José Luis Bernal

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Research Interests

Cosmology: large-scale structure, line-intensity mapping, dark matter, Hubble constant tension, agnostic modeling and data analysis, neutrino cosmology, primordial non-Gaussianity, blinding methods in cosmology.

Professional Career

Max Planck Institute for Astrophysics, Postdoctoral research fellow — Oct 2022 – present

Johns Hopkins University, Davis Postdoctoral Fellowship — Oct 2019 – Sept 2022
Department of Physics and Astronomy

University of Barcelona, FPI fellow PhD Candidate — Sept 2015 – Sept 2019
Quantum Physics and Astrophysics Department, Institute of Cosmos Sciences

Education

Ph.D. in Physics, University of Barcelona — Sept 2019
PhD Thesis: *Cosmology on the edge of ΛCDM*, (excellent *Summa Cum Laude*)
Advisor: Licia Verde

M.Sc. in Theoretical Physics, Universidad Autónoma de Madrid — Jun 2015
Master Thesis: *A consistency test of General Relativity using Expansion History and Growth of Structures*
Advisors: Licia Verde, Antonio J. Cuesta, Alexander Knebe

Bachelor Degree in Physics with honors, Universidad Autónoma de Madrid — June 2014

Honors & Awards

- Second Prize of the XXV Prize 'Claustre de Doctors' of the University of Barcelona — 2021
- Doctoral Extraordinary Prize at the University of Barcelona, class 2018-2019 — 2021
- Spanish Astronomy Society Thesis Prize to the best Doctoral Thesis in A&A — 2020
- Allan C. and Dorothy H. Davis Postdoctoral Fellowship, JHU — 2019
- FPI Fellowship for the formation of doctors, Spanish MINECO — 2015
- Postgraduate Fellowship to study the Master in Theoretical Physics, UAM+CSIC — 2014
- Extraordinary Prize for the Best Academic Record of Physics 2014 Class, UAM — 2014
- Excellent Fellowship, Madrid regional Government — 2013, 2012, 2011, 2010

Teaching

Teaching Assistant at the University of Barcelona

- Astronomy — Spring 2017
- Ordinary Differential Equations and Vector Calculus — Spring 2017, Spring 2018

Peer Review

Astrophysics and cosmology journals, including:
ApJ, JCAP, A&A, PDU, EPJC, Universe, IJMPD

External reviewer:
Universidad Computense de Madrid's program 'Ayudas para la realización de proyectos I+D para jóvenes doctores' — 2022

External reviewer for NASA's FINESST program 2020, 2021, 2022

Mentoring

Graduate students:

Gabriela Sato-Polito (3 publications), Hector A. Cruz; current graduate students at JHU

Katie Short (2 publications); current graduate student at ICC-UB

Publication Metrics

31 refereed journal publications (14 first-authored), 1700+ citations, h-index=18

1 additional first-author article accepted at PRL, 1 article accepted at PRD and other 4 submitted (2 to PRL, 1 to PRD, and 1 to JCAP).

Outreach

Round table about dark matter for the "Dark Matter Day"	2018
At what speed does the Universe expands? - Invited talk, Sabadell Astronomy Group	2018
Unravelling the dark Universe - Exhibition about cosmology, gravity and black holes	2017
Physics Experiments - UB (demonstrations for High school students)	2016, 2017, 2018
Walk on the Dark Side - Invited talk for Physics bachelor students	2016
Physis - UB (demonstrations for High school students)	2016

Professional Activities

Member of the HETDEX collaboration	2022 - present
Member of the SKA Cosmology group and Graviational Waves group	2018 - present
Member of the Australian SKA Pathfinder (ASKAP) Cosmology group	2018 - present
Postdoc representative in the "Joint JHU/STScI Colloquium Committee"	2021 - 2022
Founder and coordinator of "Physics and Astronomy Postdocs and Research Scientists" association at JHU	2020 - 2022
Organizer of the "Particle theory seminars" at JHU	2020 - 2022
Founder and organizer of the "PhD & Science" meetings at the ICCUB	2018 - 2019
LOC member in "Venice Cosmology Workshop 2018: The Island"	2018

