

Stanford



Oliver Philcox

Assistant Professor of Physics

Bio

BIO

Junior Fellow, Simons Society of Fellows (2022 - 2025)

Ph.D., Princeton University (2022)

M.A. (Cantab.), Cambridge University (2018)

I'm broadly interested in theoretical, statistical, and observational cosmology, particularly as applied to galaxy surveys and the Cosmic Microwave Background. Recently, I have worked on measuring, modeling, and interpreting new and old physics in a range of cosmological datasets, and using them to learn about the early Universe, including inflation. With Mikhail Ivanov and Marko Simonovic, I won the 2024 New Horizons Prize in Physics, for work on the Effective Field Theory of Large Scale Structure.

I am an assistant professor in the Physics department, affiliated with both the Kavli Institute for Particle Astrophysics and Cosmology (KIPAC) and the Leinweber Institute for Theoretical Physics at Stanford (LITP). Please send me an email if you're interested in working with me!

ACADEMIC APPOINTMENTS

- Assistant Professor, Physics

Teaching

COURSES

2025-26

- Cosmology and Extragalactic Astrophysics: PHYSICS 361 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Delon Shen, Mahlet Shiferaw

Publications

PUBLICATIONS

- **Reanalyzing DESI DR1. III. Constraints on inflation from galaxy power spectra and bispectra** *PHYSICAL REVIEW D*
Chudaykin, A., Ivanov, M. M., Philcox, O. H. E.
2026; 113 (6)

- **Reanalyzing DESI DR1. I. Λ CDM constraints from the power spectrum and bispectrum** *PHYSICAL REVIEW D*
Chudaykin, A., Ivanov, M. M., Philcox, O. H. E.
2026; 113 (6)
- **Quantum stress-energy at timelike boundaries: Testing a new beyond- Λ CDM parameter with cosmological data** *PHYSICAL REVIEW D*
Philcox, O. H. E., Silverstein, E., Torroba, G.
2026; 113 (4)
- **Modeling galaxy surveys with hybrid simulation-based inference** *PHYSICAL REVIEW D*
Zhang, G., Modi, C., Philcox, O. H. E.
2026; 113 (4)
- **Wonderings on wiggly bispectra: Nonlinear evolution and reconstruction of oscillations in the squeezed bispectrum** *PHYSICAL REVIEW D*
Goldstein, S., Philcox, O. H. E., Fondi, E., Coulton, W. R.
2025; 112 (8)
- **Suite of optimal and efficient power spectrum and bispectrum estimators for large-scale structure analyses** *PHYSICAL REVIEW D*
Philcox, O. H. E., Floss, T.
2025; 112 (6)
- **A Parameter-masked Mock Data Challenge for Beyond-two-point Galaxy Clustering Statistics** *ASTROPHYSICAL JOURNAL*
Krause, E., Kobayashi, Y., Salcedo, A. N., Ivanov, M. M., Abel, T., Akitsu, K., Angulo, R. E., Cabass, G., Contarini, S., Cuesta-Lazaro, C., Hahn, C., Hamaus, N., Jeong, et al
2025; 990 (2)
- **Searching for inflationary physics with the CMB trispectrum. II. Code and validation** *PHYSICAL REVIEW D*
Philcox, O. H. E.
2025; 111 (12)
- **Searching for inflationary physics with the CMB trispectrum. I. Primordial theory and optimal estimators** *PHYSICAL REVIEW D*
Philcox, O. H. E.
2025; 111 (12)
- **Searching for inflationary physics with the CMB trispectrum. III. Constraints from $\langle i \rangle$ Planck $\langle /i \rangle$** *PHYSICAL REVIEW D*
Philcox, O. H. E.
2025; 111 (12)
- **Integrated Sachs-Wolfe lensing bispectrum and trispectrum** *PHYSICAL REVIEW D*
Philcox, O. H. E., Hill, J.
2025; 111 (12)
- **Non-Gaussianity beyond the scalar sector: A search for tensor and mixed tensor-scalar bispectra with Planck data** *PHYSICAL REVIEW D*
Philcox, O. H. E., Shiraishi, M.
2025; 111 (12)
- **Searching for inflationary particle production in $\langle i \rangle$ Planck $\langle /i \rangle$ data** *PHYSICAL REVIEW D*
Philcox, O. H. E., Kumar, S., Hill, J.
2025; 111 (10)
- **BOSS constraints on massive particles during inflation: The cosmological collider in action** *PHYSICAL REVIEW D*
Cabass, G., Philcox, O. H. E., Ivanov, M. M., Akitsu, K., Chen, S., Simonovi, M., Zaldarriaga, M.
2025; 111 (6)
- **Could sample variance be responsible for the parity-violating signal seen in the Baryon Oscillation Spectroscopic Survey?** *PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A-MATHEMATICAL PHYSICAL AND ENGINEERING SCIENCES*
Philcox, O. E., Ereza, J.
2025; 383 (2290): 20240034
- **Suppression without Thawing: Constraining Structure Formation and Dark Energy with Galaxy Clustering** *PHYSICAL REVIEW LETTERS*
Chen, S., Ivanov, M. M., Philcox, O. H. E., Wenzl, L.

