep2 / keck array x: Constraints on primordial gravitational waves using planck, wmap, and new bicep2/keck observations through the 2015 season,” *Phys. Rev. Lett.* **121** (2018) 221301, [arXiv:1810.05216](#) [[astro-ph.CO](#)].
- [2756] N. Dalal, D. E. Holz, S. A. Hughes, and B. Jain, “Short grb and binary black hole standard sirens as a probe of dark energy,” *Phys. Rev. D* **74** (2006) 063006, [arXiv:astro-ph/0601275](#).
- [2757] J. M. Ezquiaga and D. E. Holz, “Jumping the gap: Searching for ligo’s biggest black holes,” *Astrophys. J. Lett.* **909** no. 2, (2021) L23, [arXiv:2006.02211](#) [[astro-ph.HE](#)].
- [2758] K. Pardo, M. Fishbach, D. E. Holz, and D. N. Spergel, “Limits on the number of spacetime dimensions from gw170817,” *JCAP* **07** (2018) 048, [arXiv:1801.08160](#) [[gr-qc](#)].
- [2759] J. Antoniadis *et al.*, “The international pulsar timing array second data release: Search for an isotropic gravitational wave background,” *Mon. Not. Roy. Astron. Soc.* **510** no. 4, (2022) 4873, [arXiv:2201.03980](#) [[astro-ph.HE](#)].
- [2760] D. Chatterjee, A. H. K. R., G. Holder, D. E. Holz, S. Perkins, K. Yagi, and N. Yunes, “Cosmology with love: Measuring the hubble constant using neutron star universal relations,” *Phys. Rev. D* **104** no. 8, (2021) 083528, [arXiv:2106.06589](#) [[gr-qc](#)].
- [2761] C. Messenger and J. Read, “Measuring a cosmological distance-redshift relationship using only gravitational wave observations of binary neutron star coalescences,” *Phys. Rev. Lett.* **108** (2012) 091101, [arXiv:1107.5725](#) [[gr-qc](#)].
- [2762] F. Xu, J. M. a. Ezquiaga, and D. E. Holz, “Please repeat: Strong lensing of gravitational waves as a probe of compact binary and galaxy populations,” (5, 2021) , [arXiv:2105.14390](#) [[astro-ph.CO](#)].
- [2763] **LIGO Scientific, Virgo** Collaboration, M. Fishbach *et al.*, “A standard siren measurement of the hubble constant from gw170817 without the electromagnetic counterpart,” *Astrophys. J. Lett.* **871** no. 1, (2019) L13, [arXiv:1807.05667](#) [[astro-ph.CO](#)].
- [2764] **CMB-S4** Collaboration, K. Abazajian *et al.*, “Cmb-s4: Forecasting constraints on primordial gravitational waves,” *Astrophys. J.* **926** no. 1, (2022) 54, [arXiv:2008.12619](#) [[astro-ph.CO](#)].

- [2765] B. Li and P. R. Shapiro, “Precision cosmology and the stiff-amplified gravitational-wave background from inflation: Nanograv, advanced ligo-virgo and the hubble tension,” *JCAP* **10** (2021) 024, [arXiv:2107.12229 \[astro-ph.CO\]](#).
- [2766] L. R. Colaço, R. F. L. Holanda, and R. C. Nunes, “Varying- α in scalar-tensor theory: Implications in light of the supernova absolute magnitude tension and forecast from gw standard sirens,” (1, 2022) , [arXiv:2201.04073 \[astro-ph.CO\]](#).
- [2767] A. Allahyari, R. C. Nunes, and D. F. Mota, “No slip gravity in light of lisa standard sirens,” (10, 2021) , [arXiv:2110.07634 \[astro-ph.CO\]](#).
- [2768] R. w. Hellings and G. s. Downs, “Upper limits on the isotropic gravitational radiation background from pulsar timing analysis,” *Astrophys. J. Lett.* **265** (1983) L39–L42.
- [2769] D. P. Mihaylov, C. J. Moore, J. R. Gair, A. Lasenby, and G. Gilmore, “Astrometric effects of gravitational wave backgrounds with non-einsteinian polarizations,” *Phys. Rev. D* **97** no. 12, (2018) 124058, [arXiv:1804.00660 \[gr-qc\]](#).
- [2770] W. Qin, K. K. Boddy, M. Kamionkowski, and L. Dai, “Pulsar-timing arrays, astrometry, and gravitational waves,” *Phys. Rev. D* **99** no. 6, (2019) 063002, [arXiv:1810.02369 \[astro-ph.CO\]](#).
- [2771] D. P. Mihaylov, C. J. Moore, J. Gair, A. Lasenby, and G. Gilmore, “Astrometric effects of gravitational wave backgrounds with nonluminal propagation speeds,” *Phys. Rev. D* **101** no. 2, (2020) 024038, [arXiv:1911.10356 \[gr-qc\]](#).
- [2772] W. Qin, K. K. Boddy, and M. Kamionkowski, “Subluminal stochastic gravitational waves in pulsar-timing arrays and astrometry,” *Phys. Rev. D* **103** no. 2, (2021) 024045, [arXiv:2007.11009 \[gr-qc\]](#).
- [2773] **Theia** Collaboration, C. Boehm *et al.*, “Theia: Faint objects in motion or the new astrometry frontier,” (7, 2017) , [arXiv:1707.01348 \[astro-ph.IM\]](#).
- [2774] V. B. Braginsky, N. S. Kardashev, I. D. Novikov, and A. G. Polnarev, “Propagation of electromagnetic radiation in a random field of gravitational waves and space radio interferometry,” *Nuovo Cim. B* **105** (1990) 1141–1158.
- [2775] N. Kaiser and A. H. Jaffe, “Bending of light by gravity waves,” *Astrophys. J.* **484** (1997) 545–554, [arXiv:astro-ph/9609043](#).
- [2776] L. G. Book and E. E. Flanagan, “Astrometric effects of a stochastic gravitational wave background,” *Phys. Rev. D* **83** (2011) 024024, [arXiv:1009.4192 \[astro-ph.CO\]](#).
- [2777] J. Darling, A. E. Truebenbach, and J. Paine, “Astrometric limits on the stochastic gravitational wave background,” *Astrophys. J.* **861** no. 2, (2018) 113, [arXiv:1804.06986 \[astro-ph.IM\]](#).
- [2778] **NANOGrav** Collaboration, Z. Arzoumanian *et al.*, “The nanograv 12.5 yr data set: Search for an isotropic stochastic gravitational-wave background,” *Astrophys. J. Lett.* **905** no. 2, (2020) L34, [arXiv:2009.04496 \[astro-ph.HE\]](#).
- [2779] B. Goncharov *et al.*, “On the evidence for a common-spectrum process in the search for the nanohertz gravitational-wave background with the parkes pulsar timing array,” *Astrophys. J. Lett.* **917** no. 2, (2021) L19, [arXiv:2107.12112 \[astro-ph.HE\]](#).
- [2780] S. Chen *et al.*, “Common-red-signal analysis with 24-yr high-precision timing of the european pulsar timing array: inferences in the stochastic gravitational-wave background search,” *Mon. Not. Roy. Astron. Soc.* **508** no. 4, (2021) 4970–4993, [arXiv:2110.13184 \[astro-ph.HE\]](#).
- [2781] S. Aiola, B. Wang, A. Kosowsky, T. Kahniashvili, and H. Firouzjahi, “Microwave background correlations from dipole anisotropy modulation,” *Phys. Rev. D* **92** (2015) 063008, [arXiv:1506.04405 \[astro-ph.CO\]](#).

- [2782] L. Van Waerbeke, M. White, H. Hoekstra, and C. Heymans, “Redshift and shear calibration: Impact on cosmic shear studies and survey design,” *Astropart. Phys.* **26** (2006) 91–101, [arXiv:astro-ph/0603696](#).
- [2783] D. Huterer, M. Takada, G. Bernstein, and B. Jain, “Systematic errors in future weak lensing surveys: Requirements and prospects for self-calibration,” *Mon. Not. Roy. Astron. Soc.* **366** (2006) 101–114, [arXiv:astro-ph/0506030](#).
- [2784] **LSST Dark Energy Science** Collaboration, R. Mandelbaum *et al.*, “The lsst dark energy science collaboration (desc) science requirements document,” (9, 2018) , [arXiv:1809.01669 \[astro-ph.CO\]](#).
- [2785] M. Lima, C. E. Cunha, H. Oyaizu, J. Frieman, H. Lin, and E. S. Sheldon, “Estimating the redshift distribution of faint galaxy samples,” *Mon. Not. Roy. Astron. Soc.* **390** (2008) 118, [arXiv:0801.3822 \[astro-ph\]](#).
- [2786] D. Masters *et al.*, “Mapping the galaxy color–redshift relation: Optimal photometric redshift calibration strategies for cosmology surveys,” *Astrophys. J.* **813** no. 1, (2015) 53, [arXiv:1509.03318 \[astro-ph.CO\]](#).
- [2787] A. H. Wright, H. Hildebrandt, J. L. van den Busch, and C. Heymans, “Photometric redshift calibration with self-organising maps,” *Astron. Astrophys.* **637** (2020) A100, [arXiv:1909.09632 \[astro-ph.CO\]](#).
- [2788] **DES** Collaboration, R. Buchs *et al.*, “Phenotypic redshifts with self-organizing maps: A novel method to characterize redshift distributions of source galaxies for weak lensing,” *Mon. Not. Roy. Astron. Soc.* **489** no. 1, (2019) 820–841, [arXiv:1901.05005 \[astro-ph.CO\]](#).
- [2789] **DES** Collaboration, J. Myles *et al.*, “Dark energy survey year 3 results: redshift calibration of the weak lensing source galaxies,” *Mon. Not. Roy. Astron. Soc.* **505** no. 3, (2021) 4249–4277, [arXiv:2012.08566 \[astro-ph.CO\]](#).
- [2790] **Euclid** Collaboration, S. A. Stanford *et al.*, “Euclid preparation. xiv. the complete calibration of the color–redshift relation (c3r2) survey: Data release 3,” *Astrophys. J. Supp.* **256** no. 1, (2021) 9, [arXiv:2106.11367 \[astro-ph.CO\]](#).
- [2791] M. Tanaka, J. Coupon, B.-C. Hsieh, S. Mineo, A. J. Nishizawa, J. Speagle, H. Furusawa, S. Miyazaki, and H. Murayama, “Photometric redshifts for hyper supprime-cam subaru strategic program data release 1,” *Publ. Astron. Soc. Jap.* **70** no. SP1, (2018) S9, [arXiv:1704.05988 \[astro-ph.GA\]](#).
- [2792] **DES** Collaboration, B. Hoyle *et al.*, “Dark energy survey year 1 results: Redshift distributions of the weak lensing source galaxies,” *Mon. Not. Roy. Astron. Soc.* **478** no. 1, (2018) 592–610, [arXiv:1708.01532 \[astro-ph.CO\]](#).
- [2793] D. Masters, D. Stern, J. Cohen, P. Capak, J. Rhodes, F. Castander, and S. Paltani, “The complete calibration of the color–redshift relation (c3r2) survey: Survey overview and data release 1,” *Astrophys. J.* **841** no. 2, (2017) 111, [arXiv:1704.06665 \[astro-ph.CO\]](#).
- [2794] D. C. Masters *et al.*, “The complete calibration of the color–redshift relation (c3r2) survey: Analysis and data release 2,” *Astrophys. J.* **877** no. 2, (2019) 81, [arXiv:1904.06394 \[astro-ph.GA\]](#).
- [2795] **Euclid** Collaboration, V. Guglielmo *et al.*, “Euclid preparation - viii. the complete calibration of the colour–redshift relation survey: Vlt/kmos observations and data release,” *Astron. Astrophys.* **642** (2020) A192, [arXiv:2007.02631 \[astro-ph.GA\]](#).
- [2796] D. Gruen and F. Brimiouille, “Selection biases in empirical $p(z)$ methods for weak lensing,” *Mon. Not. Roy. Astron. Soc.* **468** no. 1, (2017) 769–782, [arXiv:1610.01160 \[astro-ph.CO\]](#).
- [2797] J. A. Newman *et al.*, “Spectroscopic needs for imaging dark energy experiments,” *Astropart. Phys.* **63** (2015) 81–100, [arXiv:1309.5384 \[astro-ph.CO\]](#). [Erratum: *Astropart. Phys.* 65, 112–113 (2015)].
- [2798] J. A. Newman, “Calibrating redshift distributions beyond spectroscopic limits with cross-correlations,” *Astrophys. J.* **684** (2008) 88, [arXiv:0805.1409 \[astro-ph\]](#).