Visiting Research

Department of Physics and Astronomy, JHU (funded by María de Maeztu)	April 2018
Institute for Astronomy, University of Edinburgh (funded by ICCUB)	October 2017
Radcliffe Institute of Advanced Study, Harvard (funded by FPI fellowship)	April - June 2016

References

Marc Kamionkowski
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Alvise Raccanelli
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List of Publications

1. V. Poulin, **J. L. Bernal**, E. D. Kovetz, M. Kamionkowski. *The Sigma-8 Tension is a Drag* - arXiv:2209.06217.
2. **J. L. Bernal**, A. Caputo, G. Sato-Polito, J. Mirocha, M. Kamionkowski. *Seeking dark matter with γ-ray attenuation* - arXiv:2208.13794.
3. **J. L. Bernal** and E. D. Kovetz. *Line-Intesity Mapping: Theory Review* - The Astronomy and Astrophysics Review, 30, 5 - arXiv:2206.15377.
4. W. D. Kenworthy, A. G. Riess, D. Scolnic, W. Yuan, **J. L. Bernal**, D. Brout, S. Cassertano, D. O. Jones, L. Macri, E. Peterson. *Measurements of the Hubble Constant with a Two Rung Distance Ladder: Two Out of Three Ain't Bad* - ApJ 935, 2, 83 - arXiv:2204.10866.
5. K. Short, **J. L. Bernal**, K. K. Boddy, V. Gluscevic, L. Verde. *Dark matter-baryon scattering effects on temperature perturbations an implications for cosmic* - arXiv:2203.16524.
6. **J. L. Bernal**, G. Sato-Polito, M. Kamionkowski. *The cosmic optical background excess, dark matter, and line-intensity mapping* - arXiv:2203.11236.
7. G. Sato-Polito, **J. L. Bernal**. *Analytical covariance between voxel intensity distributions and line-intensity mapping power spectra* - arXiv:2202.02330.
8. L. Ji, M. Kamionkowski, **J. L. Bernal**. *Cosmological perturbations: non-cold relics without the Boltzmann hierarchy* - arXiv:2201.11129.
9. **J. L. Bernal**, A. Caputo, F. Villaescusa-Navarro, M. Kamionkowski. *Detecting the radiative decay of the cosmic neutrino background with line-intensity mapping* - PRL, 127, 131102 - arXiv:2103.12099.
10. D. Valcin, R. Jimenez, L. Verde, **J. L. Bernal**, B. D. Wandelt. *The Age of the Universe with Globular Clusters: Reducing Systematic Uncertainties* - JCAP08(2021)017 - arXiv:2102.04486.
11. G. C.-F. Chen, C. D. Fassnacht, S. H. Suyu, A. Yildrim, E. Komatsu, **J. L. Bernal**. *TDCOSMO VI: Distance Measurements in Time-delay Cosmography under the Mass-sheet transformation* - A&A 652, A7 - arXiv:2011.06002.
12. M. B. Silva, E. D. Kovetz, G. K. Keating, A. M. Dizgah, M. Bethermin, P. C. Breysse, K. Karkare, **J. L. Bernal** and J. Dellabrouille, *Mapping large-scale-structure evolution over cosmic times* - Experimental Astronomy (2021) - arXiv:1908.07533.
13. T. L. Smith, V. Poulin, **J. L. Bernal**, K. K. Boddy, M. Kamionkowski, R. Murgia. *Early dark energy is not excluded by current large-scale structure data* - PRD, 103, 123542 - arXiv:2009.10740.
14. **J. L. Bernal**, L. Verde, R. Jimenez, M. Kamionkowski, D. Valcin, B. D. Wandelt. *The trouble beyond H_0 and the new cosmic triangles* - PRD, 103, 103533 - arXiv:2102.05066.
15. G. Sato-Polito, **J. L. Bernal**, K. K. Boddy, M. Kamionkowski. *Kinetic Sunyaev-Zel'dovich tomography with line-intensity mapping* - PRD, 103, 083519 - arXiv: 2011.08193.
16. **J. L. Bernal**, A. Caputo, M. Kamionkowski. *Strategies to Detect Dark-Matter Decays with Line-Intensity Mapping* - PRD, 103, 063523 - arXiv: 2012.00771.
17. **J. L. Bernal**, T. L. Smith, K. K. Boddy and M. Kamionkowski. *Robustness of baryon acoustic oscillation constraints for early-Universe modifications of ΛCDM cosmology* - PRD, 102, 123515 - arXiv:2004.07263.
18. A. Rida Khalifeh, N. Bellomo, **J. L. Bernal** and R. Jimenez, *Can Dark Matter be Geometry? A Case Study with Mimetic Dark Matter* - PDU, 30, 100646 - arXiv:1907.03660.
19. D. Valcin, **J. L. Bernal**, R. Jimenez, L. Verde, B. D. Wandelt. *Inferring the Age of the Universe with Globular Clusters* - JCAP12(2020)002 - arXiv:2007.06594.