2024; 133 (23): 231001

- **Intermediate mass-range particles from small scales: Nonperturbative techniques for cosmological collider physics from large-scale structure surveys** *PHYSICAL REVIEW D*
Goldstein, S., Philcox, O. H. E., Hill, J., Hui, L.
2024; 110 (8)
- **The 3D Lyman- α forest power spectrum from eBOSS DR16** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
de Belsunce, R., Philcox, O. H. E., Irsic, V., McDonald, P., Guy, J., Palanque-Delabrouille, N.
2024; 533 (3): 3756-3770
- **Testing parity symmetry with the polarized cosmic microwave background** *PHYSICAL REVIEW D*
Philcox, O. H. E., Shiraishi, M.
2024; 109 (8)
- **What can galaxy shapes tell us about physics beyond the standard model?** *PHYSICAL REVIEW D*
Philcox, O. H. E., Konig, M. J., Alexander, S., Spergel, D. N.
2024; 109 (6)
- **Testing graviton parity and Gaussianity with Planck T-, E-, and B-mode bispectra** *PHYSICAL REVIEW D*
Philcox, O. H. E., Shiraishi, M.
2024; 109 (6)
- **Consistently constraining fNL with the squeezed lensing bispectrum using consistency relations** *PHYSICAL REVIEW D*
Goldstein, S., Philcox, O. H. E., Hill, J., Esposito, A., Hui, L.
2024; 109 (4)
- **Signatures of a parity-violating universe** *PHYSICAL REVIEW D*
Coulton, W. R., Philcox, O. H. E., Villaescusa-Navarro, F.
2024; 109 (2)
- **Do the CMB Temperature Fluctuations Conserve Parity?** *PHYSICAL REVIEW LETTERS*
Philcox, O. H. E.
2023; 131 (18): 181001
- **Parity-violating trispectrum from Chern-Simons gravity** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Creque-Sarbinowski, C., Alexander, S., Kamionkowski, M., Philcox, O.
2023
- **Optimal estimation of the binned mask-free power spectrum, bispectrum, and trispectrum on the full sky: Tensor edition** *PHYSICAL REVIEW D*
Philcox, O. H. E.
2023; 108 (6)
- **Optimal estimation of the binned mask-free power spectrum, bispectrum, and trispectrum on the full sky: Scalar edition** *PHYSICAL REVIEW D*
Philcox, O. H. E.
2023; 107 (12)
- **Ultra-light axions and the S8 tension: joint constraints from the cosmic microwave background and galaxy clustering** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Rogers, K. K., Hlozek, R., Lague, A., Ivanov, M. M., Philcox, O. H. E., Cabass, G., Akitsu, K., Marsh, D. J. E.
2023
- **Accurate estimation of angular power spectra for maps with correlated masks** *PHYSICAL REVIEW D*
Surrao, K. M., Philcox, O. H. E., Hill, J.
2023; 107 (8)
- **Constraining single-field inflation with MegaMapper** *PHYSICS LETTERS B*
Cabass, G., Ivanov, M. M., Philcox, O. H. E., Simonovic, M., Zaldarriaga, M.
2023; 841

