Emily Sandford

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Research Interests

Exoplanet detection and characterisation with transit photometry, stellar and solar activity, and non-linear dynamics and chaos, particularly phase space reconstruction of experimental observations.

Appointments

Gonville & Caius College, University of Cambridge, Cambridge, UK
Research Fellow — 2020 - present

Education

Columbia University, New York, NY
Ph.D., Astronomy — 2020
Dissertation: "The Shapes of Planet Transits and Planetary Systems"
Supervisor: Prof. David Kipping
M.A., M.Phil., Astronomy — 2016, 2017
Supervisors: Prof. David Kipping, Prof. Kathryn Johnston, Dr. Andreas Küpper
Yale University, New Haven, CT
B.Sc., Physics, Cum Laude, with distinction in the Physics major — 2014
Supervisor: Prof. Marla Geha

Publications

13. **E. Sandford**. Attractor reconstruction for uncertain, unevenly sampled time series. 2023, in prep.
12. **E. Sandford**, D. Kipping, & M. Collins. On Planetary Systems as Ordered Sequences. MNRAS, 2021, 505, 2224.
11. **E. Sandford**, D. Kipping, & M. Collins. The Multiplicity Distribution of *Kepler*'s Exoplanets. MNRAS, 2019, 489, 3162.
10. **E. Sandford**, N. Espinoza, R. Brahm, & A. Jordán. Estimation of Singly-Transiting K2 Planet Periods with Gaia Parallaxes. MNRAS, 2019, 489, 3149.
9. Z. Penoyre & **E. Sandford**. Higher Order Harmonics in the Light Curves of Eccentric Planetary Systems. MNRAS, 2019, 488, 4181.
8. Z. Penoyre & **E. Sandford**. The Spaceline: A Practical Space Elevator Alternative Achievable with Current Technology. In prep.
7. **E. Sandford** & D. Kipping. Shadow Imaging of Transiting Objects. AJ, 2019, 157, 42.
6. D. Kipping, **E. Sandford**, & T. Jansen. Over 2000 *Kepler* Phase Curves from `Phasma`. RNAAS, 2018 2b, 14.
5. **E. Sandford** & D. Kipping. Know the Planet, Know the Star: Precise Stellar Densities from *Kepler* Transit Light Curves. AJ, 2017, 154, 288.
4. **E. Sandford**, A. H. W. Küpper, K. V. Johnston, & J. Diemand. Quantifying Tidal Stream Disruption in a Simulated Milky Way. MNRAS, 2017, 470, 522.
3. D. Kipping, C. Cameron, J. D. Hartman, J. R. A. Davenport, J. M. Matthews, D. Sasselov, J. Rowe, R. J. Siverd, J. Chen, **E. Sandford** et al. No Conclusive Evidence for Transits of Proxima b in MOST Photometry. AJ, 2017, 153, 93.
2. D. Kipping & **E. Sandford**. Observational Biases of Transiting Planets. MNRAS, 2016, 463, 1323.
1. D. Kipping, G. Torres, C. Henze, A. Teachey, H. Isaacson, E. Petigura, ... & **E. Sandford**. A Transiting Jupiter Analog. ApJ, 2016, 820, 112.

Scientific Talks

16. Attractor reconstruction of active stellar light curves. Hills Seminar, University of Cambridge, December 2023.
15. Attractor reconstruction of experimental time series. Invited seminar, Imperial College London, November 2023.
14. Attractor reconstruction of experimental time series. Seminar, Columbia University, September 2023.
13. Attractor reconstruction of active stellar light curves. Invited seminar, Leiden University, February 2023.
12. Order or randomness in stellar light curves? Invited seminar, Caius Science Network, Gonville & Caius College, University of Cambridge, November 2021.
11. On Planetary Systems as Ordered Sequences. Invited seminar, Yale University, March 2021.
10. Computational Linguistics for Exoplanetary Systems. Invited talk, Machine Learning in Science & Engineering, Columbia University Data Science Institute, December 2020.
9. Shadow Imaging of Transiting Objects. Invited seminar, University of California, Berkeley, August 2020.
8. Planetary Systems as Ordered Sequences. Invited seminar, University of Cambridge, October 2019.
7. Linguistic Modeling of *Kepler*'s Exoplanets. Contributed talk, Extreme Solar Systems IV, Reykjavik, Iceland, August 2019.
6. Shadow Imaging of Transiting Objects. Invited seminar, Pennsylvania State University Center for Exoplanets and Habitable Worlds, March 2019.
5. How to Read a Light Curve. Seminar, Cambridge Institute of Astronomy, January 2019.
4. Shadow Imaging of Transiting Objects. Contributed talk, Diversis Mundi, Santiago, Chile, March 2018.
3. Shadow Imaging of Transiting Objects. Invited seminar, Pontifícia Universidad Católica de Chile, Santiago, Chile, March 2018.
2. Know the Star, Know the Planet: Precise Stellar Parameters with *Kepler*. Contributed talk, Kepler/K2 Science Conference IV, Mountain View, CA, June 2017.
1. Know the Star, Know the Planet: Precise Stellar Parameters with *Kepler*. Contributed talk, 229th Meeting of the American Astronomical Society, Grapevine, TX, January 2017.