- [2799] J. L. van den Busch, H. Hildebrandt, A. H. Wright, C. B. Morrison, C. Blake, B. Joachimi, T. Erben, C. Heymans, K. Kuijken, and E. N. Taylor, “Testing kids cross-correlation redshifts with simulations,” *Astron. Astrophys.* **642** (2020) A200, [arXiv:2007.01846 \[astro-ph.CO\]](#).
- [2800] H. Hildebrandt *et al.*, “Kids-1000 catalogue: Redshift distributions and their calibration,” *Astron. Astrophys.* **647** (2021) A124, [arXiv:2007.15635 \[astro-ph.CO\]](#).
- [2801] C. B. Morrison, H. Hildebrandt, S. J. Schmidt, I. K. Baldry, M. Bilicki, A. Choi, T. Erben, and P. Schneider, “The-wizz: Clustering redshift estimation for everyone,” *Mon. Not. Roy. Astron. Soc.* **467** no. 3, (2017) 3576–3589, [arXiv:1609.09085 \[astro-ph.CO\]](#).
- [2802] **DES** Collaboration, M. Gatti *et al.*, “Dark energy survey year 3 results: Clustering redshifts – calibration of the weak lensing source redshift distributions with redmagic and boss/eboss,” *Mon. Not. Roy. Astron. Soc.* **510** no. 1, (2022) 1223–1247, [arXiv:2012.08569 \[astro-ph.CO\]](#).
- [2803] A. Alarcon, C. Sánchez, G. M. Bernstein, and E. Gaztañaga, “Redshift inference from the combination of galaxy colours and clustering in a hierarchical bayesian model – application to realistic n-body simulations,” *Mon. Not. Roy. Astron. Soc.* **498** no. 2, (2020) 2614–2631, [arXiv:1910.07127 \[astro-ph.CO\]](#).
- [2804] C. Sánchez and G. M. Bernstein, “Redshift inference from the combination of galaxy colours and clustering in a hierarchical bayesian model,” *Mon. Not. Roy. Astron. Soc.* **483** no. 2, (2019) 2801–2813, [arXiv:1807.11873 \[astro-ph.CO\]](#).
- [2805] A. H. Wright, H. Hildebrandt, J. L. van den Busch, C. Heymans, B. Joachimi, A. Kannawadi, and K. Kuijken, “Kids+viking-450: Improved cosmological parameter constraints from redshift calibration with self-organising maps,” *Astron. Astrophys.* **640** (2020) L14, [arXiv:2005.04207 \[astro-ph.CO\]](#).
- [2806] **DES** Collaboration, W. G. Hartley *et al.*, “The impact of spectroscopic incompleteness in direct calibration of redshift distributions for weak lensing surveys,” *Mon. Not. Roy. Astron. Soc.* **496** no. 4, (2020) 4769–4786, [arXiv:2003.10454 \[astro-ph.GA\]](#).
- [2807] A. J. Nishizawa, B.-C. Hsieh, M. Tanaka, and T. Takata, “Photometric redshifts for the hyper supprime-cam subaru strategic program data release 2,” (2, 2020) , [arXiv:2003.01511 \[astro-ph.GA\]](#).
- [2808] N. Kaiser, G. Squires, and T. J. Broadhurst, “A method for weak lensing observations,” *Astrophys. J.* **449** (1995) 460–475, [arXiv:astro-ph/9411005](#).
- [2809] P. Melchior and M. Viola, “Means of confusion: how pixel noise affects shear estimates for weak gravitational lensing,” *Mon. Not. Roy. Astron. Soc.* **424** (2012) 2757, [arXiv:1204.5147 \[astro-ph.IM\]](#).
- [2810] L. Miller *et al.*, “Bayesian galaxy shape measurement for weak lensing surveys - iii. application to the canada-france-hawaii telescope lensing survey,” *Mon. Not. Roy. Astron. Soc.* **429** (2013) 2858–2880, [arXiv:1210.8201 \[astro-ph.CO\]](#).
- [2811] H. Hoekstra, A. Kannawadi, and T. D. Kitching, “Accounting for object detection bias in weak gravitational lensing studies,” *Astron. Astrophys.* **646** (2021) A124, [arXiv:2010.04178 \[astro-ph.CO\]](#).
- [2812] C. Heymans *et al.*, “The shear testing programme. 1. weak lensing analysis of simulated ground-based observations,” *Mon. Not. Roy. Astron. Soc.* **368** (2006) 1323–1339, [arXiv:astro-ph/0506112](#).
- [2813] **SNAP** Collaboration, J. Rhodes, A. Leauthaud, C. Stoughton, R. Massey, K. Dawson, W. Kolbe, and N. Roe, “The effects of charge transfer inefficiency (cti) on galaxy shape measurements,” *Publ. Astron. Soc. Pac.* **122** (2010) 439–450, [arXiv:1002.1479 \[astro-ph.IM\]](#).
- [2814] D. Gruen, G. M. Bernstein, M. Jarvis, B. Rowe, V. Vikram, A. A. Plazas, and S. Seitz, “Characterization and correction of charge-induced pixel shifts in decam,” *JINST* **10** no. 05, (2015) C05032, [arXiv:1501.02802 \[astro-ph.IM\]](#).
- [2815] R. Massey *et al.*, “The shear testing programme 2: Factors affecting high precision weak lensing analyses,” *Mon. Not. Roy. Astron. Soc.* **376** (2007) 13–38, [arXiv:astro-ph/0608643](#).

- [2816] S. Bridle *et al.*, “Results of the great08 challenge: An image analysis competition for cosmological lensing,” *Mon. Not. Roy. Astron. Soc.* **405** (2010) 2044, [arXiv:0908.0945 \[astro-ph.CO\]](#).
- [2817] E. Ozulker, “Is the dark energy equation of state parameter singular?,” (3, 2022) , [arXiv:2203.04167 \[astro-ph.CO\]](#).
- [2818] S. Adhikari, “The hubble tension in the non-flat super- λ cdm model,” (3, 2022) , [arXiv:2203.04835 \[astro-ph.CO\]](#).
- [2819] T. D. Kitching *et al.*, “Image analysis for cosmology: Results from the great10 galaxy challenge,” *Mon. Not. Roy. Astron. Soc.* **423** (2012) 3163, [arXiv:1202.5254 \[astro-ph.CO\]](#).
- [2820] R. Mandelbaum *et al.*, “Great3 results – i. systematic errors in shear estimation and the impact of real galaxy morphology,” *Mon. Not. Roy. Astron. Soc.* **450** no. 3, (2015) 2963–3007, [arXiv:1412.1825 \[astro-ph.CO\]](#).
- [2821] B. Rowe *et al.*, “Galsim: The modular galaxy image simulation toolkit,” (7, 2014) , [arXiv:1407.7676 \[astro-ph.IM\]](#).
- [2822] I. Fenech Conti, R. Herbonnet, H. Hoekstra, J. Merten, L. Miller, and M. Viola, “Calibration of weak-lensing shear in the kilo-degree survey,” *Mon. Not. Roy. Astron. Soc.* **467** no. 2, (2017) 1627–1651, [arXiv:1606.05337 \[astro-ph.CO\]](#).
- [2823] A. Kannawadi *et al.*, “Towards emulating cosmic shear data: Revisiting the calibration of the shear measurements for the kilo-degree survey,” *Astron. Astrophys.* **624** (2019) A92, [arXiv:1812.03983 \[astro-ph.CO\]](#).
- [2824] H. Hoekstra, M. Viola, and R. Herbonnet, “A study of the sensitivity of shape measurements to the input parameters of weak lensing image simulations,” *Mon. Not. Roy. Astron. Soc.* **468** no. 3, (2017) 3295–3311, [arXiv:1609.03281 \[astro-ph.CO\]](#).
- [2825] R. Mandelbaum *et al.*, “Weak lensing shear calibration with simulations of the hsc survey,” *Mon. Not. Roy. Astron. Soc.* **481** no. 3, (2018) 3170–3195, [arXiv:1710.00885 \[astro-ph.CO\]](#).
- [2826] C. Bruderer, C. Chang, A. Refregier, A. Amara, J. Berge, and L. Gamper, “Calibrated ultra fast image simulations for the dark energy survey,” *Astrophys. J.* **817** no. 1, (2016) 25, [arXiv:1504.02778 \[astro-ph.CO\]](#).
- [2827] D. O. Jones *et al.*, “Cosmological results from the raisin survey: Using type ia supernovae in the near infrared as a novel path to measure the dark energy equation of state,” (1, 2022) , [arXiv:2201.07801 \[astro-ph.CO\]](#).
- [2828] S. Dhawan *et al.*, “A uniform type ia supernova distance ladder with the zwicky transient facility: Absolute calibration based on the tip of the red giant branch (trgb) method,” (3, 2022) , [arXiv:2203.04241 \[astro-ph.CO\]](#).
- [2829] A. Chudaykin, D. Gorbunov, and N. Nedelko, “Exploring λ cdm extensions with spt-3g and planck data: 4σ evidence for neutrino masses, full resolution of the hubble crisis by dark energy with phantom crossing, and all that,” (3, 2022) , [arXiv:2203.03666 \[astro-ph.CO\]](#).
- [2830] **DES** Collaboration, N. MacCrann *et al.*, “Dark energy survey y3 results: blending shear and redshift biases in image simulations,” *Mon. Not. Roy. Astron. Soc.* **509** no. 3, (2021) 3371–3394, [arXiv:2012.08567 \[astro-ph.CO\]](#).
- [2831] E. Huff and R. Mandelbaum, “Metacalibration: Direct self-calibration of biases in shear measurement,” (2, 2017) , [arXiv:1702.02600 \[astro-ph.CO\]](#).
- [2832] E. S. Sheldon and E. M. Huff, “Practical weak lensing shear measurement with metacalibration,” *Astrophys. J.* **841** no. 1, (2017) 24, [arXiv:1702.02601 \[astro-ph.CO\]](#).
- [2833] E. S. Sheldon, M. R. Becker, N. MacCrann, and M. Jarvis, “Mitigating shear-dependent object detection biases with metacalibration,” *Astrophys. J.* **902** no. 2, (2020) 138, [arXiv:1911.02505 \[astro-ph.CO\]](#).

- [2834] A. Kannawadi, E. Rosenberg, and H. Hoekstra, “Mitigating the effects of undersampling in weak lensing shear estimation with metacalibration,” *Mon. Not. Roy. Astron. Soc.* **502** no. 3, (2021) 4048–4063, [arXiv:2010.04164 \[astro-ph.IM\]](#).
- [2835] H. Hoekstra, “A fully data-driven algorithm for accurate shear estimation,” *Astron. Astrophys.* **656** (2021) A135, [arXiv:2108.10057 \[astro-ph.CO\]](#).
- [2836] M. Evans *et al.*, “A horizon study for cosmic explorer: Science, observatories, and community,” (9, 2021) , [arXiv:2109.09882 \[astro-ph.IM\]](#).
- [2837] K. Jani and A. Loeb, “Gravitational-wave lunar observatory for cosmology,” (7, 2020) , [arXiv:2007.08550 \[gr-qc\]](#).
- [2838] O. Fabre, S. Prunet, and J.-P. Uzan, “Topology beyond the horizon: How far can it be probed?,” *Phys. Rev. D* **92** no. 4, (August, 2015) 043003, [arXiv:1311.3509 \[astro-ph.CO\]](#).
- [2839] P. Petersen, Y. Akrami, C. J. Copi, A. H. Jaffe, A. Kosowsky, G. D. Starkman, A. Tamosiunas, J. R. Eskilt, Ö. Güngör, S. Saha, Q. Taylor, and Compact Collaboration, “Cosmic topology. part i. limits on orientable euclidean manifolds from circle searches,” *JCAP* **2023** no. 1, (January, 2023) 030, [arXiv:2211.02603 \[astro-ph.CO\]](#).
- [2840] P. Petersen and the COMPACT collaboration, “Cosmic topology. part i. limits on non-orientable euclidean manifolds from circle searches.” in preparation, 2023.
- [2841] J. R. Eskilt and the COMPACT collaboration, “Eigenmodes and correlation matrices of orientable euclidean manifolds.” in preparation, 2023.
- [2842] S. Anselmi and the COMPACT collaboration, “Topological correlations from observations of large-scale structure.” in preparation, 2023.
- [2843] N. J. Cornish, D. N. Spergel, and G. D. Starkman, “Circles in the sky: Finding topology with the microwave background radiation,” (2, 1996) , [arXiv:gr-qc/9602039](#).
- [2844] N. J. Cornish, D. Spergel, and G. Starkman, “Can cobe see the shape of the universe?,” *Phys. Rev. D* **57** (1998) 5982–5996, [arXiv:astro-ph/9708225](#).
- [2845] N. J. Cornish, D. N. Spergel, and G. D. Starkman, “Measuring the topology of the universe,” *Proc. Nat. Acad. Sci.* **95** (1998) 82, [arXiv:astro-ph/9708083](#).
- [2846] P. M. Vaudrevange, G. D. Starkman, N. J. Cornish, and D. N. Spergel. Private communication, 2013.
- [2847] “Flying fish (no. 73), 1949 by maurits cornelis escher: History, analysis & facts.” https://arthive.com/escher/works/200144~Flying_Fish_No_73.
- [2848] R. Lehoucq, M. Lachieze-Rey, and J. P. Luminet, “Cosmic crystallography,” *Astron. Astrophys.* **313** (1996) 339–346, [arXiv:gr-qc/9604050](#).
- [2849] H. Fujii and Y. Yoshii, “A search for nontoroidal topological lensing in the sloan digital sky survey quasar catalog,” *Astrophys. J.* **773** (2013) 152, [arXiv:1306.2737 \[astro-ph.CO\]](#).
- [2850] H. Fujii and Y. Yoshii, “An improved cosmic crystallography method to detect holonomies in flat spaces,” *Astron. Astrophys.* **529** (2011) A121, [arXiv:1103.1466 \[astro-ph.CO\]](#).
- [2851] J. R. Eskilt and the COMPACT collaboration, “Eigenmodes and correlation matrices of euclidean manifolds.” in preparation, 2022.
- [2852] **COMPACT** Collaboration, J. R. Eskilt *et al.*, “Cosmic topology. part iia. eigenmodes, correlation matrices, and detectability of orientable euclidean manifolds,” *JCAP* **03** (2024) 036, [arXiv:2306.17112 \[astro-ph.CO\]](#).
- [2853] W. P. Thurston, “Three dimensional manifolds, kleinian groups and hyperbolic geometry,” *Bulletin of the American Mathematical Society* **6** (1982) 357–381.