20. **J. L. Bernal**, N. Bellomo, A. Raccanelli, L. Verde. *Beware of commonly used approximations II: estimating systematic biases in the best-fit parameters* - JCAP10(2020)017 -arXiv:2005.09666.

21. N. Bellomo, **J. L. Bernal**, G. Scelfo, A. Raccanelli, L. Verde. *Beware of commonly used approximations I: errors in forecasts* - JCAP10(2020)016 - arXiv:200510384.

22. S. Brieden, H. Gil-Marín, L. Verde, **J. L. Bernal**. *Blind Observers of the Sky* - JCAP09(2020)052 - arXiv:2006:10857.

23. G. Sato-Polito, **J. L. Bernal**, E. D. Kovetz and M. Kamionkowski. *Antisymmetric cross-correlation of line-intensity maps as a probe of reionization* - PRD, 102, 043519 - arXiv:2005.08977.

24. K. Short, **J. L. Bernal**, A. Raccanelli, L. Verde and J. Chluba. *Enlightening the dark ages with dark matter* - JCAP07(2020)020 - arXiv:1912.07409.

25. Square Kilometre Array Cosmology Science Working Group (Incl. **J. L. Bernal**). *Cosmology with Phase 1 of the Square Kilometre Array; Red Book 2018: Technical specifications and performance forecasts* - PASA, 37, e007, 2020 - arXiv:1811.02743.

26. **J. L. Bernal**, P. Breysse and E. D. Kovetz, *The Cosmic Expansion History from Line-Intensity Mapping* - PRL, 123, 251301 - arXiv:1907.10065.

27. **J. L. Bernal**, P. Breysse, H. Gil-Marín and E. D. Kovetz, *A User's Guide to Extracting Cosmological Information from Line-Intensity Maps* - PRD, 100, 123522 - arXiv:1907.10067.

28. **J. L. Bernal**, A. Raccanelli, E. D. Kovetz, D. Parkinson, R. P. Norris, G. Danforth and C. Schmitt. *Probing ΛCDM cosmology with the Evolutionary Map of the Universe survey* - JCAP02(2019)030 - arXiv:1810.06672.

29. B. Kalus, W. J. Percival, D. J. Bacon, E. M. Mueller, L. Samushia, L. Verde, A. J. Ross and **J. L. Bernal**. *A map-based method for eliminating systematic modes from galaxy clustering power spectra with application to BOSS* - MNRAS, 482, 453 - arXiv:1806.02789.

30. F. D'Eramo, R. Z. Ferreira, A. Notari, and **J. L. Bernal**. *Hot axions and the H_0 tension* - JCAP11(2018)014 - arXiv:1808.07430.

