Oliver H. E. Philcox, Ph.D.

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CURRENT POSITIONS

Simons Society of Fellows, New York, USA *2022 - Present*
Junior Fellow

Department of Physics, Columbia University, New York, USA *2022 - Present*
Postdoctoral Research Scientist

Mentors: Prof. J. Colin Hill & Prof. Lam Hui

EDUCATION

Department of Astrophysical Sciences, Princeton University, USA *2019 - 2022*
Ph.D. in Astrophysics (2022)

Thesis: 'Probing Fundamental Cosmology with Galaxy Surveys'
Thesis Advisors: Prof. David N. Spergel & Prof. Matias Zaldarriaga

M.A. in Astrophysics (2020)

Center for Astrophysics | Harvard & Smithsonian, Cambridge, USA *2018 - 2019*
Pre-Doctoral Student, *Herchel-Smith Scholar*

Advisor: Prof. Daniel J. Eisenstein

Institute of Astronomy, University of Cambridge, UK *2017 - 2018*
M.Sci. in Astrophysics

Part III: 1st Class (Rank 1/28, 97%)
Thesis: 'Detection and Removal of B-mode CMB Dust Foregrounds with Signatures of Statistical Anisotropy'
Thesis Advisor: Dr. Blake D. Sherwin

Emmanuel College, University of Cambridge, UK *2014 - 2017*
M.A. (Cantab.) in Natural Sciences, *Senior Scholar*

Parts IA, IB, II: 1st Class (Rank 1/20, 90%)

LONG-TERM ACADEMIC VISITS

Center for Computational Astrophysics Jul. 2021 - Present
Guest Researcher *New York, USA*

Institute for Advanced Study Sep. 2020 - Jul. 2022
Visiting Graduate Student with Prof. Matias Zaldarriaga *Princeton, USA*

Max-Planck Institute for Astrophysics Aug. - Sep. 2020
Visiting Graduate Student with Prof. Eiichiro Komatsu *Munich, Germany*

Department of Applied Mathematics and Theoretical Physics May - Jul. 2020
Visiting Graduate Student with Dr. Blake D. Sherwin *Cambridge, UK*

Max-Planck-Institut für Astronomie Jul. - Sep. 2017
Summer Intern with Dr. Jan Rybizki *Heidelberg, Germany*

Center for Astrophysics | Harvard & Smithsonian Jun. - Aug. 2016
Undergraduate Research Fellow with Dr. Ákos Bogdán *Cambridge, USA*