- [2854] S. Hawking, “Spacetime foam,” *Nuclear Physics B* **144** no. 2, (1978) 349–362.
<https://www.sciencedirect.com/science/article/pii/0550321378903759>.
- [2855] P. Petersen, Y. Akrami, C. J. Copi, A. H. Jaffe, A. Kosowsky, G. D. Starkman, A. Tamosiunas, J. R. Eskilt, O. Güngör, S. Saha, Q. Taylor, and T. C. collaboration, “Cosmic topology. part i. limits on orientable euclidean manifolds from circle searches,” *Journal of Cosmology and Astroparticle Physics* **2023** no. 01, (Jan, 2023) 030. <https://dx.doi.org/10.1088/1475-7516/2023/01/030>.
- [2856] Y. Akrami, S. Anselmi, C. J. Copi, J. R. Eskilt, A. H. Jaffe, A. Kosowsky, P. Petersen, G. D. Starkman, K. González-Quesada, O. Güngör, S. Saha, A. Tamosiunas, Q. Taylor, and V. Vardanyan, “The search for the topology of the universe has just begun,” [arXiv:2210.11426](https://arxiv.org/abs/2210.11426) [[astro-ph.CO](#)].
- [2857] A. Einstein, “The foundation of the general theory of relativity,” *Annalen Phys.* **49** no. 7, (1916) 769–822.
- [2858] A. Einstein, “Cosmological considerations in the general theory of relativity,” *Sitzungsber. Preuss. Akad. Wiss. Berlin (Math. Phys.)* **1917** (1917) 142–152.
- [2859] W. De Sitter, “On the relativity of inertia. remarks concerning einsteins latest hypothesis,” *Proc. Kon. Ned. Acad. Wet* **19** no. 2, (1917) 1217–1225.
- [2860] E. Abdalla *et al.*, “Cosmology intertwined: A review of the particle physics, astrophysics, and cosmology associated with the cosmological tensions and anomalies,” *JHEAp* **34** (2022) 49–211, [arXiv:2203.06142](https://arxiv.org/abs/2203.06142) [[astro-ph.CO](#)].
- [2861] A. Riazuelo, J. Weeks, J.-P. Uzan, R. Lehoucq, and J.-P. Luminet, “Cosmic microwave background anisotropies in multi-connected flat spaces,” *Phys. Rev. D* **69** (2004) 103518, [arXiv:astro-ph/0311314](https://arxiv.org/abs/astro-ph/0311314).
- [2862] S. Lam, A. Pitrou, and S. Seibert, “Numba: a llvm-based python jit compiler,” pp. 1–6. 11, 2015.
- [2863] G. Perelman, “The entropy formula for the ricci flow and its geometric applications,” 2002.
- [2864] G. Perelman, “Ricci flow with surgery on three-manifolds,” 2003.
- [2865] R. Courant and D. Hilbert, *Methods of mathematical physics, volume 2*. John Wiley & Sons, 2024.
- [2866] A. Zee, *Group Theory in a Nutshell for Physicists*. Princeton University Press, Princeton, NJ, 2016.
- [2867] I. Chavel, *Eigenvalues in Riemannian Geometry*, vol. 115 of *Pure and Applied Mathematics*. Academic Press, Orlando, FL, 1984.
- [2868] **Cosmoglobe** Collaboration, J. R. Eskilt *et al.*, “Cosmoglobe dr1 results - ii. constraints on isotropic cosmic birefringence from reprocessed wmap and planck lfi data,” *Astron. Astrophys.* **679** (2023) A144, [arXiv:2305.02268](https://arxiv.org/abs/2305.02268) [[astro-ph.CO](#)].
- [2869] S. Anselmi, M. F. Carney, J. T. Giblin, S. Kumar, J. B. Mertens, M. O’Dwyer, G. D. Starkman, and C. Tian, “What is flat Λ cdm, and may we choose it?,” *JCAP* **02** (2023) 049, [arXiv:2207.06547](https://arxiv.org/abs/2207.06547) [[astro-ph.CO](#)].
- [2870] M. Lachieze-Rey and J. Luminet, “Cosmic topology,” *Phys. Rep.* **254** (March, 1995) 135–214, [arXiv:gr-qc/9605010](https://arxiv.org/abs/gr-qc/9605010) [[gr-qc](#)].
- [2871] J.-P. Luminet and B. F. Roukema, “Topology of the universe: Theory and observation,” in *Theoretical and Observational Cosmology*, M. Lachieze-Rey, ed., vol. 541 of *NATO Advanced Study Institute (ASI) Series C*, p. 117. January, 1999. [arXiv:astro-ph/9901364](https://arxiv.org/abs/astro-ph/9901364) [[astro-ph](#)].
- [2872] D. D. Sokolov and V. F. Shvartsman, “An estimate of the size of the universe from a topological point of view,” *Soviet Journal of Experimental and Theoretical Physics* **39** (1974) 196.
- [2873] L.-Z. Fang and H. Sato, “Is the periodicity in the distribution of quasar redshifts an evidence of multiply connected universe,” *Communications in Theoretical Physics* **2** (1983) 1055.
- [2874] H. V. Fagundes and U. F. Wichoski, “A search for qos to fit a cosmological model with flat, closed spatial sections,” *Astrophys. J. Lett.* **322** (1987) L5.

- [2875] B. F. Roukema, “On determining the topology of the observable universe via 3-d quasar positions,” *Mon. Not. Roy. Astron. Soc.* **283** (1996) 1147, [arXiv:astro-ph/9603052](#).
- [2876] S. J. Weatherley, S. J. Warren, S. M. Croom, R. J. Smith, B. J. Boyle, T. Shanks, L. Miller, and M. P. Baltovic, “Ghosts of the milky way: a search for topology in new quasar catalogues,” *Mon. Not. Roy. Astron. Soc.* **342** no. 1, (June, 2003) L9–L13, [arXiv:astro-ph/0304290](#) [astro-ph].
- [2877] P. Bielewicz and A. J. Banday, “Constraints on the topology of the universe derived from the 7-year wmap data,” *Mon. Not. Roy. Astron. Soc.* **412** (2011) 2104, [arXiv:1012.3549](#) [astro-ph.CO].
- [2878] P. Bielewicz, A. J. Banday, and K. M. Gorski, “Constraining the topology of the universe using the polarised cmb maps,” *Mon. Not. Roy. Astron. Soc.* **421** (2012) 1064, [arXiv:1111.6046](#) [astro-ph.CO].
- [2879] R. Aurich and S. Lustig, “A search for cosmic topology in the final wmap data,” *Mon. Not. Roy. Astron. Soc.* **433** (2013) 2517, [arXiv:1303.4226](#) [astro-ph.CO].
- [2880] N. G. Phillips and A. Kogut, “Constraints on the topology of the universe from the wmap first-year sky maps,” *Astrophys. J.* **645** (2006) 820–825, [arXiv:astro-ph/0404400](#).
- [2881] A. Niarchou and A. Jaffe, “Imprints of spherical non-trivial topologies on the cmb,” *Phys. Rev. Lett.* **99** (2007) 081302, [arXiv:astro-ph/0702436](#).
- [2882] S. Carlip, “Spacetime foam: a review,” (9, 2022) , [arXiv:2209.14282](#) [gr-qc].
- [2883] J. Alsing, B. Wandelt, and S. Feeney, “Massive optimal data compression and density estimation for scalable, likelihood-free inference in cosmology,” *Mon. Not. Roy. Astron. Soc.* **477** no. 3, (2018) 2874–2885, [arXiv:1801.01497](#) [astro-ph.CO].
- [2884] G. F. R. Ellis, “Topology and cosmology,” *General Relativity and Gravitation* **2** no. 1, (Mar, 1971) 7–21. <https://doi.org/10.1007/BF02450512>.
- [2885] B. Mota, M. J. Reboucas, and R. Tavakol, “Circles-in-the-sky searches and observable cosmic topology in a flat universe,” *Phys. Rev. D* **81** (2010) 103516, [arXiv:1002.0834](#) [astro-ph.CO].
- [2886] S. W. Hawking and G. F. R. Ellis, *The Large Scale Structure of Space-Time*. Cambridge Monographs on Mathematical Physics. Cambridge University Press, 2, 2011.
- [2887] G. D. Starkman, “Topology and cosmology,” *Class. Quant. Grav.* **15** (1998) 2529–2538.
- [2888] **COMPACT** Collaboration, Y. Akrami *et al.*, “Promise of future searches for cosmic topology,” *Phys. Rev. Lett.* **132** (Apr, 2024) 171501, [arXiv:2210.11426](#) [astro-ph.CO].
- [2889] **COMPACT** Collaboration, P. Petersen *et al.*, “Cosmic topology. part i. limits on orientable euclidean manifolds from circle searches,” *JCAP* **01** (2023) 030, [arXiv:2211.02603](#) [astro-ph.CO]. Corrected in [2890].
- [2890] **COMPACT** Collaboration, D. P. Mihaylov *et al.*, “Erratum: Cosmic topology. part i. limits on orientable euclidean manifolds from circle searches,” *JCAP* **2024** no. 04, (Apr, 2024) E01. <https://dx.doi.org/10.1088/1475-7516/2024/04/E01>.
- [2891] A. Linde, “Creation of a compact topologically nontrivial inflationary universe,” *JCAP* **2004** no. 10, (October, 2004) 004, [arXiv:hep-th/0408164](#) [astro-ph].
- [2892] F. Bernardeau, S. Colombi, E. Gaztañaga, and R. Scoccimarro, “Large-scale structure of the universe and cosmological perturbation theory,” *Phys. Rep.* **367** no. 1-3, (September, 2002) 1–248, [arXiv:astro-ph/0112551](#) [astro-ph].
- [2893] J. T. Giblin, J. B. Mertens, and G. D. Starkman, “Departures from the friedmann-lemaitre-robertson-walker cosmological model in an inhomogeneous universe: A numerical examination,” *Phys. Rev. Lett.* **116** no. 25, (June, 2016) 251301, [arXiv:1511.01105](#) [gr-qc].
- [2894] W. Dehnen and J. I. Read, “N-body simulations of gravitational dynamics,” *European Physical Journal Plus* **126** (May, 2011) 55, [arXiv:1105.1082](#) [astro-ph.IM].

- [2895] R. E. Angulo and O. Hahn, “Large-scale dark matter simulations,” *Living Reviews in Computational Astrophysics* **8** no. 1, (December, 2022) 1, [arXiv:2112.05165 \[astro-ph.CO\]](#).
- [2896] A. J. Benson, “Galaxy formation theory,” *Phys. Rep.* **495** no. 2-3, (October, 2010) 33–86, [arXiv:1006.5394 \[astro-ph.CO\]](#).
- [2897] G. Perelman, “The entropy formula for the ricci flow and its geometric applications,” *arXiv Mathematics e-prints* (November, 2002) [math/0211159](#), [arXiv:math/0211159 \[math.DG\]](#).
- [2898] G. Perelman, “Ricci flow with surgery on three-manifolds,” *arXiv Mathematics e-prints* (March, 2003) [math/0303109](#), [arXiv:math/0303109 \[math.DG\]](#).
- [2899] W. de Sitter, “On einstein’s theory of gravitation and its astronomical consequences. third paper.,” *Mon. Not. Roy. Astron. Soc.* **78** no. 1, (11, 1917) 3–28, <https://academic.oup.com/mnras/article-pdf/78/1/3/4067045/mnras78-0003.pdf>, <https://doi.org/10.1093/mnras/78.1.3>.
- [2900] M. Lachieze-Rey and J. Luminet, “Cosmic topology,” *Phys. Rep.* **254** (March, 1995) 135–214, [arXiv:gr-qc/9605010 \[gr-qc\]](#).
- [2901] J.-P. Luminet and B. F. Roukema, “Topology of the universe: Theory and observation,” in *Theoretical and Observational Cosmology*, M. Lachi  ze-Rey, ed., vol. 541 of *NATO Advanced Study Institute (ASI) Series C*, p. 117. January, 1999. [arXiv:astro-ph/9901364 \[astro-ph\]](#).
- [2902] Y. Akrami, S. Anselmi, C. J. Copi, J. R. Eskilt, A. H. Jaffe, A. Kosowsky, P. Petersen, G. D. Starkman, K. Gonz  lez-Quesada,   . G  ng  r, S. Saha, A. Tamosiunas, Q. Taylor, and V. Vardanyan, “The search for the topology of the universe has just begun,” *arXiv e-prints* (October, 2022) [arXiv:2210.11426](#), [arXiv:2210.11426 \[astro-ph.CO\]](#).
- [2903] J.-P. Luminet, “The shape of space after wmap data,” *Brazilian Journal of Physics* **36** no. 1B, (March, 2006) 107–114, [arXiv:astro-ph/0501189 \[astro-ph\]](#).
- [2904] T. Souradeep, D. Pogosyan, and J. R. Bond, “Probing cosmic topology using cmb anisotropy,” *arXiv e-prints* (April, 1998) [astro-ph/9804042](#), [arXiv:astro-ph/9804042 \[astro-ph\]](#).
- [2905] P. D. Meerburg, D. Green, R. Flauger, B. Wallisch, M. C. D. Marsh, E. Pajer, G. Goon, C. Dvorkin, A. M. Dizgah, D. Baumann, G. L. Pimentel, S. Foreman, E. Silverstein, E. Chisari, B. Wandelt, M. Loverde, and A. Slosar, “Primordial non-gaussianity,” *Bull. Am. Astron. Soc.* **51** no. 3, (May, 2019) 107, [arXiv:1903.04409 \[astro-ph.CO\]](#).
- [2906] **Planck** Collaboration, P. A. R. and Ade *et al.*, “Planck 2015 results. xvii. constraints on primordial non-gaussianity,” *Astron. Astrophys.* **594** (September, 2016) A17, [arXiv:1502.01592 \[astro-ph.CO\]](#).
- [2907] J. R. Weeks. Personal communication, 2023.
- [2908] K. T. Inoue, “Computation of eigenmodes on a compact hyperbolic 3-space,” *Class. Quant. Grav.* **16** no. 10, (January, 1999) 3071–3094, [arXiv:astro-ph/9810034 \[astro-ph\]](#).
- [2909] R. Lehoucq, J. Weeks, J.-P. Uzan, E. Gausmann, and J.-P. Luminet, “Eigenmodes of three-dimensional spherical spaces and their application to cosmology,” *Class. Quant. Grav.* **19** no. 18, (September, 2002) 4683–4708, [arXiv:gr-qc/0205009 \[gr-qc\]](#).
- [2910] A. Riazuelo, J. Weeks, J.-P. Uzan, R. Lehoucq, and J.-P. Luminet, “Cosmic microwave background anisotropies in multiconnected flat spaces,” *Phys. Rev. D* **69** no. 10, (May, 2004) 103518, [arXiv:astro-ph/0311314 \[astro-ph\]](#).
- [2911] M. Hitchman, *Geometry with an Introduction to Cosmic Topology*. Geometry with an Introduction to Cosmic Topology. Jones and Bartlett Publishers, 2009. <https://books.google.com/books?id=yveG5B1few4C>.
- [2912] J.-P. Luminet, “The status of cosmic topology after planck data,” *Universe* **2** no. 1, (January, 2016) 1, [arXiv:1601.03884 \[astro-ph.CO\]](#).