31. **J. L. Bernal** and J. A. Peacock. *Conservative cosmology: combining data with allowance for unknown systematics* - JCAP07(2018)002 - arXiv:1803.04470.

32. **J. L. Bernal**, A. Raccanelli, L. Verde and J. Silk. *Signatures of primordial black holes as seeds of supermassive black holes* - JCAP05(2018)017 - arXiv:1712.01311.

33. N. Bellomo, **J. L. Bernal**, A. Raccanelli and L. Verde. *Primordial Black Holes as Dark Matter: Converting Constraints from Monochromatic to Extended Mass Distributions* - JCAP01(2018)004 - arXiv:1709.07467.

34. **J. L. Bernal**, N. Bellomo, A. Raccanelli and L. Verde. *Cosmological implications of primordial black holes* - JCAP10(2017)052 - arXiv:1709.07465.

35. L. Verde, **J. L. Bernal**, A. Heavens and R. Jimenez. *The length of the low-redshift standard ruler* - MNRAS, 467, 731 - arXiv:1607.05297.

36. **J. L. Bernal**, L. Verde and A. G. Riess. *The trouble with H_0* - JCAP10(2016)019 - arXiv:1607.05617.

37. **J. L. Bernal**, L. Verde and A. J. Cuesta. *Parameter splitting in dark energy: is dark energy the same in the background and in the cosmic structures* - JCAP02(2016)059 - arXiv:1511.03049.

Seminars & Talks

- *The potential of line-intensity mapping and how to fulfill it* - Invited seminar at Max Planck Institute for Astrophysics, Germany - October 2022.
- *Optimizing information return from line-intensity mapping* - Contributed talk at "Lyman-X day" workshop, Garching, Germany - October 2022.
- *Primordial non-Gaussianity with Line-Intensity Mapping* - Contributed talk at "A cosmic Window to Fundamental Physics: Primordial Non-Gaussianity and Beyond" conference, Madrid, Spain - September 2022.
- *Seeking axion-like particles with gamma-ray attenuation* - invited talk at "Particle Avenues in the Dark Universe Arena: Axions" workshop, Italy - September 2022.
- *Looking for multi-electronvolt axion-like particle dark matter on the sky* - invited seminar at IFCA, Spain - September 2022.
- *Seeking dark matter with γ-ray attenuation* - contributed talk at "Vipolze conference", Slovenia - July 2022.
- *The cosmic optical background excess and dark matter* - contributed talk at "Second EuCAPT Annual Symposium", virtual conference - May 2022.
- *On the importance of temperature perturbations sourced by dark matter-baryon scattering* - contributed talk at "Reionization and Cosmic Dawn: Looking Forward to the Past", UC Berkeley - March 2022.
- *Exploring the Universe with Line-Intensity Mapping* - invited seminar at Institute of Cosmos Sciences (ICC-UB) - January 2022.
- *Using line-intensity mapping to look for exotic radiative decays* - invited seminar at University of Maryland - September 2021.
- *Searching for exotic radiative decays with line-intensity mapping* - contributed talk at KICP LIM Workshop, Chicago University - July 2021.
- *The trouble with H_0 (and beyond)* - invited seminar at Clemson University - May 2021.
- *Dark matter and neutrino decays with line-intensity mapping* - invited seminar in the Cosmic Physics Center (CPC) at Fermilab - May 2021.
- *The trouble on H_0 (and beyond)* - invited seminar at the Kavli Institute for Cosmological Physics, University of Chicago - April 2021.
- *The trouble on H_0: reloaded* - invited talk to the "theoretical particle physics seminars" at Stanford University - April 2021.
- *Detecting dark matter decays with line-intensity mapping* - contributed lighting talk to "Latin American Workshop on Observational Cosmology" ICTP SAIFR - December 2020.
- *Cosmology on the Edge of Λ-Cold Dark Matter* - Invited talk at "XIV SEA Scientific Meeting" - Remotely, Spain - July 2020.
- Member of the panel for the discussion session, day 5 - H_0 2020 - Remote meeting - June 2020.
- *The take on cosmology and the Hubble constant tension using Line Intensity Mapping observations* - Invited talk at "Fundamental Theory" seminar at the Institute for Gravitation & Cosmology, Penn State University, USA - February 2020.
- *Exploiting Line-Intensity Mapping for Cosmology* - Invited talk at "2019 GSFC-JHU Interaction Day" - Johns Hopkins University, Baltimore, USA - October 2019.
- *The Cosmic Expansion History from Line-Intensity Mapping* - Contributed talk at "Cosmic Controversies" - Kavli Institute for Cosmological Physics at the University of Chicago, USA - October 2019.