PUBLICATION LIST

* = *Author list alphabetized*

Major Author

1. **Philcox, O. H. E.**, Ereza, J., "Could Sample Variance be Responsible for the Parity-Violating Signal Seen in the BOSS Galaxy Survey?", *submitted to Phys. Rev. D* (arXiv).
2. **Philcox, O. H. E.**, Shiraishi, M., "Testing Graviton Parity and Gaussianity with Planck T-, E- and B-mode Bispectra", *submitted to Phys. Rev. D* (arXiv).
3. Goldstein, S., **Philcox, O. H. E.**, Hill, J. C., Esposito, A., Hui, L., "Consistently Constraining $f_{\rm NL}$ with the Squeezed Lensing Bispectrum using Consistency Relations", *submitted to Phys. Rev. D* (arXiv).
4. Modi, C., **Philcox, O. H. E.**, "Hybrid SBI or How I Learned to Stop Worrying and Learn the Likelihood" *submitted to Phys. Rev. Lett.* (arXiv).
5. **Philcox, O. H. E.**, König, M. J., Alexander, S., Spergel, D. N., "What Can Galaxy Shapes Tell Us About Physics Beyond the Standard Model?", *submitted to Phys. Rev. D* (arXiv).
6. **Philcox, O. H. E.**, Shiraishi, M., "Testing Parity Symmetry with the Polarized Cosmic Microwave Background", *submitted to Phys. Rev. D* (arXiv).
7. *Coulton, W. R., **Philcox, O. H. E.**, Villaescusa-Navarro, F. A., "Signatures of a Parity-Violating Universe", *Phys. Rev. D* **109**, 023531 (2024) (arXiv).
8. **Philcox, O. H. E.**, "Optimal Estimation of the Binned Mask-Free Power Spectrum, Bispectrum, and Trispectrum on the Full Sky: Tensor Edition", *Phys. Rev. D*, **108**, 063506 (2023) (arXiv).
9. *Ivanov, M. M., **Philcox, O. H. E.**, "Measuring H_0 with Spectroscopic Surveys", *chapter in "Hubble Constant Tension" (Eds. Di Valentino, E. and Brout, D.)* (arXiv).
10. **Philcox, O. H. E.**, "Do the CMB Temperature Fluctuations Conserve Parity?", *Phys. Rev. Lett.* **131**, 181001 (2023) (arXiv).
11. **Philcox, O. H. E.**, "Optimal Estimation of the Binned Mask-Free Power Spectrum, Bispectrum, and Trispectrum on the Full Sky: Scalar Edition", *Phys. Rev. D* **107**, 123516 (2023) (arXiv).
12. Creque-Sarbinowski, C., Alexander, S., Kamkonkowski, M., **Philcox, O. H. E.**, "Parity-Violating Trispectrum from Chern-Simons Gravity", *JCAP* 11 029 (2023) (arXiv).
13. Surrao, K. M., **Philcox, O. H. E.**, Hill, J. C., "ReMASTERed: Accurate Estimation of Angular Power Spectra for Maps with Correlated Masks", *Phys. Rev. D* **107**, 083521 (2023) (arXiv).
14. Ivanov, M. M., **Philcox, O. H. E.**, Cabass, G., Nishimichi, T., Simonović, M., Zaldarriaga, M., "Cosmology with the Galaxy Bispectrum Multipoles: Optimal Estimation and Application to BOSS Data", *Phys. Rev. D* **107**, 083515 (2023) (arXiv).
15. *Cabass, G., Ivanov, M. M., **Philcox, O. H. E.**, Simonović, M., Zaldarriaga, M., "Constraining Single-Field Inflation with MegaMapper", *Phys. Lett. B* **841**, 137912 (2023) (arXiv).
16. *Cabass, G., Ivanov, M. M., **Philcox, O. H. E.**, "Colliders and Ghosts: Constraining Inflation with the Parity-Odd Galaxy Four-Point Function", *Phys. Rev. D* **107**, 023523 (2023) (arXiv).
17. Goldstein, S., Esposito, A., **Philcox, O. H. E.**, Hui, L., Hill, J. C., Scoccimarro, R., Abitbol, M. H., "Squeezing $f_{\rm NL}$ out of the matter bispectrum with consistency relations", *Phys. Rev. D* **106**, 123525 (2023) (arXiv).
18. **Philcox, O. H. E.**, Torquato, S., "The Disordered Heterogeneous Universe: Galaxy Distribution and Clustering Across Length Scales", *Phys. Rev. X* **13**, 011038 (2023) (arXiv).
19. **Philcox, O. H. E.**, Johnson, M. C., "Novel Cosmological Tests from Combining Galaxy Lensing and the Polarized Sunyaev-Zel'dovich Effect", *Phys. Rev. D* **106**, 083501 (2022) (arXiv).
20. **Philcox, O. H. E.** "Probing Parity-Violation with the Four-Point Correlation Function of BOSS Galaxies", *Phys. Rev. D* **106**, 063501 (2022) (arXiv).

21. **Philcox, O. H. E.**, Ivanov, M. M., Cabass, G., Simonović, M., Zaldarriaga, M., Nishimichi, T. "Cosmology with the Redshift-Space Galaxy Bispectrum Monopole at One-Loop Order", *Phys. Rev. D* **106**, 043530 (arXiv).

22. **Philcox, O. H. E.**, Farren, G. S., Sherwin, B. D., Baxter, E. J., Brout, D. J., "Determining the Hubble Constant without the Sound Horizon: A 3.6% Constraint on H_0 from Galaxy Surveys, CMB Lensing and Supernovae", *Phys. Rev. D* **106**, 063530 (2022) (arXiv).