- [2913] J.-P. Luminet and B. F. Roukema, “Topology of the universe: Theory and observation,” in *Theoretical and Observational Cosmology*, M. Lachièze-Rey, ed., vol. 541 of *NATO Advanced Study Institute (ASI) Series C*, p. 117. January, 1999. [arXiv:astro-ph/9901364](#) [astro-ph].
- [2914] P. Kumar Aluri *et al.*, “Is the observable universe consistent with the cosmological principle?,” *Class. Quant. Grav.* **40** no. 9, (May, 2023) 094001, [arXiv:2207.05765](#) [astro-ph.CO].
- [2915] J.-P. Luminet, “Geometry and topology in relativistic cosmology,” *arXiv e-prints* (April, 2007) [arXiv:0704.3374](#), [arXiv:0704.3374](#) [astro-ph].
- [2916] J. Weeks, “Exact polynomial eigenmodes for homogeneous spherical 3-manifolds,” *Class. Quant. Grav.* **23** no. 23, (December, 2006) 6971–6988, [arXiv:math/0502566](#) [math.SP].
- [2917] A. Lewis and A. Challinor, “Camb: Code for anisotropies in the microwave background.” Astrophysics source code library, record ascl:1102.026, February, 2011.
- [2918] J. Lesgourgues, “The cosmic linear anisotropy solving system (class) i: Overview,” *arXiv e-prints* (April, 2011) [arXiv:1104.2932](#), [arXiv:1104.2932](#) [astro-ph.IM].
- [2919] D. Blas, J. Lesgourgues, and T. Tram, “The cosmic linear anisotropy solving system (class). part ii: Approximation schemes,” *JCAP* **2011** no. 7, (July, 2011) 034, [arXiv:1104.2933](#) [astro-ph.CO].
- [2920] J. Lesgourgues, “The cosmic linear anisotropy solving system (class) iii: Comparision with camb for Λ CDM,” *arXiv e-prints* (April, 2011) [arXiv:1104.2934](#), [arXiv:1104.2934](#) [astro-ph.CO].
- [2921] S. Kullback and R. A. Leibler, “On information and sufficiency,” *Ann. Math. Stat.* **22** no. 1, (1951) 79 – 86. <https://doi.org/10.1214/aoms/1177729694>.
- [2922] S. Kullback, *Information Theory and Statistics*. Wiley publication in mathematical statistics. Wiley, 1959. <https://books.google.com/books?id=XeRQAAAAMAAJ>.
- [2923] W. Hu and S. Dodelson, “Cosmic microwave background anisotropies,” *Annu. Rev. Astron. Astrophys.* **40** (January, 2002) 171–216, [arXiv:astro-ph/0110414](#) [astro-ph].
- [2924] J. Hempel, *3-manifolds*. AMS Chelsea Publishing. AMS Chelsea Pub, 2004. <https://books.google.com/books?id=aUI8tAEACAAJ>.
- [2925] M. Hirsch, *Differential Topology*. Graduate Texts in Mathematics. Springer New York, 2012. <https://books.google.com/books?id=emTmBwAAQBAJ>.
- [2926] W. Thurston and S. Levy, *Three-Dimensional Geometry and Topology, Volume 1: (PMS-35)*. Princeton Mathematical Series. Princeton University Press, 2014.
- [2927] A. H. Nelson, “Eigenmode analysis of perturbations in the primordial medium at and before recombination,” *Astron. Astrophys.* **661** (May, 2022) A84, [arXiv:2205.06577](#) [astro-ph.CO].
- [2928] M. Lachièze-Rey and S. Caillerie, “Laplacian eigenmodes for spherical spaces,” *Class. Quant. Grav.* **22** no. 4, (February, 2005) 695–708, [arXiv:astro-ph/0501419](#) [astro-ph].
- [2929] H. Fujii and Y. Yoshii, “An improved cosmic crystallography method to detect holonomies in flat spaces,” *Astron. Astrophys.* **529** (May, 2011) A121, [arXiv:1103.1466](#) [astro-ph.CO].
- [2930] G. Efstathiou and S. Gratton, “The evidence for a spatially flat universe,” *Mon. Not. Roy. Astron. Soc.* **496** no. 1, (July, 2020) L91–L95, [arXiv:2002.06892](#) [astro-ph.CO].
- [2931] J. P. Ostriker and P. J. Steinhardt, “Cosmic concordance,” *arXiv e-prints* (May, 1995) [astro-ph/9505066](#), [arXiv:astro-ph/9505066](#) [astro-ph].
- [2932] V. Mukhanov, *Physical Foundations of Cosmology*. Physical Foundations of Cosmology. Cambridge University Press, 2005.
- [2933] D. Baumann and H. V. Peiris, “Cosmological inflation: Theory and observations,” *arXiv e-prints* (October, 2008) [arXiv:0810.3022](#), [arXiv:0810.3022](#) [astro-ph].

- [2934] S. Tsujikawa, “Introductory review of cosmic inflation,” *arXiv e-prints* (April, 2003) hep-ph/0304257, [arXiv:hep-ph/0304257](#) [hep-ph].
- [2935] J. A. Vazquez, L. E. Padilla, and T. Matos, “Inflationary cosmology: From theory to observations,” *arXiv e-prints* (October, 2018) arXiv:1810.09934, [arXiv:1810.09934](#) [astro-ph.CO].
- [2936] A. Linde, “Inflationary cosmology,” in *Lecture Notes in Physics, Berlin Springer Verlag*, M. Lemoine, J. Martin, and P. Peter, eds., vol. 738, p. 1. 2007.
- [2937] A. Rassat, J. L. Starck, P. Paykari, F. Sureau, and J. Bobin, “Planck cmb anomalies: astrophysical and cosmological secondary effects and the curse of masking,” *JCAP* **2014** no. 8, (August, 2014) 006–006, [arXiv:1405.1844](#) [astro-ph.CO].
- [2938] **COMPACT** Collaboration, S. Anselmi *et al.*, “Cosmic topology. part v. topological information from three-dimensional data.” In preparation, 2023.
- [2939] **COMPACT** Collaboration, M. Martin Barandiaran *et al.*, “Cosmic topology. part iic. eigenmodes, correlation matrices, and detectability of spherical manifolds.” In preparation, 2025.
- [2940] **COMPACT** Collaboration, C. Copi *et al.*, “Cosmic topology. part iib. eigenmodes, correlation matrices, and detectability of non-orientable euclidean manifolds.” In preparation, 2023.
- [2941] E. Wigner and H. Massey, *Group Theory: And Its Application to the Quantum Mechanics of Atomic Spectra*. Elsevier Science, 2013.
- [2942] M. White, L. M. Krauss, and J. Silk, “Cosmic variance in cosmic microwave background anisotropies: From 1 degrees to cobe,” *Astrophys. J.* **418** (December, 1993) 535, [arXiv:astro-ph/9303009](#) [astro-ph].
- [2943] D. Watkins, *Fundamentals of Matrix Computations*. Pure and Applied Mathematics: A Wiley Series of Texts, Monographs and Tracts. Wiley, 2004. <https://books.google.com/books?id=xi5omWiQ-3kC>.
- [2944] S. Mukherjee and T. Souradeep, “Statistically anisotropic gaussian simulations of the cmb temperature field,” *Phys. Rev. D* **89** no. 6, (March, 2014) 063013, [arXiv:1311.5837](#) [astro-ph.CO].
- [2945] **Planck** Collaboration, P. A. R. Ade *et al.*, “Planck 2013 results. xxiv. constraints on primordial non-gaussianity,” *Astron. Astrophys.* **571** (2014) A24, [arXiv:1303.5084](#) [astro-ph.CO].
- [2946] A. Zonca, L. Singer, D. Lenz, M. Reinecke, C. Rosset, E. Hivon, and K. Gorski, “healpy: equal area pixelization and spherical harmonics transforms for data on the sphere in python,” *Journal of Open Source Software* **4** no. 35, (March, 2019) 1298. <https://doi.org/10.21105/joss.01298>.
- [2947] K. M. Górski, E. Hivon, A. J. Banday, B. D. Wandelt, F. K. Hansen, M. Reinecke, and M. Bartelmann, “Healpix: A framework for high-resolution discretization and fast analysis of data distributed on the sphere,” *Astrophys. J.* **622** (April, 2005) 759–771, [arXiv:astro-ph/0409513](#).
- [2948] F. Pedregosa, G. Varoquaux, A. Gramfort, V. Michel, B. Thirion, O. Grisel, M. Blondel, P. Prettenhofer, R. Weiss, V. Dubourg, J. Vanderplas, A. Passos, D. Cournapeau, M. Brucher, M. Perrot, and E. Duchesnay, “Scikit-learn: Machine learning in Python,” *Journal of Machine Learning Research* **12** (2011) 2825–2830.
- [2949] J. A. Barrachina, C. Ren, C. Morisseau, G. Vieillard, and J.-P. Ovarlez, “Complex-valued vs. real-valued neural networks for classification perspectives: An example on non-circular data,” [arXiv:2009.08340](#) [stat.ML].
- [2950] K. He, X. Zhang, S. Ren, and J. Sun, “Deep residual learning for image recognition,” *arXiv e-prints* (December, 2015) arXiv:1512.03385, [arXiv:1512.03385](#) [cs.CV].
- [2951] D. Ribli, B. A. Pataki, J. M. Zorrilla Matilla, D. Hsu, Z. Haiman, and I. Csabai, “Weak lensing cosmology with convolutional neural networks on noisy data,” *Mon. Not. Roy. Astron. Soc.* **490** no. 2, (2019) 1843–1860, [arXiv:1902.03663](#) [astro-ph.CO].

- [2952] M. Kunz, N. Aghanim, L. Cayon, O. Forni, A. Riazuelo, and J. P. Uzan, “Constraining topology in harmonic space,” *Phys. Rev. D* **73** no. 2, (January, 2006) 023511, [arXiv:astro-ph/0510164 \[astro-ph\]](#).
- [2953] “Scikit-learn random forest classifier.” <https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.RandomForestClassifier.html>. Accessed: July 29, 2025.
- [2954] “Xgboost classifier: Python api reference.” https://xgboost.readthedocs.io/en/stable/python/python_api.html. Accessed: July 29, 2025.
- [2955] S. Allamy and A. Lameiras Koerich, “1d cnn architectures for music genre classification,” *arXiv e-prints* (May, 2021) [arXiv:2105.07302](#), [arXiv:2105.07302 \[cs.SD\]](#).
- [2956] S. Kiranyaz, O. Avci, O. Abdeljaber, T. Ince, M. Gabbouj, and D. J. Inman, “1d convolutional neural networks and applications: A survey,” *Mechanical Systems and Signal Processing* **151** (2021) 107398. <https://www.sciencedirect.com/science/article/pii/S0888327020307846>.
- [2957] F. Mattioli, C. Porcaro, and G. Baldassarre, “A 1d cnn for high accuracy classification and transfer learning in motor imagery eeg-based brain-computer interface,” *Journal of Neural Engineering* **18** (2021) . <https://api.semanticscholar.org/CorpusID:245278488>.
- [2958] S. Iglesias Álvarez, E. Díez Alonso, M. L. Sánchez, J. Rodríguez Rodríguez, F. Sánchez Lasheras, and F. J. de Cos Juez, “One-dimensional convolutional neural networks for detecting transiting exoplanets,” *arXiv e-prints* (December, 2023) [arXiv:2312.07161](#), [arXiv:2312.07161 \[astro-ph.EP\]](#).
- [2959] P. Jia, Q. Liu, and Y. Sun, “Detection and classification of astronomical targets with deep neural networks in wide-field small aperture telescopes,” *AJ* **159** no. 5, (May, 2020) 212, [arXiv:2002.09211 \[astro-ph.IM\]](#).
- [2960] S. E. Hong, S. Park, M. J. Jee, D. Bak, and S. Cha, “Weak-lensing mass reconstruction of galaxy clusters with a convolutional neural network,” *The Astrophysical Journal* **923** no. 2, (Dec, 2021) 266. <https://dx.doi.org/10.3847/1538-4357/ac3090>.
- [2961] C. Liu, Z. Zhang, J. Li, Y. Li, and Z. Zou, “Recognition of astronomical strong gravitational lens system based on deep learning,” in *2021 9th International Conference on Intelligent Computing and Wireless Optical Communications (ICWOC)*, pp. 58–63. 2021.
- [2962] O. S. Center, “Ohio supercomputer center,” 1987. <http://osc.edu/ark:/19495/f5s1ph73>.
- [2963] A. Hirose and S. Yoshida, “Generalization characteristics of complex-valued feedforward neural networks in relation to signal coherence,” *IEEE Transactions on Neural Networks and Learning Systems* **23** no. 4, (2012) 541–551.
- [2964] J. A. Barrachina, “Negu93/cvnn: Fixed max pooling 2d,” January, 2021. <https://doi.org/10.5281/zenodo.4452131>.
- [2965] M. Defferrard, M. Milani, F. Gusset, and N. Perraudin, “Deepsphere: a graph-based spherical cnn,” *arXiv e-prints* (December, 2020) [arXiv:2012.15000](#), [arXiv:2012.15000 \[cs.LG\]](#).
- [2966] T. Chen and C. Guestrin, “Xgboost: A scalable tree boosting system,” *arXiv e-prints* (March, 2016) [arXiv:1603.02754](#), [arXiv:1603.02754 \[cs.LG\]](#).
- [2967] D. Marcos, M. Volpi, and D. Tuia, “Learning rotation invariant convolutional filters for texture classification,” *arXiv e-prints* (April, 2016) [arXiv:1604.06720](#), [arXiv:1604.06720 \[cs.CV\]](#).
- [2968] J. Kim, W. Jung, H. Kim, and J. Lee, “Cycnn: A rotation invariant cnn using polar mapping and cylindrical convolution layers,” *arXiv e-prints* (July, 2020) [arXiv:2007.10588](#), [arXiv:2007.10588 \[cs.CV\]](#).
- [2969] T. Alt, K. Schrader, J. Weickert, P. Peter, and M. Augustin, “Designing rotationally invariant neural networks from pdes and variational methods,” *arXiv e-prints* (August, 2021) [arXiv:2108.13993](#), [arXiv:2108.13993 \[cs.LG\]](#).

