

Oliver H. E. Philcox MSci

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EDUCATION

Department of Astrophysical Sciences, Princeton University, USA
Graduate Student

2019 - Present

Advisors: Prof. David N. Spergel, Prof. Jo Dunkley & Prof. Matias Zaldarriaga

Center for Astrophysics | Harvard & Smithsonian, Cambridge, USA
Pre-Doctoral Student (Herchel-Smith Scholar)

2018 - 2019

Courses: *Radiative Processes in Astrophysics (A)*, *Astrophysical Fluid Dynamics (A)*
Advanced Scientific Computing: Stochastic Methods (A)

Research Projects: 'Estimating Covariance Matrices for the Two- and Three-Point Galaxy Correlation Functions in Arbitrary Survey Geometries' & 'Configuration-Space Estimators for Small-Scale Anisotropic Power Spectra and Bispectra' (*Advisors: Prof. Daniel J. Eisenstein & Dr. Ross O'Connell*)

Institute of Astronomy, University of Cambridge
MSci in Astrophysics

2017 - 2018

Part III: 1st Class (Rank 1/28, 97%)

Courses: *Cosmology (97%)*, *Advanced Cosmology (91%)*, *General Relativity (92%)*
Quantum Field Theory (84%), *Stellar Structure and Evolution (95%)*

Master's Thesis: 'Detection and Removal of B-mode CMB Dust Foregrounds with Signatures of Statistical Anisotropy' (*Advisors: Dr. Blake D. Sherwin & Dr. Alexander van Engelen*)

Institute of Astronomy Prize

Emmanuel College, University of Cambridge
BA (Hons) in Natural Sciences, *Senior Scholar*

2014 - 2017

Part II: 1st Class (Rank 1/20, 90%)

Courses include: *Cosmology*, *Stars*, *Galactic Dynamics*, *Fluids*, *Relativity*, *Quantum Mechanics*

Part IB: 1st Class (Rank 9/578)

Courses: *Maths (86%)*, *Physics A (94%)* and *Physics B (85%)*

Part IA: 1st Class (Rank 6/626)

Courses: *Maths (94%)*, *Physics (89%)*, *Chemistry (84%)* and *Earth Sciences (73%)*

Holgate Pollard Memorial Prize for Part II Examination Results, 2017

College & Rowley Mainhood Prizes for Achievement, 2015-8

RESEARCH EXPERIENCE

Center for Astrophysics | Harvard & Smithsonian
Pre-Doctoral Student with Prof. Daniel Eisenstein

Sep. 2018 - Jun. 2019
Cambridge, USA

- Developed approximations for the covariance matrices of two- and three-point galaxy correlation functions using only a single large scale structure survey via a grid-based jackknife approach.
- Derived relevant statistical estimators involving Monte Carlo methods and importance sampling to compute high-dimensional integrals at low computational expense, allowing for matrices with precisions comparable to millions of mocks to be computed in tens of CPU-hours.
- Created a new estimator for small-scale power spectrum estimation in configuration space.
- Applied techniques to survey data from BOSS and compared this to results from mock galaxy catalogs.
- Developed the publicly released **Rasca1C** and **HIPSTER** codes and wrote three first-author papers on the techniques.

Institute of Astronomy*Master's Student with Dr. Blake Sherwin*

Oct. 2017 - Jun. 2018

Cambridge, UK

- Searched for signatures of polarized Galactic thermal dust emission in CMB B-mode maps via statistical analyses of characteristic intermediate-scale anisotropy patterns.
- Constructed a rudimentary method for single-frequency CMB dust removal and used up-to-date thermal dust simulations to forecast the effectiveness of these techniques for upcoming experiments.
- Created a freely-available Python package (**HADES**) and published a first-author paper on the results.

Max-Planck-Institut für Astronomie*Summer Intern with Dr. Jan Rybizki*

Jul. - Sep. 2017

Heidelberg, Germany

- Developed a statistical scoring system to rank nucleosynthetic yield tables based on their abilities to reproduce proto-solar abundances using the galactic chemical evolution code *Chempy* and MCMC.
- Created statistical models using Bayesian and Cross-Validation approaches in Python.
- Optimised the software performance by implementation of a neural network, using **PyTorch**.
- Prepared a first-author paper on the methodologies and published code online.

Center for Astrophysics | Harvard & Smithsonian*PRISE Research Fellow with Dr. Ákos Bogdán*

Jun. - Aug. 2016

Cambridge, USA

- Worked in the High Energy group, calculating dark matter profiles for nearby elliptical galaxies, using IR and X-ray observations to trace stellar mass and hot gas (a proxy for gravitational mass).
- Analysed Chandra and 2MASS data using the **CIAO** and **XSPEC** packages, fitting to established models.

SELECTED PUBLICATIONS & TALKS

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

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).

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).

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)

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).

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).

Dec. 2019 Princeton University (Gravity Group)

Detection and Removal of CMB B-mode Dust via Statistical Anisotropy

Nov. 2019 JINA-CEE Nuclear Astrophysics Seminar

Inferring the Milky Way Stellar Initial Mass Function using Chemical Evolution Modelling

Jul. 2019 Center for Astrophysics | Harvard & Smithsonian (Daniel Eisenstein's Group)

Computing Clustering Statistics and Covariances in Configuration Space

Apr. 2019 Center for Astrophysics | Harvard & Smithsonian (Joint Cosmology Group)

Detection and Removal of CMB B-mode Dust via Statistical Anisotropy

Mar. 2018 CMB-S4 Conference (Argonne)

Modeling Dust Foregrounds (Contributed slides)

Sep. 2017 Max-Planck-Institut für Astronomie (Hans-Walter Rix's Group)

Creating Objective Scores for Nucleosynthetic Yield Tables

Sep. 2017 Heidelberg Institute for Theoretical Studies (Volker Springel's Group)

Choosing Nucleosynthetic Yield Tables for Hydrodynamical Simulations

REFEREES

References available on request