

Gerrit Farren

Curriculum Vitae

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I am a PhD student in cosmology at the University of Cambridge. I graduated from Haverford College with a Bachelor of Science in Physics in May of 2020. My interests lie in computational modelling and data analysis, which I have mostly applied to cosmological datasets. I am working on developing and testing models to measure for example neutrino masses, dark matter properties, structure formation and the expansion rate of the universe from large scale cosmic structure and gravitational lensing of the Cosmic Microwave Background (CMB).

Research Experience

- 2020 – present **Cosmology from CMB lensing cross-correlations with galaxy surveys**, *University of Cambridge*.
Developing a pipeline to measure and analyse the correlations between the distribution of galaxies and gravitational lensing of the Cosmic Microwave Background to inform our understanding of the physics of structure formation and measure the neutrino mass.
- 2020 – 2022 **Measuring the expansion rate of the universe using galaxy surveys**, *University of Cambridge*.
We developed a novel method for measuring the present day expansion rate of the universe that relies on a different physical feature than previous measurement.
- 2018 – 2021 **Testing ultra-light axion dark matter with the kinetic Sunyaev-Zeldovich effect**, *Haverford College & Imperial College London*.
We probe models of ultra-light dark matter with observations of the distortions of the CMB due to scattering off free electrons with bulk velocities, an effect known as kinetic Sunyaev-Zeldovich effect.
- 2018 – 2021 **Confirming the calibration of the ALMA telescope using observations from the *Planck* Satellite**, *Haverford College*.
Transfer of the absolute calibration of the *Planck* satellite to the Atacama Large Millimetre/submillimetre Array by using observations of compact radio sources.

Employment

- Oct 2020 – present **Undergraduate Supervisor**, *University of Cambridge*, United Kingdom.
- Oct 2021 – Jan 2022 **Example Class Instructor**, *University of Cambridge*, United Kingdom.
- Sep 2018 – May 2020 **Course Assistant**, *Haverford College*, PA, United States.
- Jan 2017 – May 2020 **Research Assistant**, *Haverford College*, PA, United States.
- May 2019 – Aug 2019 **Summer Research Student**, *Durham University*, United Kingdom.
- Jun 2018 – Aug 2018 **Summer Research Student**, *Imperial College London*, United Kingdom.

Education

- 2020 – present **PhD student**, *Department of Applied Mathematics and Theoretical Physics, University of Cambridge*, Cambridge, United Kingdom, Due to graduate: October 2024.
- 2016 – 2020 **BSc in Physics**, *Haverford College*, Haverford, PA United States, Graduated *Summa Cum Laude*: May 2020.
Physics Major, Mathematics Minor, Scientific Computing Concentration
- 2007 – 2015 **Abitur**, *Hugo-Junkers-Gymnasium*, Mönchengladbach, Germany, June 2015.

Technical and Personal skills

- **Programming Languages:** Python, C++, C#
Including parallel and distributed computing, large datasets, numeric simulations. Also basic ability in MatLab and Fortran.
- **Data analysis:** Parametric modelling, Bayesian model inference, model comparison, data compression
- **Basic knowledge in machine learning:** Followed "Machine Learning for Physicists" by Prof. Florian Marquardt at the University of Erlangen-Nürnberg
- **Languages:** German (native language), English (fluent written and spoken)

Awards and Recognitions

- 2020 – 2024 **Isaac Newton Studentship**, *University of Cambridge*.
- 2020 – 2023 **Honorary Vice Chancellor's Award**, *University of Cambridge*.
- 2020 – 2023 **Cambridge Trust Helen Stone Scholarship**, *University of Cambridge*.
- 2020 **American Physical Society LeRoy Apker Award finalist**, *Haverford College*.
- 2019 **Royal Astronomical Society Undergraduate Research Bursary**, *Durham University*.
- 2019 **Phi Beta Kappa**, *Haverford College*, Inducted junior year.
- 2016 – 2020 **Class of 1950 International Student Scholarship**, *Haverford College*.
- 2016 – 2017 **The Robert Maquinay 1948 Scholarship and C.V. Star Scholarship**, *Haverford College*.

Publications

First author publications

Gerrit S. Farren, Daniel Grin, Andrew H. Jaffe, Renée Hložek, and David J. E. Marsh. Ultralight axions and the kinetic Sunyaev-Zel'dovich effect. *Phys. Rev. D*, 105:063513, Mar 2022.

Gerrit S. Farren, Bruce Partridge, Rüdiger Kneissl, Simone Aiola, Rahul Datta, Megan Gralla, and Yaqiong Li. Confirming the calibration of ALMA using *Planck* observations. *The Astrophysical Journal Supplement Series*, 256(1):19, Sep 2021.

Gerrit S. Farren, Oliver H. E. Philcox, and Blake D. Sherwin. Determining the Hubble constant without the sound horizon: Perspectives with future galaxy surveys. *Phys. Rev. D*, 105:063503, Mar 2022.

Selected co-authored works

Rahul Datta et al. The Atacama Cosmology Telescope: two-season ACTPol extragalactic point sources and their polarization properties. *Monthly Notices of the Royal Astronomical Society*, 486(4):5239–5262, Nov 2018.

Oliver H. E. Philcox, Gerrit S. Farren, Blake D. Sherwin, Eric J. Baxter, and Dillon J. Brout. Determining the Hubble Constant without the Sound Horizon: A 3.6% Constraint on H_0 from Galaxy Surveys, CMB Lensing and Supernovae. *arXiv e-prints*, page arXiv:2204.02984, April 2022.

Oliver H. E. Philcox, Blake D. Sherwin, Gerrit S. Farren, and Eric J. Baxter. Determining the Hubble constant without the sound horizon: Measurements from galaxy surveys. *Phys. Rev. D*, 103:023538, Jan 2021.