- [2970] H. Mo and G. Zhao, “Ric-cnn: Rotation-invariant coordinate convolutional neural network,” *arXiv e-prints* (November, 2022) arXiv:2211.11812, arXiv:2211.11812 [cs.CV].
- [2971] C. J. Copi, D. Huterer, and G. D. Starkman, “Multipole vectors: A new representation of the cmb sky and evidence for statistical anisotropy or non-gaussianity at $2 \leq l \leq 8$,” *Phys. Rev. D* **70** no. 4, (August, 2004) 043515, arXiv:astro-ph/0310511 [astro-ph].
- [2972] I. Bello, W. Fedus, X. Du, E. D. Cubuk, A. Srinivas, T.-Y. Lin, J. Shlens, and B. Zoph, “Revisiting resnets: Improved training and scaling strategies,” *arXiv e-prints* (March, 2021) arXiv:2103.07579, arXiv:2103.07579 [cs.CV].
- [2973] O. Russakovsky, J. Deng, H. Su, J. Krause, S. Satheesh, S. Ma, Z. Huang, A. Karpathy, A. Khosla, M. Bernstein, A. C. Berg, and L. Fei-Fei, “Imagenet large scale visual recognition challenge,” *arXiv e-prints* (September, 2014) arXiv:1409.0575, arXiv:1409.0575 [cs.CV].
- [2974] “Complex-valued neural networks (cvnn).” <https://complex-valued-neural-networks.readthedocs.io/en/latest/>. Accessed: July 29, 2025.
- [2975] F. Chollet *et al.*, “Keras.” <https://keras.io>, 2015.
- [2976] M. Abadi, A. Agarwal, P. Barham, E. Brevdo, Z. Chen, C. Citro, G. S. Corrado, A. Davis, J. Dean, M. Devin, S. Ghemawat, I. Goodfellow, A. Harp, G. Irving, M. Isard, Y. Jia, R. Jozefowicz, L. Kaiser, M. Kudlur, J. Levenberg, D. Mané, R. Monga, S. Moore, D. Murray, C. Olah, M. Schuster, J. Shlens, B. Steiner, I. Sutskever, K. Talwar, P. Tucker, V. Vanhoucke, V. Vasudevan, F. Viégas, O. Vinyals, P. Warden, M. Wattenberg, M. Wicke, Y. Yu, and X. Zheng, “TensorFlow: Large-scale machine learning on heterogeneous systems,” 2015. <https://www.tensorflow.org/>. Software available from tensorflow.org.
- [2977] O. Fabre, S. Prunet, and J.-P. Uzan, “Topology beyond the horizon: How far can it be probed?,” *Phys. Rev. D* **92** no. 4, (August, 2015) 043003, arXiv:1311.3509 [astro-ph.CO].
- [2978] G. Biau, “Analysis of a random forests model,” *arXiv e-prints* (May, 2010) arXiv:1005.0208, arXiv:1005.0208 [stat.ML].
- [2979] R. Genuer, J.-M. Poggi, C. Tuleau-Malot, and N. Villa-Vialaneix, “Random forests for big data,” *arXiv e-prints* (November, 2015) arXiv:1511.08327, arXiv:1511.08327 [stat.ML].
- [2980] G. Biau and E. Scornet, “A random forest guided tour,” *arXiv e-prints* (November, 2015) arXiv:1511.05741, arXiv:1511.05741 [math.ST].
- [2981] R. Aurich and F. Steiner, “Betti functionals as a probe for cosmic topology,” *arXiv e-prints* (March, 2024) arXiv:2403.09221, arXiv:2403.09221 [astro-ph.CO].
- [2982] I. Ahern, A. Noack, L. Guzman-Nateras, D. Dou, B. Li, and J. Huan, “Normlime: A new feature importance metric for explaining deep neural networks,” *arXiv e-prints* (September, 2019) arXiv:1909.04200, arXiv:1909.04200 [cs.LG].
- [2983] M. Wojtas and K. Chen, “Feature importance ranking for deep learning,” *arXiv e-prints* (October, 2020) arXiv:2010.08973, arXiv:2010.08973 [cs.LG].
- [2984] K. H. Lee, C. Park, J. Oh, and N. Kwak, “Lfi-cam: Learning feature importance for better visual explanation,” *arXiv e-prints* (May, 2021) arXiv:2105.00937, arXiv:2105.00937 [cs.LG].
- [2985] K. M. Górski, E. Hivon, A. J. Banday, B. D. Wandelt, F. K. Hansen, M. Reinecke, and M. Bartelman, “Healpix - a framework for high resolution discretization, and fast analysis of data distributed on the sphere,” *Astrophys. J.* **622** (2005) 759–771, arXiv:astro-ph/0409513.
- [2986] A. Zonca, L. Singer, D. Lenz, M. Reinecke, C. Rosset, E. Hivon, and K. Gorski, “healpy: equal area pixelization and spherical harmonics transforms for data on the sphere in python,” *Journal of Open Source Software* **4** no. 35, (March, 2019) 1298. <https://doi.org/10.21105/joss.01298>.

- [2987] T. Charnock, G. Lavaux, and B. D. Wandelt, “Automatic physical inference with information maximizing neural networks,” *Phys. Rev. D* **97** no. 8, (April, 2018) 083004, [arXiv:1802.03537 \[astro-ph.IM\]](#).
- [2988] T. S. Pereira, C. Pitrou, and J.-P. Uzan, “Theory of cosmological perturbations in an anisotropic universe,” *JCAP* **09** (2007) 006, [arXiv:0707.0736 \[astro-ph\]](#).
- [2989] A. E. Gumrukcuoglu, C. R. Contaldi, and M. Peloso, “Inflationary perturbations in anisotropic backgrounds and their imprint on the cmb,” *JCAP* **11** (2007) 005, [arXiv:0707.4179 \[astro-ph\]](#).
- [2990] D. A. Varshalovich, A. N. Moskalev, and V. K. Khersonskii, *Quantum theory of angular momentum*. World Scientific, 1988.
- [2991] V. K. Khersonskii, A. N. Moskalev, and D. A. Varshalovich, *Quantum theory of angular momentum*. World Scientific Publishing Company, 1988.
- [2992] C. Pitrou, T. S. Pereira, and J.-P. Uzan, “Predictions from an anisotropic inflationary era,” *JCAP* **04** (2008) 004, [arXiv:0801.3596 \[astro-ph\]](#).
- [2993] P. Schneider, L. Van Waerbeke, and Y. Mellier, “B-modes in cosmic shear from source redshift clustering,” *Astron. Astrophys.* **389** (2002) 729–741, [arXiv:astro-ph/0112441](#).
- [2994] R. G. Crittenden, P. Natarajan, U.-L. Pen, and T. Theuns, “Discriminating weak lensing from intrinsic spin correlations using the curl-gradient decomposition,” *Astrophys. J.* **568** (2002) 20–27, [arXiv:astro-ph/0012336](#).
- [2995] R. G. Crittenden, P. Natarajan, U.-L. Pen, and T. Theuns, “Spin induced galaxy alignments and their implications for weak lensing measurements,” *Astrophys. J.* **559** (2001) 552–571, [arXiv:astro-ph/0009052](#).
- [2996] M. Lachize-Rey and S. Caillerie, “Laplacian eigenmodes for spherical spaces,” *Class. Quant. Grav.* **22** (2005) 695–708, [arXiv:astro-ph/0501419](#).
- [2997] K. T. Inoue, “Computation of eigenmodes on a compact hyperbolic space,” *Class. Quant. Grav.* **16** (1999) 3071–3094, [arXiv:astro-ph/9810034](#).
- [2998] J. R. Weeks, “Exact polynomial eigenmodes for homogeneous spherical 3-manifolds,” *Class. Quant. Grav.* **23** (2006) 6971–6988, [arXiv:math/0502566](#).
- [2999] R. Lehoucq, J. Weeks, J.-P. Uzan, E. Gausmann, and J.-P. Luminet, “Eigenmodes of three-dimensional spherical spaces and their application to cosmology,” *Class. Quant. Grav.* **19** (2002) 4683–4708, [arXiv:gr-qc/0205009](#).
- [3000] E. Mitsou, J. Yoo, R. Durrer, F. Scaccabarozzi, and V. Tansella, “General and consistent statistics for cosmological observations,” *Phys. Rev. Res.* **2** no. 3, (2020) 033004, [arXiv:1905.01293 \[astro-ph.CO\]](#).
- [3001] F. Lacasa, *Non-Gaussianity and extragalactic foregrounds to the Cosmic Microwave Background*. PhD thesis, Orsay, IAS, 2013. [arXiv:1406.0441 \[astro-ph.CO\]](#).
- [3002] L. R. Abramo and T. S. Pereira, “Testing gaussianity, homogeneity and isotropy with the cosmic microwave background,” *Adv. Astron.* **2010** (2010) 378203, [arXiv:1002.3173 \[astro-ph.CO\]](#).
- [3003] C. Pitrou, T. S. Pereira, and J.-P. Uzan, “Weak-lensing by the large scale structure in a spatially anisotropic universe: theory and predictions,” *Phys. Rev. D* **92** no. 2, (2015) 023501, [arXiv:1503.01125 \[astro-ph.CO\]](#).
- [3004] D. Baumann, *Cosmology*. Cambridge University Press, 2022.
- [3005] J. Grain, M. Tristram, and R. Stompor, “Cmb eb and tb cross-spectrum estimation via pseudospectrum techniques,” *Phys. Rev. D* **86** no. 7, (October, 2012) 076005, [arXiv:1207.5344 \[astro-ph.CO\]](#).
- [3006] S. Weinberg, *Cosmology*. OUP Oxford, 2008.

- [3007] N. Aghanim, Y. Akrami, M. Ashdown, J. Aumont, C. Baccigalupi, M. Ballardini, A. J. Banday, R. Barreiro, N. Bartolo, S. Basak, *et al.*, “Planck 2018 results-vi. cosmological parameters,” *Astronomy & Astrophysics* **641** (2020) A6.
- [3008] Y. Cai, Y.-T. Wang, and Y.-S. Piao, “Chirality oscillation of primordial gravitational waves during inflation,” *JHEP* **03** (2017) 024, [arXiv:1608.06508 \[astro-ph.CO\]](#).
- [3009] T. Takahashi and J. Soda, “Chiral primordial gravitational waves from a lifshitz point,” *Phys. Rev. Lett.* **102** (2009) 231301, [arXiv:0904.0554 \[hep-th\]](#).
- [3010] T. Fujita, Y. Minami, M. Shiraishi, and S. Yokoyama, “Can primordial parity violation explain the observed cosmic birefringence?,” *Phys. Rev. D* **106** no. 10, (2022) 103529, [arXiv:2208.08101 \[astro-ph.CO\]](#).
- [3011] J. R. Eskilt and E. Komatsu, “Improved constraints on cosmic birefringence from the wmap and planck cosmic microwave background polarization data,” *Phys. Rev. D* **106** no. 6, (2022) 063503, [arXiv:2205.13962 \[astro-ph.CO\]](#).
- [3012] S. Jazayeri, Y. Akrami, H. Firouzjahi, A. R. Solomon, and Y. Wang, “Inflationary power asymmetry from primordial domain walls,” *JCAP* **11** (2014) 044, [arXiv:1408.3057 \[astro-ph.CO\]](#).
- [3013] M. Akhshik, R. Emami, H. Firouzjahi, and Y. Wang, “Statistical anisotropies in gravitational waves in solid inflation,” *JCAP* **09** (2014) 012, [arXiv:1405.4179 \[astro-ph.CO\]](#).
- [3014] R. Watkins, T. Allen, C. J. Bradford, A. Ramon, A. Walker, H. A. Feldman, R. Cionitti, Y. Al-Shorman, E. Kourkchi, and R. B. Tully, “Analysing the large-scale bulk flow using cosmicflows4: increasing tension with the standard cosmological model,” *Mon. Not. Roy. Astron. Soc.* **524** no. 2, (2023) 1885–1892, [arXiv:2302.02028 \[astro-ph.CO\]](#).
- [3015] W. Hu, “Weak lensing of the cmb: A harmonic approach,” *Phys. Rev. D* **62** (2000) 043007, [arXiv:astro-ph/0001303](#).
- [3016] Y. Minami, H. Ochi, K. Ichiki, N. Katayama, E. Komatsu, and T. Matsumura, “Simultaneous determination of the cosmic birefringence and miscalibrated polarization angles from cmb experiments,” *PTEP* **2019** no. 8, (2019) 083E02, [arXiv:1904.12440 \[astro-ph.CO\]](#).
- [3017] M. Lachieze-Rey and J.-P. Luminet, “Cosmic topology,” *Phys. Rept.* **254** (1995) 135–214, [arXiv:gr-qc/9605010](#).
- [3018] J.-P. Luminet, “Geometry and topology in relativistic cosmology,” [arXiv:0704.3374 \[astro-ph\]](#).
- [3019] W. P. Thurston, “Three dimensional manifolds, kleinian groups and hyperbolic geometry,” *Bull. Am. Math. Soc.* **6** (1982) 357–381.
- [3020] M. Kunz, N. Aghanim, A. Riazuelo, and O. Forni, “On the detectability of non-trivial topologies,” *Phys. Rev. D* **77** (2008) 023525, [arXiv:0704.3076 \[astro-ph\]](#).
- [3021] N. Kitajima, F. Kozai, F. Takahashi, and W. Yin, “Power spectrum of domain-wall network, and its implications for isotropic and anisotropic cosmic birefringence,” *Journal of Cosmology and Astroparticle Physics* **2022** no. 10, (Oct, 2022) 043. <https://dx.doi.org/10.1088/1475-7516/2022/10/043>.
- [3022] T. Namikawa, “Exact cmb b-mode power spectrum from anisotropic cosmic birefringence,” 2024. <https://arxiv.org/abs/2404.13771>.
- [3023] H. Nakatsuka, T. Namikawa, and E. Komatsu, “Is cosmic birefringence due to dark energy or dark matter? a tomographic approach,” *Phys. Rev. D* **105** (Jun, 2022) 123509. <https://link.aps.org/doi/10.1103/PhysRevD.105.123509>.
- [3024] C. Guandalin, J. Piat, C. Clarkson, and R. Maartens, “Theoretical systematics in testing the cosmological principle with the kinematic quasar dipole,” *Astrophys. J.* **953** no. 2, (2023) 144, [arXiv:2212.04925 \[astro-ph.CO\]](#).