- **Cosmology with the galaxy bispectrum multipoles: Optimal estimation and application to BOSS data** *PHYSICAL REVIEW D*
Ivanov, M. M., Philcox, O. H. E., Cabass, G., Nishimichi, T., Simonovic, M., Zaldarriaga, M.
2023; 107 (8)
- **The CAMELS Project: Public Data Release** *ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES*
Villaescusa-Navarro, F., Genel, S., Angles-Alcazar, D., Perez, L. A., Villanueva-Domingo, P., Wadekar, D., Shao, H., Mohammad, F. G., Hassan, S., Moser, E., Lau, E. T., Valle, L., Nicola, et al
2023; 265 (2)
- **A uniform spherical goat (problem): explicit solution for homologous collapse's radial evolution in time** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
Slepian, Z., Philcox, O. H. E.
2023; 522 (1): L42-L45
- **Disordered Heterogeneous Universe: Galaxy Distribution and Clustering across Length Scales** *PHYSICAL REVIEW X*
Philcox, O. H. E., Torquato, S.
2023; 13 (1)
- **Colliders and ghosts: Constraining inflation with the parity-odd galaxy four-point function** *PHYSICAL REVIEW D*
Cabas, G., Ivanov, M. M., Philcox, O. H. E.
2023; 107 (2)
- **Squeezing f_{NL} out of the matter bispectrum with consistency relations** *PHYSICAL REVIEW D*
Goldstein, S., Esposito, A., Philcox, O. H. E., Hui, L., Hill, J., Scoccimarro, R., Abitbol, M. H.
2022; 106 (12)
- **Novel cosmological tests from combining galaxy lensing and the polarized Sunyaev-Zel'dovich effect** *PHYSICAL REVIEW D*
Philcox, O. H. E., Johnson, M. C.
2022; 106 (8)
- **Determining the Hubble constant without the sound horizon: A 3.6% constraint on H_0 from galaxy surveys, CMB lensing, and supernovae** *PHYSICAL REVIEW D*
Philcox, O. H. E., Farren, G. S., Sherwin, B. D., Baxter, E. J., Brout, D. J.
2022; 106 (6)
- **Probing parity violation with the four-point correlation function of BOSS galaxies** *PHYSICAL REVIEW D*
Philcox, O. H. E.
2022; 106 (6)
- **Cosmology with the redshift-space galaxy bispectrum monopole at one-loop order** *PHYSICAL REVIEW D*
Philcox, O. H. E., Ivanov, M. M., Cabass, G., Simonovic, M., Zaldarriaga, M., Nishimichi, T.
2022; 106 (4)
- **Efficient computation of N -point correlation functions in D dimensions** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Philcox, O. H. E., Slepian, Z.
2022; 119 (33): e2111366119
- **Constraints on multifield inflation from the BOSS galaxy survey** *PHYSICAL REVIEW D*
Cabass, G., Ivanov, M. M., Philcox, O. H. E., Simonovic, M., Zaldarriaga, M.
2022; 106 (4)
- **Analytic Gaussian covariance matrices for galaxy N -point correlation functions** *PHYSICAL REVIEW D*
Hou, J., Cahn, R. N., Philcox, O. H. E., Slepian, Z.
2022; 106 (4)
- **Constraints on Single-Field Inflation from the BOSS Galaxy Survey** *PHYSICAL REVIEW LETTERS*
Cabass, G., Ivanov, M. M., Philcox, O. H. E., Simonovi, M., Zaldarriaga, M.
2022; 129 (2): 021301

- **Cosmology intertwined: A review of the particle physics, astrophysics, and cosmology associated with the cosmological tensions and anomalies** *JOURNAL OF HIGH ENERGY ASTROPHYSICS*
Abdalla, E., Abellan, G., Aboubrahim, A., Agnello, A., Akarsu, O., Akrami, Y., Alestas, G., Aloni, D., Amendola, L., Anchordoqui, L. A., Anderson, R. I., Arendse, N., Asgari, et al
2022; 34: 49-211
- **Precision analysis of the redshift-space galaxy bispectrum** *PHYSICAL REVIEW D*
Ivanov, M. M., Philcox, O. H. E., Nishimichi, T., Simonovic, M., Takada, M., Zaldarriaga, M.
2022; 105 (6)
- **Determining the Hubble constant without the sound horizon: Perspectives** *PHYSICAL REVIEW D*
Farren, G. S., Philcox, O. H. E., Sherwin, B. D.
2022; 105 (6)
- **Cosmological constraints without nonlinear redshift-space distortions** *PHYSICAL REVIEW D*
Ivanov, M. M., Philcox, O. H. E., Simonovic, M., Zaldarriaga, M., Nishimichi, T., Takada, M.
2022; 105 (4)
- **BOSS DR12 full-shape cosmology: Λ CDM constraints from the large-scale galaxy power spectrum and bispectrum monopole** *PHYSICAL REVIEW D*
Philcox, O. H. E., Ivanov, M. M.
2022; 105 (4)
- **Cosmology without window functions. II. Cubic estimators for the galaxy bispectrum** *PHYSICAL REVIEW D*
Philcox, O. H. E.
2021; 104 (12)
- **encore: an $\mathcal{O}(N^2)$ estimator for galaxy N -point correlation functions** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
Philcox, O. H. E., Slepian, Z., Hou, J., Warner, C., Cahn, R. N., Eisenstein, D. J.
2022; 509 (2): 2457-2481
- **An exact integral-to-sum relation for products of Bessel functions** *PROCEEDINGS OF THE ROYAL SOCIETY A-MATHEMATICAL PHYSICAL AND ENGINEERING SCIENCES*
Philcox, O. H. E., Slepian, Z.
2021; 477 (2253)
- **Kepler's Goat Herd: An exact solution to Kepler's equation for elliptical orbits** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
Philcox, O. H. E., Goodman, J., Slepian, Z.
2021; 506 (4): 6111-6116
- **The CAMELS Project: Cosmology and Astrophysics with Machine-learning Simulations** *ASTROPHYSICAL JOURNAL*
Villaescusa-Navarro, F., Angles-Alcazar, D., Genel, S., Spergel, D. N., Somerville, R. S., Dave, R., Pillepich, A., Hernquist, L., Nelson, D., Torrey, P., Narayanan, D., Li, Y., Philcox, et al
2021; 915 (1)
- **Beyond the Yamamoto approximation: Anisotropic power spectra and correlation functions with pairwise lines of sight** *PHYSICAL REVIEW D*
Philcox, O. H. E., Slepian, Z.
2021; 103 (12)
- **Cosmology without window functions: Quadratic estimators for the galaxy power spectrum** *PHYSICAL REVIEW D*
Philcox, O. H. E.
2021; 103 (10)
- **Modeling galaxies in redshift space at the field level** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Schmittfull, M., Simonovic, M., Ivanov, M. M., Philcox, O. H. E., Zaldarriaga, M.
2021

