

# Oliver H. E. Philcox MSci MA

Peyton Hall, 4 Ivy Lane, Princeton, NJ 08544, USA

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## EDUCATION

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**Department of Astrophysical Sciences, Princeton University, USA**

*2019 - Present*

PhD Candidate

**Thesis:** ‘Cosmology from the bispectrum and  $N$ -point correlation functions (TBC)’

*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**

*2017 - 2018*

MSci in Astrophysics

**Part III:** 1<sup>st</sup> 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

Institute of Astronomy Prize

**Emmanuel College, University of Cambridge**

*2014 - 2017*

BA (Hons) in Natural Sciences, *Senior Scholar*

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

Holgate Pollard Memorial Prize for Part II Examination Results, 2017

College & Rowley Mainhood Prizes for Achievement, 2015-8

## ADDITIONAL RESEARCH EXPERIENCE

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**Institute for Advanced Study**

Sep. 2020 - Present

*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*

## PUBLICATIONS

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### *Major Author*

1. **Philcox, O. H. E.**, Slepian, Z., Hou, J., Warner, C., Cahn, R. N., Eisenstein, D. J. "ENCORE: Estimating Galaxy  $N$ -point Correlation Functions in  $\mathcal{O}(N_g^2)$  Time", *submitted to MNRAS* (arXiv).
2. **Philcox, O. H. E.**, Slepian, Z. "An Exact Integral-to-Sum Relation for Products of Bessel Functions", *submitted to Proc. Roy. Soc. A* (arXiv).
3. **Philcox, O. H. E.**, Goodman, J., Slepian, Z. "Kepler's Goat Herd: An Exact Solution to Kepler's Equation for Elliptical Orbits", *accepted by MNRAS* (arXiv).
4. Slepian, Z., **Philcox, O. H. E.** "A Uniform Spherical Goat (Problem): Explicit Solution for Homologous Collapse's Radial Evolution in Time" (arXiv).
5. **Philcox, O. H. E.**, Slepian, Z. "Beyond Yamamoto: Anisotropic Power Spectra and Correlation Functions with Pairwise Lines-of-Sight", *accepted by Phys. Rev. D* (arXiv).
6. **Philcox, O. H. E.** "Cosmology Without Windows: Quadratic Estimators for the Galaxy Power Spectrum", *Phys. Rev. D* **103**, 103504 (2021) (arXiv).
7. **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).
8. **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).
9. **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).
10. **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).
11. **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).
12. **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).
13. **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).
14. **Philcox, O. H. E.**, Rybizki, J. "Inferring Galactic Parameters from Chemical Abundances: A Multi-Star Approach", *ApJ* **887**, 9 (2019) (arXiv).
15. **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).
16. **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).
17. **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).
18. **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).
19. **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*

20. Schmittfull, M., Simonović, M., Ivanov, M. M., **Philcox, O. H. E.**, Zaldarriaga, M. "Modeling Galaxies in Redshift Space at the Field Level", *accepted by JCAP* (arXiv).

21. 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", *accepted by ApJ* (arXiv).
22. 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).
23. 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).