- [3025] S. von Hausegger, “The expected kinematic matter dipole is robust against source evolution,” [arXiv:2404.07929](#) [[astro-ph.CO](#)].
- [3026] G. Zagatti, M. Bortolami, A. Gruppuso, P. Natoli, L. Pagano, and G. Fabbian, “Planck constraints on cosmic birefringence and its cross-correlation with the cmb,” *JCAP* **05** (2024) 034, [arXiv:2401.11973](#) [[astro-ph.CO](#)].
- [3027] C. G. Tsagas, A. Challinor, and R. Maartens, “Relativistic cosmology and large-scale structure,” *Phys. Rept.* **465** (2008) 61–147, [arXiv:0705.4397](#) [[astro-ph](#)].
- [3028] S. D. Brechet, M. P. Hobson, and A. N. Lasenby, “First-order adiabatic perturbations of a perfect fluid about a general flrw background using the 1+3 covariant and gauge-invariant formalism,” [arXiv:0909.5384](#) [[gr-qc](#)].
- [3029] **COMPACT** Collaboration, A. Tamosiunas *et al.*, “Cosmic topology. part iva. classification of manifolds using machine learning: a case study with small toroidal universes,” *JCAP* **09** (2024) 057, [arXiv:2404.01236](#) [[astro-ph.CO](#)].
- [3030] **COMPACT** Collaboration, S. Saha *et al.*, “Cosmic topology. part ic. limits on lens spaces from circle searches,” *JCAP* **01** (2025) 004, [arXiv:2409.02226](#) [[astro-ph.CO](#)].
- [3031] **COMPACT** Collaboration, A. Samandar *et al.*, “Cosmic topology. part iiic. correlation matrices of microwave background observables and detectability of orientable euclidean manifolds.” In preparation.
- [3032] J. Jones, C. J. Copi, G. D. Starkman, and Y. Akrami, “The universe is not statistically isotropic,” [arXiv:2310.12859](#) [[astro-ph.CO](#)].
- [3033] K. Schwarzschild, “Ueber das zulässige krümmunsmass des raumes. vierteljahrssch. astr. ges.”.
- [3034] K. Schwarzschild, “On the permissible curvature of space,” *Classical and Quantum Gravity* **15** no. 9, (1998) 2539–2544.
- [3035] **COMPACT** Collaboration, A. Samandar *et al.*, “Cosmic topology. part iiia. microwave background parity violation without parity-violating microphysics,” *JCAP* **11** (2024) 020, [arXiv:2407.09400](#) [[astro-ph.CO](#)].
- [3036] D. Bessada and O. D. Miranda, “Cmb anisotropies induced by tensor modes in massive gravity,” *JCAP* **08** (2009) 033, [arXiv:0908.1360](#) [[astro-ph.CO](#)].
- [3037] **Taurus** Collaboration, J. L. May *et al.*, “Instrument overview of taurus: a balloon-borne cmb and dust polarization experiment,” *Proc. SPIE Int. Soc. Opt. Eng.* **13094** (2024) 1309432, [arXiv:2407.01438](#) [[astro-ph.IM](#)].
- [3038] A. Kosowsky, “Cosmic microwave background polarization,” *Annals Phys.* **246** (1996) 49–85, [arXiv:astro-ph/9501045](#).
- [3039] **COMPACT** Collaboration, D. P. Mihaylov *et al.*, “Cosmic topology. part ib. limits on flat euclidean manifolds from circle searches.” In preparation, 2024.
- [3040] J. Brian Pitts, “The nontriviality of trivial general covariance: How electrons restrict time coordinates, spinors (almost) fit into tensor calculus, and of a tetrad is surplus structure,” *Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics* **43** no. 1, (February, 2012) 1–24.
- [3041] **Euclid Theory Working Group** Collaboration, L. Amendola *et al.*, “Cosmology and fundamental physics with the euclid satellite,” *Living Rev. Rel.* **16** (2013) 6, [arXiv:1206.1225](#) [[astro-ph.CO](#)].
- [3042] L. Amendola *et al.*, “Cosmology and fundamental physics with the euclid satellite,” *Living Rev. Rel.* **21** no. 1, (2018) 2, [arXiv:1606.00180](#) [[astro-ph.CO](#)].
- [3043] A. D. Linde, “Creation of a compact topologically nontrivial inflationary universe,” *JCAP* **10** (2004) 004, [arXiv:hep-th/0408164](#).

- [3044] C. J. Copi and the COMPACT collaboration, “Eigenmodes and correlation matrices of non-orientable euclidean manifolds.” in preparation, 2023.
- [3045] B. F. Roukema, S. Bajtlik, M. Biesiada, A. Szaniewska, and H. Jurkiewicz, “A weak acceleration effect due to residual gravity in a multiply connected universe,” *A.&A.* **463** no. 3, (March, 2007) 861–871, [arXiv:astro-ph/0602159](#) [astro-ph].
- [3046] Q. Vigneron and B. F. Roukema, “Gravitational potential in spherical topologies,” *Phys. Rev. D* **107** no. 6, (March, 2023) 063545, [arXiv:2201.09102](#) [astro-ph.CO].
- [3047] L. Infeld and A. E. Schild, “A new approach to kinematic cosmology-(b),” *Physical Review* **70** no. 5-6, (September, 1946) 410–425.
- [3048] D. Stevens, D. Scott, and J. Silk, “Microwave background anisotropy in a toroidal universe,” *Phys. Rev. Lett.* **71** no. 1, (July, 1993) 20–23.
- [3049] A. A. Starobinskij, “New restrictions on spatial topology of the universe from microwave background temperature fluctuations,” *Soviet Journal of Experimental and Theoretical Physics Letters* **57** no. 10, (May, 1993) 622–625, [arXiv:gr-qc/9305019](#) [gr-qc].
- [3050] J. Barrow, “Light elements and the isotropy of the universe,” *Mon. Not. Roy. Astron. Soc.* **175** (1976) 359–370.
- [3051] M. Bridges, J. D. McEwen, A. N. Lasenby, and M. P. Hobson, “Markov chain monte carlo analysis of bianchi vii(h) models,” *Mon. Not. Roy. Astron. Soc.* **377** (2007) 1473–1480, [arXiv:astro-ph/0605325](#).
- [3052] **COMPACT** Collaboration, J. R. Eskilt *et al.*, “Cosmic topology. part iia. eigenmodes, correlation matrices, and detectability of orientable euclidean manifolds,” *JCAP* **03** (2024) 036, [arXiv:2306.17112](#) [astro-ph.CO].
- [3053] S. Mukherjee, “The annotated resnet-50.” <https://towardsdatascience.com/the-annotated-resnet-50-a6c536034758>. Accessed: July 29, 2025.
- [3054] P. Gorla, “Resnet-50 diagram.” <https://commons.wikimedia.org/wiki/File:ResNet50.png>. Accessed: July 29, 2025.
- [3055] **COMPACT** Collaboration, A. Samandar *et al.*, “Cosmic topology. part iiib. tensor eigenmodes and correlation matrices of orientable euclidean manifolds.” In preparation.
- [3056] W. de Sitter, “On einstein’s theory of gravitation and its astronomical consequences. third paper,” *Mon. Not. Roy. Astron. Soc.* **78** no. 1, (1917) 3–28.
- [3057] M. Kunz, N. Aghanim, L. Cayon, O. Forni, A. Riazuelo, and J. P. Uzan, “Constraining topology in harmonic space,” *Phys. Rev. D* **73** (2006) 023511, [arXiv:astro-ph/0510164](#).
- [3058] E. Gausmann, R. Lehoucq, J.-P. Luminet, J.-P. Uzan, and J. Weeks, “Topological lensing in spherical spaces,” *Class. Quant. Grav.* **18** (2001) 5155–5186, [arXiv:gr-qc/0106033](#).
- [3059] G. I. Gomero, M. J. Reboucas, and R. K. Tavakol, “Detectability of cosmic topology in almost flat universes,” *Class. Quant. Grav.* **18** (2001) 4461–4476, [arXiv:gr-qc/0105002](#).
- [3060] J.-P. Uzan, A. Riazuelo, R. Lehoucq, and J. Weeks, “Cosmic microwave background constraints on lens spaces,” *Phys. Rev. D* **69** (2004) 043003, [arXiv:astro-ph/0303580](#).
- [3061] R. Aurich, P. Kramer, and S. Lustig, “Cmb radiation in an inhomogeneous spherical space,” *Phys. Scripta* **84** (2011) 055901, [arXiv:1107.5214](#) [astro-ph.CO].
- [3062] R. Aurich and S. Lustig, “How well-proportioned are lens and prism spaces?,” *Class. Quant. Grav.* **29** (2012) 175003, [arXiv:1201.6490](#) [astro-ph.CO].
- [3063] R. Aurich and S. Lustig, “A survey of lens spaces and large scale cmb anisotropy,” *Mon. Not. Roy. Astron. Soc.* **424** (2012) 1556–1562, [arXiv:1203.4086](#) [astro-ph.CO].

- [3064] W. Threlfall and H. Seifert, “Topologische untersuchung der diskontinuitätsbereiche endlicher bewegungsgruppen des dreidimensionalen sphärischen raumes,” *Mathematische Annalen* **104** (1931) 1–70. <http://eudml.org/doc/159448>.
- [3065] M. Boyle, “Angular velocity of gravitational radiation from precessing binaries and the corotating frame,” *Phys. Rev. D* **87** no. 10, (2013) 104006, [arXiv:1302.2919](https://arxiv.org/abs/1302.2919) [gr-qc].
- [3066] W. Hu, “Weak lensing of the cmb: A harmonic approach,” *Physical Review D* **62** no. 4, (July, 2000) . <http://dx.doi.org/10.1103/PhysRevD.62.043007>.
- [3067] C. J. Copi and the COMPACT collaboration, “Eigenmodes and correlation matrices of non-orientable euclidean manifolds.” in preparation, 2024.
- [3068] S. Anselmi and the COMPACT collaboration, “Topological correlations from observations of large-scale structure.” in preparation, 2024.
- [3069] P. Petersen and the COMPACT collaboration, “Cosmic topology. part ib. limits on non-orientable euclidean manifolds from circle searches.” in preparation, 2024.
- [3070] P. A. R. A. e. a. Planck Collaboration, “Planck2013 results. xxiii. isotropy and statistics of the cmb,” *Astronomy & Astrophysics* **571** (October, 2014) A23. <http://dx.doi.org/10.1051/0004-6361/201321534>.
- [3071] P. A. R. A. e. a. Planck Collaboration, “Planck2015 results: Xvi. isotropy and statistics of the cmb,” *Astronomy & Astrophysics* **594** (September, 2016) A16. <http://dx.doi.org/10.1051/0004-6361/201526681>.
- [3072] Y. A. e. a. Planck Collaboration, “Planck2018 results: Vii. isotropy and statistics of the cmb,” *Astronomy & Astrophysics* **641** (September, 2020) A7. <http://dx.doi.org/10.1051/0004-6361/201935201>.
- [3073] N. A. e. a. Planck Collaboration, “Planck2018 results: Vi. cosmological parameters,” *Astronomy & Astrophysics* **641** (September, 2020) A6. <http://dx.doi.org/10.1051/0004-6361/201833910>.
- [3074] D. J. Schwarz, C. J. Copi, D. Huterer, and G. D. Starkman, “Cmb anomalies after planck,” *Classical and Quantum Gravity* **33** no. 18, (August, 2016) 184001. <http://dx.doi.org/10.1088/0264-9381/33/18/184001>.
- [3075] E. A. et al., “Cosmology intertwined: A review of the particle physics, astrophysics, and cosmology associated with the cosmological tensions and anomalies,” *Journal of High Energy Astrophysics* **34** (June, 2022) 49–211. <http://dx.doi.org/10.1016/j.jheap.2022.04.002>.
- [3076] S. Vagnozzi, E. Di Valentino, S. Gariazzo, A. Melchiorri, O. Mena, and J. Silk, “The galaxy power spectrum take on spatial curvature and cosmic concordance,” *Physics of the Dark Universe* **33** (September, 2021) 100851. <http://dx.doi.org/10.1016/j.dark.2021.100851>.
- [3077] M. Lachièze-Rey and J.-P. Luminet, “Cosmic topology,” *Physics Reports* **254** no. 3, (March, 1995) 135–214. [http://dx.doi.org/10.1016/0370-1573\(94\)00085-H](http://dx.doi.org/10.1016/0370-1573(94)00085-H).
- [3078] R. Lehoucq, M. Lachieze-Rey, and J. P. Luminet, “Cosmic crystallography,” *Astronomy & Astrophysics* **313** (September, 1996) 339–346, [arXiv:gr-qc/9604050](https://arxiv.org/abs/gr-qc/9604050) [gr-qc].
- [3079] J. R. Eskilt, Y. Akrami, S. Anselmi, C. J. Copi, A. H. Jaffe, A. Kosowsky, D. P. Mihaylov, G. D. Starkman, A. Tamosiunas, J. B. Mertens, P. Petersen, S. Saha, Q. Taylor, and Ö. Güngör, “Cosmic topology. part ii. eigenmodes, correlation matrices, and detectability of orientable euclidean manifolds,” 2023.
- [3080] E. Gausmann, R. Lehoucq, J.-P. Luminet, J.-P. Uzan, and J. Weeks, “Topological lensing in spherical spaces,” *Classical and Quantum Gravity* **18** no. 23, (November, 2001) 5155–5186. <http://dx.doi.org/10.1088/0264-9381/18/23/311>.
- [3081] R. Aurich, S. Lustig, and F. Steiner, “Cmb anisotropy of spherical spaces,” *Class. Quant. Grav.* **22** (2005) 3443–3460, [arXiv:astro-ph/0504656](https://arxiv.org/abs/astro-ph/0504656).

