Dr Benjamin Pope

Lecturer in Astrophysics & ARC DECRA Fellow

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Current Position

Lecturer in Astrophysics & ARC DECRA Fellow

Jan 2020-present

School of Mathematics & Physics, University of Queensland — *Brisbane, Queensland, Australia*

- Grants: ARC Discovery Early Career Researcher Award (DECRA Fellowship) and ARC Discovery Project 2023
- Supervising: 2 undergrads, 4 PhD students and 1 Postdoctoral Researcher
- Awards: Big Questions Institute Fellowship, Queensland Tall Poppy Award for Science
- Teaching:
  - PHYS2082 - Space Science and Stellar Astrophysics
  - PHYS3080 - Extragalactic Astrophysics and Cosmology
  - PHYS4080 - Frontiers in Astrophysics

Experience

NASA Sagan Postdoctoral Fellow

November 2017 - October 2020

Center for Data Science & Center for Cosmology and Particle Physics, New York University — *New York, NY*

- Recipient of the most prestigious NASA named fellowship in exoplanet astronomy, oversubscribed 35:1.
- Visiting Researcher at the Simons Foundation's Flatiron Institute Center for Computational Astrophysics.
- Built an open-source Python pipeline using convex optimization to obtain the best ever measurements of naked-eye stars such as the Seven Sisters, and released all code and data open-source.
- Developed a radically-new method based on the technology underpinning deep learning, automatic differentiation, to design and use optical devices for high-resolution imaging.
- Helped discover radio waves from a planet outside our solar system for the first time, using the Dutch national observatory LOFAR and optical telescopes on the ground and in space.
- Awarded USD $100,000 in competitive research grants to use the NASA TESS Space Telescope.
- Lectured on statistical and machine learning methods to NYU Masters in Data Science students.

Breakthrough Foundation Postdoctoral Research Associate

June-November 2017

University of Sydney — *Sydney, NSW*

- Contributed to the optical design of what we hope will be Australia's first space telescope, Toliman.
- Lectured in the Physics Honours course on Bayesian methods and machine learning.
- Mentored two Honours student projects in physics, both students obtaining first-class honours.

Education

Doctor of Philosophy (DPhil) in Astrophysics

October 2013 - May 2017

Balliol College, University of Oxford — *Oxford, England*

- Thesis: *Observing Bright Stars and their Planets from Earth and from Space*
- Clarendon Scholarship: Full scholarship awarded to 0.5% of graduate degree applicants.
- Developed algorithms in Python to enhance the dynamic range of the *Kepler* space telescope by a factor of 10,000.
- Developed high resolution image analysis techniques in hardware and software.
- Led five first author papers, discovering 145 exoplanet candidates.

Master of Science (MSc)

2013

University of Sydney — *Sydney, NSW, Australia*

- Vice-Chancellor's Research Award (awarded to 12 people across the University).
- Experimental physics thesis: "Vision and Revision: Wavefront Sensing from the Image Domain".

Bachelor of Science (First Class Honours with the University Medal) *2009-2012*

University of Sydney *Sydney, NSW, Australia*

- Physics Honours Thesis: "Dancing in the Dark: Kernel Phase Interferometry of Ultracool Dwarfs".
- University Medal, Dean's Honours List, University prizes for best physics and astrophysics thesis, and national Bok Prize for best astrophysics honours thesis.
- Studied abroad at the University of California, Berkeley (2010-11) and Nanjing University (南京大学), China (2011).

Study Abroad *2010-11*

University of California, Berkeley *Berkeley, California, USA*

- Undergraduate research project with Nobel Laureate and inventor of the laser, Prof. Charles H. Townes.

Research

Publications Led 13 refereed publications; co-author of 44, with 1032 citations; h-index: 16. (Full list). Published in *Proceedings of the Royal Society A*, *Nature Astronomy*, *The Astrophysical Journal*, *Monthly Notices of the Royal Astronomical Society*, *Astronomy & Astrophysics*, and other journals.