23. *Cabass, G., Ivanov, M. M., **Philcox, O. H. E.**, Simonović, M., Zaldarriaga, M. "Constraints on Multi-Field Inflation from the BOSS Galaxy Survey", *Phys. Rev. D* **106**, 043506 (2022) (arXiv).

24. *Cabass, G., Ivanov, M. M., **Philcox, O. H. E.**, Simonović, M., Zaldarriaga, M. "Constraints on Single-Field Inflation from the BOSS Galaxy Survey", *Phys. Rev. Lett.* **129**, 021301 (2022) (arXiv).

25. Farren, G. S., **Philcox, O. H. E.**, Sherwin, B. D. "Determining the Hubble Constant without the Sound Horizon: Perspectives with Future Galaxy Surveys", *Phys. Rev. D* **105**, 063503 (2022) (arXiv).

26. **Philcox, O. H. E.**, Ivanov, M. M. "The BOSS DR12 Full-Shape Cosmology: ΛCDM Constraints from the Large-Scale Galaxy Power Spectrum and Bispectrum Monopole", *Phys. Rev. D* **105**, 043517 (2022) (arXiv).

27. Ivanov, M. M., **Philcox, O. H. E.**, Nishimichi, T., Simonović, M., Takada, M., Zaldarriaga, M. "Precision Analysis of the Redshift-Space Galaxy Bispectrum", *Phys. Rev. D* **105**, 063512 (2022) (arXiv).

28. Ivanov, M. M., **Philcox, O. H. E.**, Simonović, M., Zaldarriaga, M., Nishimichi, T., Takada, M. "Cosmological Constraints Without Non-linear Redshift-Space Distortions", *Phys. Rev. D* **105**, 043531 (2022) (arXiv).

29. **Philcox, O. H. E.**, Hou J., Slepian, Z. "A First Detection of the Connected 4-Point Correlation Function of Galaxies using the BOSS CMASS Sample", *submitted to Phys. Rev. D* (arXiv).

30. **Philcox, O. H. E.** "Cosmology Without Windows: Cubic Estimators for the Galaxy Bispectrum", *Phys. Rev. D* **104**, 123529 (2021) (arXiv).

31. **Philcox, O. H. E.**, Slepian Z. "Efficient Computation of N-Point Correlation Functions in D Dimensions", *PNAS* **119**, 33 (2022) (arXiv).

32. **Philcox, O. H. E.**, Slepian, Z., Hou, J., Warner, C., Cahn, R. N., Eisenstein, D. J. "ENCORE: Estimating Galaxy N-point Correlation Functions in $\mathcal{O}(N_{\rm g}^2)$ Time", *MNRAS* **509**, 2457 – 2481 (2022) (arXiv).

33. **Philcox, O. H. E.**, Slepian, Z. "An Exact Integral-to-Sum Relation for Products of Bessel Functions", *Proc. Roy. Soc. A* **477**, 2253 (2021) (arXiv).

34. **Philcox, O. H. E.**, Goodman, J., Slepian Z. "Kepler's Goat Herd: An Exact Solution to Kepler's Equation for Elliptical Orbits", *MNRAS* **506**, 6111 – 6116 (2021) (arXiv).

35. Slepian, Z., **Philcox, O. H. E.** "A Uniform Spherical Goat (Problem): Explicit Solution for Homologous Collapse's Radial Evolution in Time", *MNRAS* **522**, L42-L45 (2023) (arXiv).

36. **Philcox, O. H. E.**, Slepian, Z. "Beyond Yamamoto: Anisotropic Power Spectra and Correlation Functions with Pairwise Lines-of-Sight", *Phys. Rev. D* **103**, 123509 (2021) (arXiv).

37. **Philcox, O. H. E.** "Cosmology Without Windows: Quadratic Estimators for the Galaxy Power Spectrum", *Phys. Rev. D* **103**, 103504 (2021) (arXiv).