- **Modeling the marked spectrum of matter and biased tracers in real- and redshift-space** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Philcox, O. H. E., Aviles, A., Massara, E.
2021
- **Fewer mocks and less noise: Reducing the dimensionality of cosmological observables with subspace projections** *PHYSICAL REVIEW D*
Philcox, O. H. E., Ivanov, M. M., Zaldarriaga, M., Simonovic, M., Schmittfull, M.
2021; 103 (4)
- **Determining the Hubble constant without the sound horizon: Measurements from galaxy surveys** *PHYSICAL REVIEW D*
Philcox, O. H. E., Sherwin, B. D., Farren, G. S., Baxter, E. J.
2021; 103 (2)
- **A faster Fourier transform? Computing small-scale power spectra and bispectra for cosmological simulations in $\mathcal{O}(N^2)$ time** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
Philcox, O. H. E.
2021; 501 (3): 4004-4034
- **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** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
Wang, Y., Zhao, G., Zhao, C., Philcox, O. H. E., Alam, S., Tamone, A., de Mattia, A., Ross, A. J., Raichoor, A., Burtin, E., Paviot, R., de la Torre, S., Percival, et al
2020; 498 (3): 3470–83
- **Nonlinear perturbation theory extension of the Boltzmann code CLASS** *PHYSICAL REVIEW D*
Chudaykin, A., Ivanov, M. M., Philcox, O. H. E., Simonovic, M.
2020; 102 (6)
- **What does the marked power spectrum measure? Insights from perturbation theory** *PHYSICAL REVIEW D*
Philcox, O. H. E., Massara, E., Spergel, D. N.
2020; 102 (4)
- **Effective halo model: Creating a physical and accurate model of the matter power spectrum and cluster counts** *PHYSICAL REVIEW D*
Philcox, O. H. E., Spergel, D. N., Villaescusa-Navarro, F.
2020; 101 (12)
- **Combining full-shape and BAO analyses of galaxy power spectra: a 1.6% CMB-independent constraint on H_0** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Philcox, O. H. E., Ivanov, M. M., Simonovic, M., Zaldarriaga, M.
2020
- **Computing the small-scale galaxy power spectrum and bispectrum in configuration space** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
Philcox, O. H. E., Eisenstein, D. J.
2020; 492 (1): 1214-1242
- **RASCALC: a jackknife approach to estimating single- and multitracer galaxy covariance matrices** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
Philcox, O. H. E., Eisenstein, D. J., O'Conne, R., Wiegand, A.
2020; 491 (3): 3290-3317
- **Inferring Galactic Parameters from Chemical Abundances: A Multi-star Approach** *ASTROPHYSICAL JOURNAL*
Philcox, O. H. E., Rybizki, J.
2019; 887 (1)
- **Estimating covariance matrices for two- and three-point correlation function moments in Arbitrary Survey Geometries** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
Philcox, O. H. E., Eisenstein, D. J.
2019; 490 (4): 5931-5951

- **Detection and removal of B-mode dust foregrounds with signatures of statistical anisotropy** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*
Philcox, O. H. E., Sherwin, B. D., van Engelen, A.
2018; 479 (4): 5577-5595
- **On the Optimal Choice of Nucleosynthetic Yields, Initial Mass Function, and Number of SNe Ia for Chemical Evolution Modeling** *ASTROPHYSICAL JOURNAL*
Philcox, O., Rybizki, J., Gutcke, T. A.
2018; 861 (1)