Presentations Presented as an invited speaker at Harvard, MIT, Yale, Columbia, University of Washington, Johns Hopkins, Carnegie Mellon, Cambridge, Oxford, the Royal Astronomical Society, University of Sydney, Swinburne, Monash, University of Melbourne, and other institutions.

Peer Review Refereed papers for the *Journal of Open Source Software*; all main astronomy journals *ApJ*, *MNRAS*, *A&A* and all their Letters sections; and optics journal *JOSA*; and reviewed telescope proposals, fellowships, and other grants for the ARC, NASA, STFC, NSF.

Open Source All publications are available on arXiv, with source code on GitHub. Lead creator of `halophot`, code for enhancing the dynamic range of *Kepler* and TESS space telescopes, `dLux`, an automatically-differentiable Jax simulation package for astronomical optics, and `ticktack`, the first open-source package for Bayesian modelling of radiocarbon data.

Research Supervision Co-supervisor of four Honours-level projects in astronomy, all achieving First Class Honours and continuing to funded PhDs in astrophysics. Three current PhD students and four current undergraduate students.

Public Communication

University Challenge Member of the winning team for Balliol College, Oxford on the 2016-17 season of the BBC's most popular quiz show, *University Challenge*.

Science Writing Science journalism published in *The Monthly* magazine, *Cooper Square Review*, and *Oxonian Review*. Completed Introductory and Advanced Science Communication courses at NYU Journalism School. Included in *Best Australian Science Writing 2021* and *The Lines of Code that Changed the World* (PUP).

Consulting Scientific consultant for *War of the Worlds*, the 2019 Fox/Studio Canal TV series.

Presentation Sold-out performances for World Science Festival at QPAC, Caveat NYC, and Astronomy on Tap Brooklyn. Interviewed on ABC News Radio & TV, quoted in the *Guardian*, *Sydney Morning Herald*, and *New York Times*.

Outreach Lead organizer of public telescope viewings of eclipses and the Transits of Venus and Mercury in Sydney, New York, Oxford, and Brisbane. Telescope guide at Uluru, Stargazing Oxford, and PopScope DC and Baltimore.

Select Publications

22. Desdoigts, **Pope**, Dennis, and Tuthill: *Differentiable optics with ∂Lux: I—deep calibration of flat field and phase retrieval with automatic differentiation,* JATIS, 9, 028007 (2023) ADS

21. Zhang, Sharma, Dennis, Scifo, Kuitems, Büntgen, Owens, Dee, and **Pope**: *Modelling cosmic radiation events in the tree-ring radiocarbon record,* RSPSA, 478, 20220497 (2022) arXiv:2210.13775

20. *The TESS View of LOFAR Radio-Emitting Stars*. **Pope, Benjamin J. S.** ; Callingham, Joseph R. ; Feinstein, Adina D. ; Günther, Maximilian N. ; Vedantham, Harish K. ; Ansdell, Megan ; Shimwell, Timothy W. ApJL, Volume 919, Number 1, 2021. arXiv:2110.04759

19. *The population of M dwarfs observed at low radio frequencies*. J. R. Callingham, H. K. Vedantham, T. W. Shimwell, **B. J. S. Pope**, I. E. Davis, P. N. Best, M. J. Hardcastle, H. J. A. Röttgering, J. Sabater, C. Tasse, R. J. van Weeren, W. L. Williams, P. Zarka, F. de Gasperin & A. Drabent. *Nature Astronomy*, (2021). arXiv:2110.03713

18. *Phase retrieval and design with automatic differentiation: tutorial*. Alison Wong, **Benjamin Pope**, Louis Desdoigts, Peter Tuthill, Barnaby Norris, Chris Betters. JOSA B, vol. 38, issue 9, p. 2465, 2021. arXiv:2107.00952