- *The next frontier: clustering at ultra-large scales* - Invited talk at "Concordances and challenges in cosmology after Planck" - Sexten Center for Astrophysics, Italy - February 2019.
- *Synergies and fundamental physics from the large-scale structure* - California Institute of Technology, USA - February 2019.
- *Synergies and fundamental physics from the large-scale structure* - University of California in Santa Cruz, USA - January 2019.
- *Synergies and fundamental physics from the large-scale structure* - Invited talk at Lawrence Berkeley National Laboratory, USA - January 2019.
- *Synergies and fundamental physics from the large-scale structure* - Center for Astrophysics, Harvard University, USA - January 2019.
- *Synergies and fundamental physics from the large-scale structure* - Harvard University, USA - January 2019.
- *Cosmology from the Dark Ages* - Institute of Theoretical Physics (IFT), Spain - October 2018.
- *Cosmology with 21 cm Intensity Mapping from the Dark Ages* - Invited talk at "From Dark Energy to Bright Synergies " - Sexten Center for Astrophysics, Italy - July 2018.
- *Signatures of primordial black holes as seeds of supermassive black holes* - Contributed talk at "XIII SEA Scientific meeting" - Salamanca, Spain - July 2018.
- *Measuring Galaxy Clustering at Ultra Large Scales* - Invited talk at "Unsolved Problems in Astrophysics and Cosmology" - Eötvos University, Hungary - July 2018.
- *Signatures of primordial black holes as seeds of supermassive black holes* - Contributed talk at "Cosmology2018 Cosmological Applications from First Stars, Reionization and 21-cm Observations" - Institute of Cosmos Sciences (ICC-UB), Spain - June 2018.
- *Using High Redshift Intensity Mapping for Cosmology* - Invited talk at "Venice Cosmology Workshop 2018: The Island" - Venice International University, Italy - June 2018.
- *Signatures of primordial black holes as seeds of supermassive black holes* - Center for Computational Astrophysics, Flatiron Institute, USA - May 2018.
- *Signatures of primordial black holes as seeds of supermassive black holes* - Center for Cosmology and Particle Physics, New York University, USA - April 2018.
- *Cosmological implications of primordial black holes* - Coffee talk. Institute for Astronomy, Royal Observatory of Edinburgh, UK - October 2017.
- *Diving into precision cosmology and the role of cosmic magnification* - Invited talk at "ICCUB Winter Meeting 2017" - Institute of Cosmos Sciences, Spain - February 2017.
- *The trouble with H_0 and the low redshift standard ruler* - Astrophysics group journal club. Imperial College London, UK - November 2016.
- *Parameter splitting in dark energy: is dark energy the same in the background and in the cosmic structures* - Contributed talk at "XII SEA Scientific meeting" - Bilbao, Spain - July 2016.
- *Digging into the tensions of LambdaCDM* - Center for Astrophysics, Harvard University, USA - May 2016.
- *Background expansion vs. growth of structure: consistency check* - Columbia University, USA - April 2016.

Posters

– *The trouble with H_0* - Cosmology school in the Canary Islands - Fuerteventura, Spain, September 2017.
– *Parameter splitting in dark energy: is dark energy the same in the background and in the cosmic structures* - Meeting on fundamental cosmology - Barcelona, Spain, June 2016.