38. **Philcox, O. H. E.**, Aviles, A., Massara, E. "Modeling the Marked Spectra of Matter and Biased Tracers in Real and Redshift Space", *JCAP* 03 038 (2021) (arXiv).

39. **Philcox, O. H. E.**, Ivanov, M. M., Simonović, M., Zaldarriaga, M., Schmittfull, M. "Fewer Mocks and Less Noise: Reducing the Dimensionality of Cosmological Observables with Subspace Projections", *Phys. Rev. D* **103**, 043508 (2021) (arXiv).

40. **Philcox, O. H. E.**, Sherwin, B. D., Farren, G. S., Baxter, E. J. "Determining the Hubble Constant without the Sound Horizon: Measurements from Galaxy Surveys", *Phys. Rev. D* **103**, 023538 (2021) (arXiv).

41. **Philcox, O. H. E.**, Massara, E., Spergel, D. N. "What does the Marked Power Spectrum Measure? Insights from Perturbation Theory", *Phys. Rev. D* **102**, 043516 (2020) (arXiv).

42. **Philcox, O. H. E.** "A Faster Fourier Transform? Computing Small-Scale Power Spectra and Bispectra for Cosmological Simulations in $\mathcal{O}(N^2)$ Time", *MNRAS* **501**, 4004 – 4034 (2021) (arXiv).

43. **Philcox, O. H. E.**, Spergel, D. N., Villaescusa-Navarro, F. "The Effective Halo Model: Creating a Physical and Accurate Model of the Matter Power Spectrum and Cluster Counts", *Phys. Rev. D* **101**, 123520 (2020) (arXiv).

44. **Philcox, O. H. E.**, Ivanov, M. M., Simonović, M., Zaldarriaga, M. "Combining Full-Shape and BAO Analyses of Galaxy Power Spectra: A 1.6% CMB-Independent Constraint on H_0", *JCAP* 05 032 (2020) (arXiv).

45. **Philcox, O. H. E.**, Rybizki, J. "Inferring Galactic Parameters from Chemical Abundances: A Multi-Star Approach", *ApJ* **887**, 9 (2019) (arXiv).

46. **Philcox, O. H. E.**, Eisenstein, D. J., "Computing the Small-Scale Galaxy Power Spectrum and Bispectrum in Configuration-Space", *MNRAS* **492** 1214 – 1242 (2019) (arXiv).

47. **Philcox, O. H. E.**, Eisenstein, D. J., "Estimating Covariance Matrices for Two- and Three-Point Correlation Function Moments in Arbitrary Survey Geometries", *MNRAS* **490**, 5931 – 5951 (2019) (arXiv).

48. **Philcox, O. H. E.**, Eisenstein, D. J., O'Connell, R., Wiegand, A., "RascalC: A Jackknife Approach to Estimating Single and Multi-Tracer Galaxy Covariance Matrices", *MNRAS* **491**, 3290 – 3317 (2019) (arXiv).

49. **Philcox, O. H. E.**, Sherwin, B. D., van Engelen, A., "Detection and Removal of B-mode Dust Foregrounds with Signatures of Statistical Anisotropy", *MNRAS* **479**, 5577 – 5595 (2018) (arXiv).

50. **Philcox, O. H. E.**, Rybizki, J., Gutcke, T., "On the Optimal Choice of Nucleosynthetic Yields, Initial Mass Function, and Number of SNe Ia for Chemical Evolution Modeling", *ApJ* **861**, 40 (2018) (arXiv).

Contributing Author

51. Rogers, K. K., Hložek, R., Laguë, A. , Ivanov, M. M. , **Philcox, O. H. E.**, *et al.* "Ultra-Light Axions and the S_8 Tension: Joint Constraints from the Cosmic Microwave Background and Galaxy Clustering", *JCAP* 06 023 (2023) (arXiv).

52. *Abdalla, E., *et al.* (inc. **Philcox, O. H. E.**) "Cosmology Intertwined: A Review of the Particle Physics, Astrophysics, and Cosmology Associated with the Cosmological Tensions and Anomalies" *Snowmass 2021 report*, *JHEA* **34**, 49 – 221 (2022) (arXiv).