17. *Kernel Phase and Coronagraphy with Automatic Differentiation*. **Benjamin J. S. Pope**, Laurent Pueyo, Yinzi Xin, Peter G. Tuthill. ApJ, Vol. 907, Issue 1, id.40, 14 pp, 2021. arXiv:2011.09780

16. *No Massive Companion to the Coherent Radio-Emitting M Dwarf GJ 1151*. **Benjamin J. S. Pope**, Megan Bedell, Joseph R. Callingham, Harish K. Vedantham, Ignas A. G. Snellen, Adrian M. Price-Whelan, Timothy W. Shimwell. ApJL February 17, 2020. arXiv:2002.07850

15. *Coherent radio emission from a quiescent red dwarf indicative of star–planet interaction*. H. K. Vedantham, J. R. Callingham, T. W. Shimwell, C. Tasse, **B. J. S. Pope**, M. Bedell, I. Snellen, P. Best, M. J. Hardcastle, M. Haverkorn, A. Mechev, S. P. O'Sullivan, H. J. A. Röttgering, G. J. White. *Nature Astronomy* 2020. arXiv:2002.08727

14. *The K2 Bright Star Survey I: Methodology and Data Release*. **Benjamin J. S. Pope** et al., ApJS Vol. 245, Issue 1, article id. 8, 15 pp. (2019). arXiv:1908.06981

13. *The Kepler Smear Campaign: Light curves for 102 Very Bright Stars*. **Benjamin J. S. Pope** et al., ApJS Vol. 244, Issue 1, article id. 18, 19 pp. (2019). arXiv:1905.09831

12. *Exoplanet Transits with Next-Generation Radio Telescopes*. **Benjamin J. S. Pope**, Paul Withers, Joseph R. Callingham, and Marissa F. Vogt. MNRAS, March 2019, Vol. 484, Issue 1, p.648-658. arXiv:1810.11493

11. *Anisotropic winds in Wolf-Rayet colliding-wind binary identify potential gamma-ray burst progenitor*. J. R. Callingham, P. G. Tuthill, **B. J. S. Pope** et al. *Nature Astronomy*, 2018. Online

10. *Aldebaran b's temperate past uncovered in planet search data*. Farr, Will M., **Pope, Benjamin J. S.** et al. ApJL Vol. 865, Issue 2, article id. L20, 12 pp. (2018). arXiv:1802.09812

9. *Beyond the Kepler/K2 bright limit: variability in the seven brightest members of the Pleiades*. White, T. R.; **Pope, B. J. S.** et al. MNRAS (2017). arXiv:1708.07462

8. *Anchoring historical sequences using a new source of astro-chronological tie-points.* Michael Dee, **Benjamin Pope**. Proc. R. Soc. A 20160263 (2016). Online

7. *Kernel Phase and Kernel Amplitude in Fizeau imaging.* **Benjamin Pope**. MNRAS Vol. 463, Issue 4, p.3573-3581 (2016). arXiv:1609.00200

6. *Transiting exoplanet candidates from K2 Campaigns 5 and 6.* **Benjamin Pope**, Hannu Parviainen, Suzanne Aigrain. MNRAS, Vol. 461, Issue 4, p.3399-3409 (2016). arXiv:1606.01264

5. *K2SC: Flexible systematics correction and detrending of K2 light curves using Gaussian Process regression*. Suzanne Aigrain, Hannu Parviainen, **Benjamin Pope**. MNRAS, 2016. arXiv:1603.09167

4. *The Palomar Kernel Phase Experiment: Testing Kernel Phase Interferometry for Ground-based Astronomical Observations*. **Benjamin Pope**, Peter Tuthill, Sasha Hinkley, Michael J. Ireland, Alexandra Greenbaum, Alexey Latyshev, John D. Monnier, Frantz Martinache. MNRAS, Vol. 455, Issue 2, p.1647-1653 (2016). arXiv:1510.06406

3. *Photometry of Very Bright Stars with* Kepler *and* K2 *Smear Data*. **Benjamin Pope**, Timothy White, Daniel Huber, Simon Murphy, Tim Bedding, Douglas Caldwell, Aleksa Sarai, Suzanne Aigrain, Thomas Barclay. MNRAS Letters, Vol. 455, Issue 1, p.L36-L40 (2016). arXiv:1510.00008.