- [3082] R. Aurich and S. Lustig, “How well proportioned are lens and prism spaces?,” *Classical and Quantum Gravity* **29** no. 17, (August, 2012) 175003. <http://dx.doi.org/10.1088/0264-9381/29/17/175003>.
- [3083] G. I. Gomero, M. J. Rebouças, and R. Tavakol, “Detectability of cosmic topology in almost flat universes,” *Classical and Quantum Gravity* **18** no. 21, (October, 2001) 4461–4476. <http://dx.doi.org/10.1088/0264-9381/18/21/306>.
- [3084] R. Lehoucq, J. Weeks, J.-P. Uzan, E. Gausmann, and J.-P. Luminet, “Eigenmodes of three-dimensional spherical spaces and their application to cosmology,” *Classical and Quantum Gravity* **19** no. 18, (August, 2002) 4683–4708. <http://dx.doi.org/10.1088/0264-9381/19/18/305>.
- [3085] J. Weeks, “Exact polynomial eigenmodes for homogeneous spherical 3-manifolds,” *Classical and Quantum Gravity* **23** no. 23, (October, 2006) 6971–6988. <http://dx.doi.org/10.1088/0264-9381/23/23/023>.
- [3086] N. e. a. PlanckCollaboration, Aghanim, “Planck2018 results: Vi. cosmological parameters,” *Astronomy & Astrophysics* **641** (September, 2020) A6. <http://dx.doi.org/10.1051/0004-6361/201833910>.
- [3087] S. Anselmi, M. F. Carney, J. T. Giblin, S. Kumar, J. B. Mertens, M. O’Dwyer, G. D. Starkman, and C. Tian, “What is flat lcdm, and may we choose it?,” *Journal of Cosmology and Astroparticle Physics* **2023** no. 02, (February, 2023) 049. <http://dx.doi.org/10.1088/1475-7516/2023/02/049>.
- [3088] M. Kunz, N. Aghanim, L. Cayon, O. Forni, A. Riazuelo, and J. P. Uzan, “Constraining topology in harmonic space,” *Phys. Rev. D* **73** no. 2, (January, 2006) 023511, [arXiv:astro-ph/0510164](https://arxiv.org/abs/astro-ph/0510164) [astro-ph].
- [3089] Y. Cai, Y.-T. Wang, and Y.-S. Piao, “Chirality oscillation of primordial gravitational waves during inflation,” *Journal of High Energy Physics* **2017** no. 3, (2017) 1–13.
- [3090] T. Takahashi and J. Soda, “Chiral primordial gravitational waves from a lifshitz point,” *Physical Review Letters* **102** no. 23, (2009) 231301.
- [3091] T. Fujita, Y. Minami, M. Shiraishi, and S. Yokoyama, “Can primordial parity violation explain the observed cosmic birefringence?,” *Physical Review D* **106** no. 10, (2022) 103529.
- [3092] Y. Minami and E. Komatsu, “New extraction of the cosmic birefringence from the planck 2018 polarization data,” *Physical Review Letters* **125** no. 22, (2020) 221301.
- [3093] J. R. Eskilt and E. Komatsu, “Improved constraints on cosmic birefringence from the wmap and planck cosmic microwave background polarization data,” *Physical Review D* **106** no. 6, (2022) 063503.
- [3094] E. Komatsu, “New physics from the polarized light of the cosmic microwave background,” *Nature Reviews Physics* **4** no. 7, (2022) 452–469.
- [3095] J. Jones, C. J. Copi, G. D. Starkman, and Y. Akrami, “The universe is not statistically isotropic,” *arXiv e-prints* (October, 2023) [arXiv:2310.12859](https://arxiv.org/abs/2310.12859), [arXiv:2310.12859](https://arxiv.org/abs/2310.12859) [astro-ph.CO].
- [3096] J. R. Eskilt, Y. Akrami, S. Anselmi, C. J. Copi, A. H. Jaffe, A. Kosowsky, D. P. Mihaylov, G. D. Starkman, A. Tamosiunas, J. B. Mertens, *et al.*, “Cosmic topology. part iia. eigenmodes, correlation matrices, and detectability of orientable euclidean manifolds,” *Journal of Cosmology and Astroparticle Physics* **2024** no. 03, (2024) 036.
- [3097] N. J. Secrest, S. von Hausegger, M. Rameez, R. Mohayaee, S. Sarkar, and J. Colin, “A test of the cosmological principle with quasars,” *The Astrophysical Journal Letters* **908** no. 2, (Feb, 2021) L51. <https://dx.doi.org/10.3847/2041-8213/abdd40>.
- [3098] R. Watkins, T. Allen, C. J. Bradford, J. Ramon, Albert, A. Walker, H. A. Feldman, R. Cionitti, Y. Al-Shorman, E. Kourkchi, and R. B. Tully, “Analysing the large-scale bulk flow using cosmicflows4: increasing tension with the standard cosmological model,” *Monthly Notices of the Royal Astronomical Society* **524** no. 2, (07, 2023) 1885–1892, <https://academic.oup.com/mnras/article-pdf/524/2/1885/50877754/stad1984.pdf>. <https://doi.org/10.1093/mnras/stad1984>.

- [3099] A. LEWIS and A. CHALLINOR, “Weak gravitational lensing of the cmb,” *Physics Reports* **429** no. 1, (June, 2006) 1–65. <http://dx.doi.org/10.1016/j.physrep.2006.03.002>.
- [3100] Y. Minami, H. Ochi, K. Ichiki, N. Katayama, E. Komatsu, and T. Matsumura, “Simultaneous determination of the cosmic birefringence and miscalibrated polarization angles from cmb experiments,” *Progress of Theoretical and Experimental Physics* **2019** no. 8, (08, 2019) 083E02, <https://academic.oup.com/ptep/article-pdf/2019/8/083E02/29117835/ptz079.pdf>. <https://doi.org/10.1093/ptep/ptz079>.
- [3101] P. Diego-Palazuelos, J. R. Eskilt, Y. Minami, M. Tristram, R. M. Sullivan, A. J. Banday, R. B. Barreiro, H. K. Eriksen, K. M. Górski, R. Keskitalo, E. Komatsu, E. Martínez-González, D. Scott, P. Vielva, and I. K. Wehus, “Cosmic birefringence from the planck data release 4,” *Phys. Rev. Lett.* **128** (Mar, 2022) 091302. <https://link.aps.org/doi/10.1103/PhysRevLett.128.091302>.
- [3102] A. Riazuelo, J. Weeks, J.-P. Uzan, R. Lehoucq, and J.-P. Luminet, “Cosmic microwave background anisotropies in multiconnected flat spaces,” *Phys. Rev. D* **69** (May, 2004) 103518. <https://link.aps.org/doi/10.1103/PhysRevD.69.103518>.
- [3103] A. Riazuelo, J.-P. Uzan, R. Lehoucq, and J. Weeks, “Simulating cosmic microwave background maps in multiconnected spaces,” *Phys. Rev. D* **69** (May, 2004) 103514. <https://link.aps.org/doi/10.1103/PhysRevD.69.103514>.
- [3104] M. Skorski, “Modern analysis of Hutchinson’s trace estimator,” in *2021 55th Annual Conference on Information Sciences and Systems (CISS)*, pp. 1–5, IEEE. 2021.
- [3105] G. H. Golub and G. Meurant, *Matrices, moments and quadrature with applications*, vol. 30. Princeton University Press, 2009.
- [3106] Z. Bai and G. H. Golub, “Bounds for the trace of the inverse and the determinant of symmetric positive definite matrices,” *Annals of Numerical Mathematics* **4** (1996) 29–38.
- [3107] P. W. Graham, R. Harnik, and S. Rajendran, “Observing the dimensionality of our parent vacuum,” *Physical Review D* **82** no. 6, (2010) 063524.
- [3108] J. R. Bond, D. Pogosyan, and T. Souradeep, “Computing CMB anisotropy in compact hyperbolic spaces,” *Classical and Quantum Gravity* **15** no. 9, (1998) 2671.
- [3109] R. Aurich and F. Steiner, “Statistical properties of highly excited quantum eigenstates of a strongly chaotic system,” *Physica D: Nonlinear Phenomena* **64** no. 1-3, (1993) 185–214.
- [3110] N. J. Cornish and D. N. Spergel, “On the eigenmodes of compact hyperbolic 3-manifolds,” *arXiv preprint math/9906017* (1999) .
- [3111] J. Bond, A. H. Jaffe, and L. Knox, “Estimating the power spectrum of the cosmic microwave background,” *Physical Review D* **57** no. 4, (1998) 2117.
- [3112] M. Kac, “Can one hear the shape of a drum?,” *The american mathematical monthly* **73** no. 4P2, (1966) 1–23.
- [3113] J. S. Key, N. J. Cornish, D. N. Spergel, and G. D. Starkman, “Extending the wmap bound on the size of the universe,” *Physical review D* **75** no. 8, (2007) 084034.
- [3114] P. M. Vaudrevange, G. D. Starkman, N. J. Cornish, and D. N. Spergel, “Constraints on the topology of the universe: Extension to general geometries,” *Physical Review D* **86** no. 8, (2012) 083526.
- [3115] N. J. Cornish, D. N. Spergel, and G. D. Starkman, “Circles in the sky: finding topology with the microwave background radiation,” *Classical and Quantum Gravity* **15** no. 9, (1998) 2657.
- [3116] N. J. Cornish, D. Spergel, and G. Starkman, “Can COBE see the shape of the universe?,” *Physical Review D* **57** no. 10, (1998) 5982.

- [3117] P. Petersen, Y. Akrami, C. J. Copi, A. H. Jaffe, A. Kosowsky, G. D. Starkman, A. Tamosiunas, J. R. Eskilt, Ö. Güngör, S. Saha, *et al.*, “Cosmic topology. part i. limits on orientable Euclidean manifolds from circle searches,” *Journal of Cosmology and Astroparticle Physics* **2023** no. 01, (2023) 030.
- [3118] D. P. Mihaylov, Y. Akrami, C. J. Copi, A. H. Jaffe, A. Kosowsky, P. Petersen, G. D. Starkman, A. Tamosiunas, J. R. Eskilt, Ö. Güngör, *et al.*, “Erratum: Cosmic topology. part i. limits on orientable euclidean manifolds from circle searches,” *Journal of Cosmology and Astroparticle Physics* **2024** no. 04, (2024) E01.
- [3119] J. Jones, C. J. Copi, G. D. Starkman, and Y. Akrami, “The universe is not statistically isotropic,” *arXiv preprint arXiv:2310.12859* (2023) .
- [3120] J. R. Weeks, *The shape of space*. CRC press, 2001.
- [3121] G. D. Starkman, “Topology and cosmology,” *Classical and Quantum Gravity* **15** no. 9, (1998) 2529.
- [3122] G. Ellis, “Theory and observational limits in cosmology,” in *Proc. Vatican Obs. Conf. held in Castel Gandolfo, WR Stoeger, Specola Vaticana*, vol. 43. 1987.
- [3123] G. Lemaître, “Ann. soc. sci. bruxelles,”.
- [3124] A. A. Friedmann, *Papers On Curved Spaces and Cosmology*. Minkowski Institute Press, 2014.
- [3125] W. De Sitter, “On the relativity of inertia. remarks concerning Einstein’s latest hypothesis,” *Proc. Kon. Ned. Acad. Wet* **19** no. 2, (1917) 1217–1225.
- [3126] D. M. Y. Sommerville, *The elements of non-Euclidean geometry*. G. Bell and sons, Limited, 1914.
- [3127] K. Schwarzschild, “Über das zulässige Krümmungsmaass des Raumes,” *Vierteljahrsschrift der Astronomische Gesellschaft* (1900) 337–347.
- [3128] A. Smith, C. J. Copi, and G. D. Starkman, “CMB limits on anisotropic Thurston geometries,” In preparation.
- [3129] C. Bennett, R. S. Hill, G. Hinshaw, M. Nolta, N. Odegard, L. Page, D. Spergel, J. Weiland, E. Wright, M. Halpern, *et al.*, “First-year wilkinson microwave anisotropy probe (wmap)* observations: foreground emission,” *The Astrophysical Journal Supplement Series* **148** no. 1, (2003) 97.
- [3130] S. Hanany, P. Ade, A. Balbi, J. Bock, J. Borrill, A. Boscaleri, P. de Bernardis, P. Ferreira, V. Hristov, A. H. Jaffe, *et al.*, “Maxima-1: a measurement of the cosmic microwave background anisotropy on angular scales of 10^{-5} ,” *The Astrophysical Journal* **545** no. 1, (2000) L5.
- [3131] P. de Bernardis, P. A. Ade, J. J. Bock, J. Bond, J. Borrill, A. Boscaleri, K. Coble, B. Crill, G. De Gasperis, P. Farese, *et al.*, “A flat universe from high-resolution maps of the cosmic microwave background radiation,” *Nature* **404** no. 6781, (2000) 955–959.
- [3132] Y. Akrami, S. Anselmi, C. J. Copi, J. R. Eskilt, A. H. Jaffe, A. Kosowsky, P. Petersen, G. D. Starkman, K. González-Quesada, Ö. Güngör, *et al.*, “Promise of future searches for cosmic topology,” *Physical Review Letters* **132** no. 17, (2024) 171501.
- [3133] P. Ade, N. Aghanim, M. Arnaud, M. Ashdown, J. Aumont, C. Baccigalupi, A. Banday, R. Barreiro, N. Bartolo, S. Basak, *et al.*, “Planck 2015 results-xviii. background geometry and topology of the universe,” *Astronomy & Astrophysics* **594** (2016) A18.
- [3134] P. A. Ade, N. Aghanim, C. Armitage-Caplan, M. Arnaud, M. Ashdown, F. Atrio-Barandela, J. Aumont, C. Baccigalupi, A. Banday, R. Barreiro, *et al.*, “Planck 2013 results. xxvi. background geometry and topology of the universe,” *Astronomy & Astrophysics* **571** (2014) A26.
- [3135] W. De Sitter, “Einstein’s theory of gravitation and its astronomical consequences,” *Monthly Notices of the Royal Astronomical Society, Vol. 76, p. 699-728* **76** (1916) 699–728.
- [3136] A. Einstein, “Cosmological considerations on the general theory of relativity,” *Cosmological Constants* (1986) 16.