## SELECTED TALKS

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|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Apr. 2021 | Princeton University (Gravity Group)<br><i>Have We Exhausted the Galaxy Two-Point Function?</i>                                                       |
| Mar. 2021 | Southampton $H_0$ Workshop (Invited talk & panel discussion)<br><i><math>H_0</math> from Galaxy Surveys: With and Without the Sound Horizon</i>       |
| Jan. 2021 | University of Geneva (Cosmology & Particle Physics Group)<br><i>Have We Exhausted the Galaxy Two-Point Function?</i>                                  |
| Nov. 2020 | Institute for Advanced Study (Cosmology Group)<br><i>Tutorial on CLASS-PT and Large Scale Structure Parameter Inference</i>                           |
| Oct. 2020 | DESI Galaxy & Quasar Clustering Working Group<br><i>Compressing Cosmological Observables via Subspace Projections</i>                                 |
| Oct. 2020 | Center for Astrophysics   Harvard & Smithsonian (Eisenstein Group)<br><i>Modeling and Interpreting Marked Power Spectra of Matter and Halos</i>       |
| Sep. 2020 | UK Cosmology Meeting<br><i>What's Next for the Effective Field Theory of Large Scale Structure?</i>                                                   |
| Sep. 2020 | Institute for Advanced Study (Cosmology Group)<br><i>Data Compression via Subspace Projections &amp; <math>H_0</math> Without the Sound Horizon</i>   |
| Aug. 2020 | Cosmology from Home Conference<br><i>Measuring <math>H_0</math> from Galaxy Surveys: With and Without the Sound Horizon</i>                           |
| Aug. 2020 | American Statistical Association (Joint Statistical Meeting, invited talk)<br><i>Inferring Galactic Parameters from Stellar Chemical Abundances</i>   |
| Jun. 2020 | Perimeter Institute for Theoretical Physics (Cosmology Colloquium)<br><i>What's Next for the Effective Field Theory of Large Scale Structure?</i>     |
| May 2020  | Berkeley Center for Cosmological Physics (Journal Club)<br><i>The Effective Halo Model: Accurate Models for the Power Spectrum and Cluster Counts</i> |
| Apr. 2020 | NYU / CCA (Cosmology X Data Science Group)<br><i>The Effective Halo Model: Accurate Models for the Power Spectrum and Cluster Counts</i>              |
| Mar. 2020 | Institute for Advanced Study (Cosmology Group)<br><i>Constraining Cosmology from Galaxy Surveys: Combining Full Shape and BAO Analyses</i>            |
| Dec. 2019 | Princeton University (Gravity Group)<br><i>Detection and Removal of CMB B-mode Dust via Statistical Anisotropy</i>                                    |
| Nov. 2019 | JINA-CEE Nuclear Astrophysics Seminar<br><i>Inferring the Milky Way Stellar Initial Mass Function using Chemical Evolution Modelling</i>              |
| Jul. 2019 | Center for Astrophysics   Harvard & Smithsonian (Eisenstein Group)<br><i>Computing Clustering Statistics and Covariances in Configuration Space</i>   |
| Apr. 2019 | Center for Astrophysics   Harvard & Smithsonian (Joint Cosmology Group)<br><i>Detection and Removal of CMB B-mode Dust via Statistical Anisotropy</i> |
| Sep. 2017 | Max-Planck-Institut für Astronomie (Rix Group)<br><i>Creating Objective Scores for Nucleosynthetic Yield Tables</i>                                   |
| Sep. 2017 | Heidelberg Institute for Theoretical Studies (Springel Group)<br><i>Choosing Nucleosynthetic Yield Tables for Hydrodynamical Simulations</i>          |

## PROFESSIONAL ACTIVITIES

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**Referee** MNRAS (2020–), JCAP (2020–), MPLA (2021–)  
**Coadvisor** *Jess Boyland* Simons-NSBP Undergraduate Scholars Program (2020–)

## MISCELLANEOUS

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**Computing Languages** PYTHON, C++, CUDA  
**Codes Developed** `encore`, `EffectiveHalos`, `CLASS-PT`, `HIPSTER`, `RascalC`, `ChempyMulti`, `HADES`  
**Teaching** 6 years of online tutoring (high-school to post-Masters level)  
Teaching assistant for Princeton introductory astronomy class (AST203)  
TEFL qualification in English teaching with 2 months experience in China

## REFEREES

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**Prof. D N Spergel**  
(*Princeton Advisor*)  
Center for Computational Astrophysics  
Flatiron Institute, 162 5<sup>th</sup> Ave.  
New York, NY 10010  
*Tel:* +1 (609) 258-3589  
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**Prof. M Zaldarriaga**  
(*IAS Advisor*)  
Institute for Advanced Study  
1 Einstein Drive  
Princeton, NJ 08540  
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**Prof. D J Eisenstein**  
(*Harvard Advisor*)  
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Cambridge, MA 02138, USA  
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