2. *A Demonstration of Wavefront Sensing from the Image Domain*. **Benjamin Pope**, Nick Cvetojevic, Anthony Cheetham, Frantz Martinache, Barnaby Norris, Peter Tuthill. MNRAS, Vol. 440, Issue 1, p.125-133 (2014). arXiv:1401.7566

1. *Dancing in the Dark: New Brown Dwarf Binaries From Kernel Phase Interferometry*. **Benjamin Pope**, Frantz Martinache, Peter Tuthill. ApJ, V. 767, Issue 2, article id. 110, 14 (2013). arXiv:1302.6682

Other Publications

20. Bloot, Callingham, Vedantham, Kavanagh, **Pope**, Climent, Guirado, Peña-Moñino, and Pérez-Torres: *Phenomenology and periodicity of radio emission from the stellar system AU Microscopii,* accepted ApJ, arXiv:2312.09071 (2023) arXiv:2312.09071

19. Fitzmaurice, Stefánsson, Kavanagh, Mahadevan, Cañas, Winn, Robertson, Ninan, Albrecht, Callingham, Cochran, Delamer, Kanodia, Lin, Marcussen, **Pope**, Ramsey, Roy, Vedantham, and Wright: *Astrometry and Precise Radial Velocities Yield a Complete Orbital Solution for the Nearby Eccentric Brown Dwarf LHS 1610 b,* arXiv:2310.07827 (2023) arXiv:2310.07827

18. Calissendorff, De Furio, Meyer, Albert, Aganze, Ali-Dib, Bardalez Gagliuffi, Baron, Beichman, Burgasser, Cushing, Faherty, Fontanive, Gelino, Gizis, Greenbaum, Kirkpatrick, Leggett, Martinache, Mary, N'Diaye, **Pope**, Roellig, Sahlmann, Sivaramakrishnan, Thorngren, Ygouf, and Vandal: *JWST/NIRCam Discovery of the First Y+Y Brown Dwarf Binary: WISE J033605.05-014350.4,* ApJL, 947, L30 (2023) arXiv:2303.16923

17. Callingham, Shimwell, Vedantham, Bassa, O'Sullivan, Yiu, Bloot, Best, Hardcastle, Haverkorn, Kavanagh, Lamy, **Pope**, Röttgering, Schwarz, Tasse, van Weeren, White, Zarka, Bomans, Bonafede, Bonato, Botteon, Bruggen, Chyży, Drabent, Emig, Gloudemans, Gürkan, Hajduk, Hoang, Hoeft, Iacobelli, Kadler, Kunert-Bajraszewska, Mingo, Morabito, Nair, Pérez-Torres, Ray, Riseley, Rowlinson, Shulevski, Sweijen, Timmerman, Vaccari, and Zheng: *V-LoTSS: The circularly polarised LOFAR Two-metre Sky Survey,* A&A, 670, A124 (2023) arXiv:2212.09815

16. Sivaramakrishnan, Tuthill, Lloyd, Greenbaum, Thatte, Cooper, Vandal, Kammerer, Sanchez-Bermudez, **Pope**, Blakely, Albert, Cook, Johnstone, Martel, Volk, Soulain, Artigau, Lafrenière, Willott, Parmentier, Ford, McKernan, Vila, Rowlands, Doyon, Beaulieu, Desdoigts, Fullerton,

De Furio, Goudfrooij, Holfeltz, LaMassa, Maszkiewicz, Meyer, Perrin, Pueyo, Sahlmann, Sohn, Teixeira, and Zheng: *The Near Infrared Imager and Slitless Spectrograph for the James Webb Space Telescope. IV. Aperture Masking Interferometry,* PASP, 135, 015003 (2023) arXiv:2210.17434