53. Villaescusa-Navarro, F., Anglés-Alcázar, D., Genel, S., *et al.* (inc. **Philcox, O. H. E.**) "The CAMELS project: public data release", *ApJS* **265** 54 (2023) (arXiv).

54. Hou, J., Cahn, R. N., **Philcox, O. H. E.**, Slepian, Z., "Analytic Gaussian Covariance Matrices for Galaxy N-Point Correlation Functions", *Phys. Rev. D* **106**, 043515 (2022) (arXiv).

55. Schmittfull, M., Simonović, M., Ivanov, M. M, **Philcox, O. H. E.**, Zaldarriaga, M. "Modeling Galaxies in Redshift Space at the Field Level", *JCAP* 05 059 (2021) (arXiv).

56. Villaescusa-Navarro, F., Anglés-Alcázar, D., Genel, S., *et al.* (inc. **Philcox, O. H. E.**) "The CAMELS project: Cosmology and Astrophysics with MachinE Learning Simulations", *ApJ* **915**, 1 (2018) (arXiv).

57. Wang, Y., Zhao, G-B., Zhao, C., **Philcox, O. H. E.**, *et al.* "The clustering of the SDSS-IV extended Baryon Oscillation Spectroscopic Survey DR16 luminous red galaxy and emission line galaxy samples: cosmic distance and structure growth measurements using multiple tracers in configuration space", *MNRAS* **498**, 3470 – 3483 (2020) (arXiv).

58. *Chudaykin, A., Ivanov, M. M., **Philcox, O. H. E.**, Simonović, M., "Class-PT: non-linear perturbation theory extension of the Boltzmann code Class", *Phys. Rev. D* **102**, 063533 (2020) (arXiv).

MEDIA

1. "Universe's 'Cosmological Collider' Lands 3 Scientists $100,000 Physics Prize", *Live Science*, 14 Sep. 2023.

2. "What Happened Right After the Universe Began?", *Simons Foundation*, 30 Aug. 2023.

3. "The Cosmos as a Colloid", *Physics Magazine*, 14 Mar. 2023.

4. "Pinpoint Simulations Provide Perspective on Universe Structure", *IAS News* & *Phys.Org*, 14 Mar. 2023.

5. "Spatial Pattens In Distribution of Galaxies", *Princeton News* & *ScienceDaily*, 14 Mar. 2023.

6. "Is the Universe Asymmetrical?", *Columbia News*, 27 Feb. 2023.
7. "Do We Live in a Mirror Universe?", *Into The Unknown Podcast*, 26 Jan. 2023.
8. "Asymmetry Detected in the Distribution of Galaxies", *Quanta*, 5 Dec. 2022.
9. "The Universe is Surprisingly Lopsided and We Don't Know Why", *New Scientist*, 18 Jun. 2022.

SELECTED TALKS

* = *Virtual Talk*

2023 Large-Scale Parity Violation, Taipei, *Conference* (Invited Talk)
Max-Planck-Institute for Nuclear Physics, Heidelberg, *Particle Physics Seminar*
New Physics from Galaxy Clustering II, ICTP Trieste, *Workshop*
University of Montreal, *Astrophysics Seminar*
*Parity-Violation from Home, *Conference*
Ohio State University, *Cosmology and Astro-Particle Physics Seminar*
*Early Universe / AliCPT Forum, University of Science and Technology of China, *Webinar*
New Strategies For Extracting Cosmology From Future Galaxy Surveys, Sexten, *Workshop* (Invited Plenary)
Cosmology with the Large Scale Structure of the Universe, Donostia, *Workshop* (Invited Talk)
University of Pennsylvania, *PDT Partners Retreat* (Invited Talk)
Future Science with CMB × LSS, Kyoto, *Conference* (Invited Talk)
Kavli IPMU, *Astronomy Seminar*
Stony Brook, *Cosmology Seminar*
*Newcastle University, *Astronomy Seminar*
Cosmology on Safari, *Conference*
Johns Hopkins University, *Particle Physics Seminar*
University of Maryland, *Particle Physics Seminar*
*Copernicus Series, *Cosmology Webinar*
*University of Oxford, *Cosmology Seminar*