Teaching and Advising

Lecturer, Cambridge M.Phil. in Data-Intensive Science 2024
"Applications of Data Science to Exoplanets"

Guest lecturer, Cambridge Digital Humanities workshop on ChatGPT at Work December 2023

Research mentor, Nuffield Research Placement August 2023
Project: Simulating sunspot light curves
Students advised: Adam Clarke

Guest lecturer, Gonville & Caius College postgraduate seminar series November 2022
"How to Teach in a Climate Crisis"

Supervisor, University of Cambridge Part II Astrophysics
Astrophysical Fluid Dynamics 2022 - 2023
Structure and Evolution of Stars 2021 - 2022

Guest lecturer, Astrostatistics, Columbia University April 2021
"A Superficial Introduction to Neural Networks"

Research mentor, American Museum of Natural History Science Research Mentoring Program 2017-2018
Project: The Kepler Atlas, an interactive 3D model of *Kepler*'s exoplanet discoveries
Students advised: Christopher Ambrus, Catherine Atalig, James Hamue, and Caroline Klewinowski

Instructor: Astronomy Lab I, Astronomy Lab II 2015 - 2017

Teaching assistant: Astrostatistics, Modeling the Universe, Another Earth 2015 - 2016

Successful Proposals

ESA Archival Research Visitor Programme, cycle 5 — awarded 2023
"Multi-wavelength attractor reconstruction of the Solar rotation cycle"
For 2-month visit to ESTEC for work on archival data from the Solar and Heliospheric Observatory

Awards/Prizes

Shortlisted for the Caroline Herschel Prize Lectureship — 2023
Columbia University President's Global Innovation Fund Grant, for study in Santiago, Chile — 2018
Columbia University Dean's Fellowship — 2014 - 2020
Honorable Mention, National Science Foundation Graduate Research Fellowship — 2016
American Astronomical Society Chambliss Student Poster Award — 2014
Yale College Dean's Office Science, Technology, and Research Scholars Fellowship — 2013 - 2014

Open-Source Code Development

Lead developer:

`spotchaos`, a `Python` package for attractor reconstruction — 2023
`EightBitTransit`, a `Python` package which generates light curves of arbitrary transiting shapes, and infers the transiting shape which produced an arbitrary light curve. — 2018

Contributing developer:

`single`, a `Python` package which fits single-transit events using stellar density information. — 2019
`OoT`, a `Python` package which generates self-consistent planet light curves including transits, secondary eclipses, tides, reflections, and relativistic beaming. — 2019
`SEDBuilder`, a `Python` package which collates archival photometric data points for any object with a 2MASS ID and generates its SED. — 2018
Kepler Atlas, a `javascript`-implemented interactive 3D model of *Kepler*'s exoplanet discoveries. — 2018

Public Outreach

Cool Worlds YouTube channel contributor — 2016 - present
Cambridge Institute of Astronomy public outreach talk, "Oh, the Planets You'll Go!" — 2023
Cambridge Creative Encounters collaboration with artist Dr. Alina Loth — 2020
Cambridge Behind the Curtains workshop with local playwrights — 2020
Sky & Telescope freelance contributor — 2018
Astrobites staff writer — 2016 - 2018

Organizing & Service

Anti-casualisation representative on the Cambridge UCU Executive Committee — 2023 - present
Cambridge LGBTQ+-in-astro coffee chat organizer — 2023 - present
Justice for College Supervisors negotiating committee member — 2023 - present
Cambridge exoplanet seminar committee chair — 2022 - present
Cambridge postdoc committee member — 2022 - present
Leverhulme Centre for Life in the Universe Annual Meeting organizer — 2023
Cambridge exoplanets group meeting organizer — 2021 - 2022
Astrobites editorial committee chair & vision committee chair — 2018 - 2019
Columbia Astronomy graduate student representative to faculty meetings — 2017 - 2019
Columbia Astrophysics Laboratory computing committee member — 2017 - 2018
Mentor, Columbia Astronomy graduate mentorship program — 2016 - 2020
Columbia Astronomy graduate admissions committee member — 2016 - 2017