15. *A search for transits among the δ Scuti variables in Kepler*. Daniel R. Hey, Benjamin T. Montet, **Benjamin J.S. Pope**, Simon J. Murphy, Timothy R. Bedding. AJ, Vol. 162, Issue 5, id.204 (2021). arXiv:2108.03785

14. *Low-frequency monitoring of flare star binary CR Draconis: long-term electron-cyclotron maser emission*. Callingham, J. R. ; Pope, B. J. S. ; et al. A&A, Vol. 648, id.A13, 15 pp. (2021). arXiv:2102.04751

13. *TESS Data for Asteroseismology: Photometry*. Handberg, Rasmus ; Lund ; the T'DA Collaboration, inc. **Pope, Benjamin J. S.** et al.. arXiv:2106.08341

12. *A Mystery in Chamaeleon: Serendipitous Discovery of a Galactic Symbiotic Nova*. Lancaster, Lachlan et al., inc. **Pope, Benjamin J. S.** ; AJ, Vol. 160, Issue 3, id.125. (2020) arXiv:2002.07852

11. *Radiocarbon Production Events and their Potential Relationship with the Schwabe Cycle*. A. Scifo et al., inc. **B.J.S. Pope**, Scientific Reports, Volume 9, id. 17056. (2019) Online

10. *Extended Aperture Photometry of K2 RR Lyrae stars.* Plachy, Emese et al., inc. **Pope, Benjamin J. S.** ApJS, Vol. 244, Issue 2, article id. 32, 16 pp. (2019). arXiv:1901.06187

9. *A Ghost in the Toast: TESS Background Light Produces a False "Transit" Across τ Ceti.* Eisner, Nora L.; **Pope, Benjamin J. S.** et a. RNAAS, Vol. 3, Issue 10, article id. 145 (2019).

8. *Asteroseismology of the Hyades red giant and planet host ε Tauri*. T. Arentoft et al., inc. **B. J. S. Pope**. A&A, Vol,. 622, id.A190, 12 pp. (2019) arXiv:1901.06187

7. *Magneto-Asteroseismic Study of ι Lib*. B. Buysschaert, C. Neiner, C. Aerts, T. R. White and **B. J. S. Pope**. Proceedings SF2A (2018). Online

6. *The TOLIMAN space telescope*. Peter Tuthill et al. inc. **Benjamin Pope**. Proc. SPIE 10701, Optical and Infrared Interferometry and Imaging VI, 107011J, (2018). Online

5. *Non-redundant masking ideas on JWST*, Sivaramakrishnan, Anand et al., inc. **Pope, Benjamin**. Proc. SPIE, Vol. 9143, id. 91433S 8 pp. (2014). Online

4. *Wavefront sensing from the image domain with the Oxford-SWIFT integral field spectrograph*, **Benjamin Pope**, Niranjan Thatte, Rick Burruss, Matthias Tecza, Fraser Clarke, Garret Cotter, Proc. SPIE, Vol. 9148, id. 914859 8 pp. (2014). arXiv:1407.0724

3. *Spatial dispersion management in three-dimensional drawn magnetic metamaterials,* A. Tuniz et al. in CLEO: QELS-Fundamental Science, OSA Technical Digest (Optical Society of America, 2012), paper QTu3F.2. Online

2. *Photonic Technologies for a Pupil Remapping Interferometer*. Tuthill, Peter et al., inc. **Pope, Benjamin**. Proceedings of the SPIE, Vol. 7734, id. 77341P (2010). arXiv:1006.2587

1. *PIMMS: Photonic Integrated Multimode Microspectrograph* (Proceedings Paper). Joss Bland-Hawthorn et al., inc. **Ben Pope**. SPIE Proceedings Vol. 7735. (2010) Online