2022 Essential Cosmology for the Next Generation, Mexico, *Conference* (Invited Plenary)
LSS × Inflation, UCSD, *Workshop*
*HEP / Astro Results Forum, Texas, *Seminar*
PNG 2022 Workshop, Madrid, *Conference*
Columbia University, *Theory Seminar*
Large Scale Structure Beyond the Two-Point Function, ICTP, Trieste, *Workshop*
BCCP Conference, Vipolže, Slovenia, *Conference*
Cosmology and Astrophysics with the Sunyaev-Zel'dovich Effect, Flatiron Institute, *Workshop*
*L'Action Dark Energy, *Webinar*
*University of Chicago, *KICP Lunch Talk*
Center for Computational Astronomy, *Tri-State Cosmology Meeting*
*Simons Modern Inflationary Cosmology Group, *Seminar*

2021 *Max Planck Institute for Astrophysics, *Seminar*
*Perimeter Institute, *Cosmology & Gravitation Seminar*
*University of Cambridge, *Cosmology Lunch Seminar*
Harvard University, *Cosmology Seminar*
*Lawrence Berkeley National Laboratory, *Physics Division Seminar*
*Jet Propulsion Laboratory, *Dark Sector Group*
Pennsylvania State University, *Quantum Gravity Seminar*
Johns Hopkins University, *Astronomy Colloquium*
University of Pennsylvania, *Astronomy & Astrophysics Seminar*
Berkeley Center for Cosmological Physics, *Cosmology Seminar*
Stanford University, *Theory Colloquium*
*Columbia University, *Theory Seminar*
*Cosmology from Home, *Conference*
*Princeton University, *Gravity Group*
*Southampton University, H_0 *Workshop* (Invited Talk)
*University of Geneva, *Cosmology & Particle Physics Group*

PRIZES & GRANTS

2024	New Horizons in Physics Prize, *Breakthrough Prize Foundation*
2023	Buchalter Cosmology Prize (First Prize)
2022	Simons Society of Fellows (Junior Fellowship, \$450 000) NHFP Einstein Fellowship, *declined* LBL Chamberlain Fellowship, *declined* Cambridge Kavli Fellowship, *declined*
2018	Herchel-Smith Scholarship (\$70 000), *Cambridge* → *Harvard* Institute of Astronomy Prize, *Cambridge*
2017	Holgate Pollard Memorial Prize, *Cambridge*

PROFESSIONAL ACTIVITIES

Referee	MNRAS (2020−), JCAP (2020−), MPLA (2021−), Phys. Rev. Lett. (2022−) Phys. Rev. D (2022−), ApJS (2022−), Phys. Dark Univ. (2023−)	
Conferences	Large-Scale Parity Violation (Taiwan 2023, SOC)	
Review Panels	NASA Astrophysics Theory Program (2023)	
Advisor	*John Moynihan*	Columbia Undergraduate Student (2023−)
	Sam Goldstein	Columbia Graduate Student (2022−)
Coadvisor	*Gemma Zhang*	Harvard Graduate Student (2023−)
	Kristen Surrao	Columbia Graduate Student (2022−)
	Gerrit Farren	Cambridge Graduate Student (2020−2022)
	Jess Boyland	Simons-NSBP Undergraduate Scholar (2020−2021)

MISCELLANEOUS

Computing Languages	Python, C++, Julia, Mathematica, Cuda
Codes Developed	PolyBin3D, PolyBin, Encore, NPCFs.jl, Class-PT, Spectra-Without-Windows, EffectiveHalos, Hipster, RascalC
Teaching	6 years of online tutoring (high-school to Masters level) Teaching assistant for Princeton introductory astronomy class (AST203) TEFL qualification in English teaching
Other	DipABRSM in Music Performance (Distinction)

REFERENCES

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