- [3137] K. Schwarzschild, *Gesammelte Werke Collected Works: Volume 1*, vol. 1. Springer-Verlag, 2013.
- [3138] G. Meurant and P. Tichý, *Error Norm Estimation in the Conjugate Gradient Algorithm*. SIAM, 2024.
- [3139] D. Calvetti, S. Morigi, L. Reichel, and F. Sgallari, “Computable error bounds and estimates for the conjugate gradient method,” *Numerical Algorithms* **25** (2000) 75–88.
- [3140] D. Calvetti, S. Morigi, L. Reichel, and F. Sgallari, “An iterative method with error estimators,” *Journal of computational and applied mathematics* **127** no. 1-2, (2001) 93–119.
- [3141] D. Calvetti, S. Morigi, L. Reichel, and F. Sgallari, “Tikhonov regularization and the L-curve for large discrete ill-posed problems,” *Journal of computational and applied mathematics* **123** no. 1-2, (2000) 423–446.
- [3142] M. R. Hestenes, E. Stiefel, *et al.*, *Methods of conjugate gradients for solving linear systems*, vol. 49. NBS Washington, DC, 1952.
- [3143] C. Lanczos, “Solution of systems of linear equations by minimized iterations,” *J. Res. Nat. Bur. Standards* **49** no. 1, (1952) 33–53.
- [3144] S. Ubaru, J. Chen, and Y. Saad, “Fast estimation of $\text{tr}(f(A))$ via stochastic Lanczos quadrature,” *SIAM Journal on Matrix Analysis and Applications* **38** no. 4, (2017) 1075–1099.
- [3145] M. F. Hutchinson, “A stochastic estimator of the trace of the influence matrix for Laplacian smoothing splines,” *Communications in Statistics-Simulation and Computation* **18** no. 3, (1989) 1059–1076.
- [3146] F. Lindgren, D. Bolin, and H. Rue, “The SPDE approach for Gaussian and non-Gaussian fields: 10 years and still running,” *Spatial Statistics* **50** (2022) 100599.
- [3147] J. Weeks, “SnapPea,” <http://geometrygames.org/SnapPea> (1995) .
- [3148] B. P. Abbott, R. Abbott, T. Abbott, S. Abraham, F. Acernese, K. Ackley, C. Adams, R. Adhikari, V. Adya, C. Affeldt, *et al.*, “GWTC-1: a gravitational-wave transient catalog of compact binary mergers observed by LIGO and Virgo during the first and second observing runs,” *Physical Review X* **9** no. 3, (2019) 031040.
- [3149] N. Waniorek, D. Calvetti, and E. Somersalo, “Bayesian hierarchical dictionary learning,” *Inverse Problems* **39** no. 2, (2023) 024006.
- [3150] A. Bocchinfuso, D. Calvetti, and E. Somersalo, “Bayesian sparsity and class sparsity priors for dictionary learning and coding,” *Journal of Computational Mathematics and Data Science* **11** (2024) 100094.
- [3151] P. I. Frazier, “A tutorial on Bayesian optimization,” *arXiv preprint arXiv:1807.02811* (2018) .
- [3152] P. I. Frazier, “Bayesian optimization,” in *Recent advances in optimization and modeling of contemporary problems*, pp. 255–278. Informs, 2018.
- [3153] P. Yla-Oijala and E. Somersalo, “Computation of electromagnetic fields in axisymmetric rf structures with boundary integral equations,” *Journal of electromagnetic waves and applications* **13** no. 4, (1999) 445–491.
- [3154] M. Lassas and E. Somersalo, “Analysis of the pml equations in general convex geometry,” *Proceedings of the Royal Society of Edinburgh Section A: Mathematics* **131** no. 5, (2001) 1183–1207.
- [3155] M. Lassas, J. Liukkonen, and E. Somersalo, “Complex riemannian metric and absorbing boundary conditions,” *Journal de mathématiques pures et appliquées* **80** no. 7, (2001) 739–768.
- [3156] D. Calvetti and E. Somersalo, *Bayesian Scientific Computing*, vol. 215. Springer Nature, 2023.
- [3157] J. Kaipio and E. Somersalo, *Statistical and computational inverse problems*, vol. 160. Springer Science & Business Media, 2006.
- [3158] A. E. Gelfand and D. K. Dey, “Bayesian model choice: asymptotics and exact calculations,” *Journal of the Royal Statistical Society: Series B (Methodological)* **56** no. 3, (1994) 501–514.

- [3159] R. E. Kass and A. E. Raftery, “Bayes factors,” *Journal of the american statistical association* **90** no. 430, (1995) 773–795.
- [3160] M. A. Capistrán, J. A. Christen, and S. Donnet, “Bayesian analysis of odes: solver optimal accuracy and bayes factors,” *SIAM/ASA Journal on Uncertainty Quantification* **4** no. 1, (2016) 829–849.
- [3161] A. Durmus, E. Moulines, and M. Pereyra, “Efficient bayesian computation by proximal markov chain monte carlo: when langevin meets moreau,” *SIAM Journal on Imaging Sciences* **11** no. 1, (2018) 473–506.
- [3162] N. Chopin and C. P. Robert, “Properties of nested sampling,” *Biometrika* **97** no. 3, (2010) 741–755.
- [3163] E. National Academies of Sciences and Medicine, *The Science of Effective Mentorship in STEMM*. The National Academies Press, Washington, DC, 2019. <https://nap.nationalacademies.org/catalog/25568/the-science-of-effective-mentorship-in-stemm>.
- [3164] “Effective practices for physics programs, guide to equity, diversity, and inclusion.” <https://ep3guide.org/guide/equity-diversity-and-inclusion>. Accessed: 11-15-2023.
- [3165] “Campus organizations and resources.” <https://case.edu/diversity/faculty-staff/campus-organizations-and-resources>. Accessed: 11-15-2023.
- [3166] A. Bocchinfuso, D. Calvetti, and E. Somersalo, “Adaptive anisotropic Bayesian meshing for inverse problems,” *arXiv preprint arXiv:2310.03855* (2023) .
- [3167] A. Bocchinfuso, D. Calvetti, and E. Somersalo, “Bayesian sparsity and class sparsity priors for dictionary learning and coding,” *arXiv preprint arXiv:2309.00999* (2023) .
- [3168] D. Calvetti, A. Cosmo, S. Perotto, and E. Somersalo, “Bayesian mesh adaptation for estimating distributed parameters,” *SIAM Journal on Scientific Computing* **42** no. 6, (2020) A3878–A3906.
- [3169] D. Calvetti, M. Pragliola, E. Somersalo, and A. Strang, “Sparse reconstructions from few noisy data: analysis of hierarchical Bayesian models with generalized gamma hyperpriors,” *Inverse Problems* **36** no. 2, (2020) 025010.
- [3170] D. Calvetti, F. Pitolli, E. Somersalo, and B. Vantaggi, “Bayes meets Krylov: Statistically inspired preconditioners for CGLS,” *SIAM Review* **60** no. 2, (2018) 429–461.
- [3171] D. Calvetti, E. Somersalo, and A. Strang, “Hierarchical Bayesian models and sparsity: l^2 -magic,” *Inverse Problems* **35** no. 3, (2019) 035003.
- [3172] D. Calvetti, M. Pragliola, and E. Somersalo, “Sparsity promoting hybrid solvers for hierarchical bayesian inverse problems,” *SIAM Journal on Scientific Computing* **42** no. 6, (2020) A3761–A3784.
- [3173] D. Calvetti, A. Pascarella, F. Pitolli, E. Somersalo, and B. Vantaggi, “Brain activity mapping from meg data via a hierarchical bayesian algorithm with automatic depth weighting,” *Brain Topography* **32** (2019) 363–393.
- [3174] D. Calvetti, S. Nakkireddy, and E. Somersalo, “Approximation of continuous eit data from electrode measurements with bayesian methods,” *Inverse Problems* **35** no. 4, (2019) 045012.
- [3175] D. Calvetti, J. Prezioso, R. Occhipinti, W. F. Boron, and E. Somersalo, “Computational model of electrode-induced microenvironmental effects on ph measurements near a cell membrane,” *Multiscale Modeling & Simulation* **18** no. 2, (2020) 1053–1075.
- [3176] D. Calvetti and E. Somersalo, “Computationally efficient sampling methods for sparsity promoting hierarchical Bayesian models,” *arXiv preprint arXiv:2303.16988* (2023) .
- [3177] M. Pragliola, D. Calvetti, and E. Somersalo, “Overcomplete representation in a hierarchical bayesian framework,” *Inverse Problems and Imaging* **16** no. 1, (2022) 19–38.

- [3178] D. Calvetti, B. Johnson, A. Pascarella, F. Pitolli, E. Somersalo, and B. Vantaggi, “Mining the mind: linear discriminant analysis of MEG source reconstruction time series supports dynamic changes in deep brain regions during meditation sessions,” *Brain Topography* **34** no. 6, (2021) 840–862.
- [3179] D. Calvetti, A. Hoover, J. Rose, and E. Somersalo, “Bayesian particle filter algorithm for learning epidemic dynamics,” *Inverse Problems* **37** no. 11, (2021) 115008.
- [3180] N. Starkman, J. Bovy, J. J. Webb, D. Calvetti, and E. Somersalo, “On the fast track: Rapid construction of stellar stream paths,” *Monthly Notices of the Royal Astronomical Society* **522** no. 4, (2023) 5022–5036.
- [3181] M. Pragliola, D. Calvetti, and E. Somersalo, “Overcomplete representation in a hierarchical bayesian framework,” *arXiv preprint arXiv:2006.13524* (2020) .
- [3182] D. Calvetti, A. Pascarella, F. Pitolli, E. Somersalo, and B. Vantaggi, “The IAS-MEEG package: A flexible inverse source reconstruction platform for reconstruction and visualization of brain activity from M/EEG data,” *Brain Topography* **36** no. 1, (2023) 10–22.
- [3183] D. Calvetti, A. P. Hoover, J. Rose, and E. Somersalo, “Modeling epidemic spread among a commuting population using transport schemes,” *Mathematics* **9** no. 16, (2021) 1861.
- [3184] G. Idumah, E. Somersalo, and D. Calvetti, “A spatially distributed model of brain metabolism highlights the role of diffusion in brain energy metabolism,” *Journal of Theoretical Biology* **572** (2023) 111567.
- [3185] A. Bocchinfuso, D. Calvetti, and E. Somersalo, “Modeling surface pH measurements of oocytes,” *Biomedical Physics & Engineering Express* **8** no. 4, (2022) 045006.
- [3186] A. Bocchinfuso, D. Calvetti, and E. Somersalo, “Estimation of the cell membrane permeability for gas transport from surface ph measurements,” *Inverse Problems* **39** no. 9, (2023) 094004.
- [3187] D. Calvetti, M. Dunlop, E. Somersalo, and A. Stuart, “Iterative updating of model error for Bayesian inversion,” *Inverse Problems* **34** no. 2, (2018) 025008.
- [3188] D. Calvetti and E. Somersalo, “Inverse problems: From regularization to bayesian inference,” *Wiley Interdisciplinary Reviews: Computational Statistics* **10** no. 3, (2018) e1427.
- [3189] D. Calvetti, F. Pitolli, J. Prezioso, E. Somersalo, and B. Vantaggi, “Priorconditioned cgls-based quasi-map estimate, statistical stopping rule, and ranking of priors,” *SIAM Journal on Scientific Computing* **39** no. 5, (2017) S477–S500.
- [3190] G. Lemaître, “vol. 47a,” *Ann. Soc. Sci. de Bruxelles* (1927) 49.
- [3191] D. Calvetti and E. Somersalo, “Distributed tikhonov regularization for ill-posed inverse problems from a bayesian perspective,” *arXiv preprint arXiv:2404.05956* (2024) .
- [3192] D. Calvetti, M. Pragliola, and E. Somersalo, “Sparsity-promoting hierarchical bayesian model for eit with a blocky target,” *arXiv preprint arXiv:2404.19115* (2024) .
- [3193] Y. B. Zeldovich, D. Sokoloff, and A. Starobinskii, “Some problems of geometry as a whole in general relativity, in 150 years of the lobachevsky geometry,” *Institute of Scientific and Technic Information, Moscow* (1977) 271–282.
- [3194] M. Pragliola, D. Calvetti, and E. Somersalo, “An efficient hierarchical bayesian method for the kuopio tomography challenge 2023,” *arXiv preprint arXiv:2405.03343* (2024) .
- [3195] M. Amankwah, A. Bersani, D. Calvetti, G. Davico, E. Somersalo, and M. Viceconti, “Exploring muscle recruitment by bayesian methods during motion,” *bioRxiv* (2024) 2024–02.
- [3196] D. Adams, *The Hitchhiker’s Guide to the Galaxy*. San Val, 1995.
<http://books.google.com/books?id=W-xMPgAACAAJ>.
- [3197] A. Ikeda, “On the spectrum of homogeneous spherical space forms,” *Kodai Mathematical Journal* **18** no. 1, (January, 1995) .

- [3198] D. A. Varshalovich, A. N. Moskalev, and V. K. Khersonskii, *Quantum Theory of Angular Momentum: Irreducible Tensors, Spherical Harmonics, Vector Coupling Coefficients, 3nj Symbols*. World Scientific Publishing Company, 1988.
- [3199] R. Lehoucq, J.-P. Uzan, and J. Weeks, “Eigenmodes of lens and prism spaces,” 2004. <https://arxiv.org/abs/math/0202072>.
- [3200] W. P. Thurston, *Three-dimensional geometry and topology*. Princeton mathematical series 35. Princeton University Press, 1997.
- [3201] J. Ben Achour, E. Huguet, J. Queva, and J. Renaud, “Explicit vector spherical harmonics on the 3-sphere,” *J. Math. Phys.* **57** no. 2, (2016) 023504, [arXiv:1505.03426](https://arxiv.org/abs/1505.03426) [math-ph].
- [3202] M. Bander and C. Itzykson, “Group theory and the hydrogen atom,” *Rev. Mod. Phys.* **38** (1966) 330–345.
- [3203] L. F. Abbott and R. K. Schaefer, “A general, gauge-invariant analysis of the cosmic microwave anisotropy,” *The Astrophysical Journal* **308** (September, 1986) 546.
- [3204] S. Caillerie, M. Lachieze-Rey, J. P. Luminet, R. Lehoucq, A. Riazuelo, and J. Weeks, “A new analysis of poincaré dodecahedral space model,” *Astron. Astrophys.* **476** (2007) 691, [arXiv:0705.0217](https://arxiv.org/abs/0705.0217) [astro-ph].
- [3205] J. Lesgourgues and T. Tram, “Fast and accurate cmb computations in non-flat frw universes,” *JCAP* **09** (2014) 032, [arXiv:1312.2697](https://arxiv.org/abs/1312.2697) [astro-ph.CO].
- [3206] T. Tram, “Computation of hyperspherical bessel functions,” *Commun. Comput. Phys.* **22** no. 3, (2017) 852–862, [arXiv:1311.0839](https://arxiv.org/abs/1311.0839) [astro-ph.IM].
- [3207] E. M. Lifshitz and I. M. Khalatnikov, “Investigations in relativistic cosmology,” *Adv. Phys.* **12** (1963) 185–249.
- [3208] J. M. Bardeen, “Gauge invariant cosmological perturbations,” *Phys. Rev. D* **22** (1980) 1882–1905.
- [3209] W. Hu, U. Seljak, M. J. White, and M. Zaldarriaga, “A complete treatment of cmb anisotropies in a frw universe,” *Phys. Rev. D* **57** (1998) 3290–3301, [arXiv:astro-ph/9709066](https://arxiv.org/abs/astro-ph/9709066).
- [3210] A. Riazuelo, J.-P. Uzan, R. Lehoucq, and J. Weeks, “Simulating cosmic microwave background maps in multi-connected spaces,” *Phys. Rev. D* **69** (2004) 103514, [arXiv:astro-ph/0212223](https://arxiv.org/abs/astro-ph/0212223).