Shubham Kanodia

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Appointments

Carnegie Institution for Science **Washington, DC, USA**
Carnegie Postdoctoral Fellow, Earth and Planets Laboratory July 2022 – Present
From Pixels to Population: Understanding Gas Giants around M dwarfs

Pennsylvania State University **Pennsylvania, USA**
Research Technologist February 2017 – July 2017
HPF and NEID spectrograph design and instrument assembly

Education

Pennsylvania State University **Pennsylvania, USA**
Doctor of Philosophy (Ph.D.) Astrophysics May 2019 – May 2022
Developing new tools and techniques to probe the M dwarf planet population

Pennsylvania State University **Pennsylvania, USA**
Master of Science (M.Sc.) Astrophysics Sept 2017 – May 2019
Combining the Next Generation of Exoplanet Instrumentation & Astrostatistics

Brown University **Rhode Island, USA**
Master of Science (Sc.M.) Physics Sept 2015 – Dec 2016
Optical Design of the Exoplanet Climate Infrared Telescope Spectrometer

St. Xavier's College **Mumbai, India**
Bachelor of Science (B.Sc.) Physics June 2012 – Apr 2015

Telescope Time Allocation

- JWST Cycle 2 (GO 3171): 133 hours
- HET 10 m HPF: > 50 nights
- Gemini-N 8 m MAROON-X: 1.5 nights
- PFS 6.5 Magellan: 4 nights
- ARC 3.5 m: > 50 half nights
- WIYN 3.5 m NEID: > 20 nights

Awards & Grants

- Carnegie Postdoctoral Fellow, Carnegie Earth & Planets Lab, 2022 onwards
- NASA Group Achievement Award, NEID Team, 2020
- Downsbrough Graduate Fellowship in Astrophysics, Penn State, 2021
- Zaccheus Daniel Fellowship, Penn State, 2018, 2020, 2021
- Homer F. Braddock / Nellie H. and Oscar L. Roberts Fellowship, Penn State, 2017
- J.N. Tata Endowment Fund for Higher Education, Mumbai, 2015
- INSPIRE Scholarship: Government of India, Mumbai, 2013

Mentoring & Advising

- Helen Baran (2019 – 2020): Undergraduate at Pennsylvania State University
- Marissa Maney (2019 – 2021): Undergraduate at Pennsylvania State University
- Brody McElwain (2020 – 2022): Master's student at Pennsylvania State University
- Narisara (Mick) Mayer (2023 –): Undergraduate at Haverford College
- Caleb Dando-Haenisch (2023 –): Undergraduate at American University
- Radia Islam (2023 –): Undergraduate at University of Texas, Austin
- Andrew Hotnisky (2023 –): Undergraduate at Pennsylvania State University

Co-advised:

- Megan Delamer (2022 –): PhD student at Pennsylvania State University
- Varghese Reji (2023 –): PhD student at Tata Institute of Fundamental Research (India)
- Te Han (2023 –): PhD student at University of California, Irvine
- Lia Marta Bernabò (2023 –): PhD student at Institute of Planetary Research - DLR (Germany)

Academic Service

NSF's NOIRLab Telescope Time Allocation Committee
Panel Member

NASA Exoplanets Research Program (XRP)
Panel Member, Executive Secretary

ApJ, AJ, MNRAS, International Journal of Astrobiology
Referee

Emerging Researchers in Exoplanet Sciences IV, VII
Organizing Committee 2018, 2022

Outreach

In addition to regular Astronomy open nights and public events at each of my host institutions, I have contributed to the following:

- **Public Talks**:
  - Astronomy on Tap: State College, USA, *Digging through the Cosmic Haystack*, 2019
  - Nerd Nite: Webster's Cafe, State College, USA, *Searching for other worlds, other life*, 2019
  - Nehru Planetarium, Mumbai, India, *Finding Earth 2.0*, 2018
- **Education**:
  - Volunteered for Carnegie Academy of Science (CASE): First Light science program for middle-school kids (2022 – 23)
  - Volunteered for Astrofest: Penn State Department of Astronomy Annual outreach event (2017 – 2019)
  - Volunteered with Brown Cubesat Educational Outreach Saturday STEM program at West Broadway Middle School to communicate Science and Physics to students. (2015 – 2016)
  - Volunteered at Umang Foundation, Mumbai: Teaching underprivileged children basic Mathematics and English. (2012 – 2014)

Teaching

Teaching probabilistic programming **State College**
Pennsylvania State University 2021 and 2022
Developed and taught a course on probabilistic programming, and statistical inference using the Hamiltonian Monte Carlo Python code: `PyMC3` and package `exoplanet`.

Teaching Assistant for Astronomy lab **Providence, USA**
Brown University Jan 2016 – Apr 2016
Lab assistant for basic astronomy lab course.

Software Development

- `pyastrotools`: Repository with set of astronomy helper functions
- `barycorrpy`: Python package for barycentric corrections at the cm/s level for precise radial velocity measurements. Used for HPF, NEID, SPIROU, EXPRES, CARMENES (Kanodia and Wright, 2018; Wright and Kanodia, 2020).
- `MRExo`: Nonparametric tool used to fit mass-radius relationships using beta density functions. It is currently being expanded to simultaneously fit 5 dimensions to model additional planetary parameters (Kanodia et al. 2019, 2023).

Professional Talks

- American University Physics Colloquium, November 2023
- Steward Observatory/NSF's NOIRLab Joint Colloquium, October 2023
- DAA Seminar, Tata Institute for Fundamental Research, Mumbai, August 2023
- Strange New Worlds, Pune, August 2023
- Origins of Solar Systems, Gordon Research Seminar, June 2023
- EPL General Seminar, Carnegie EPL, February 2023
- School of Earth and Planetary Sciences (SEPS), NISER Bhubaneshwar, March 2023
- SPIE Astronomical Telescopes + Instrumentation, Montreal, August 2022
- DAA Seminar, Tata Institute for Fundamental Research, Mumbai, March 2022
- EPL Astronomy Seminar, Carnegie EPL, October 2021
- PSU Center for Exoplanets and Habitable Worlds Seminar, PSU, September 2021
- NASA Goddard Extrasolar Planets Seminar, NASA Goddard, September 2021
- Order of the Octopus, PSU, July 2021
- PSETI Seminar, PSU, October 2020
- NASA Technosignatures Workshop, USRA, September 2018
- Emerging Researchers in Exoplanet Science Symposium, PSU, June 2018

Publications

First Author (Refereed): 13 (10); Significant Contributions: 17[ADS]
Total Citations: 954 on 01 November, 2023. Mentee Publications are indicated with *

First Author

13. **S. Kanodia**, C. Cañas, S. Mahadevan, et al., *Searching for Giant Exoplanets around M-dwarf Stars (GEMS) I: Survey Motivation*, Submitted to AAS Journals [Manuscript available upon request]
12. **S. Kanodia**, M. He, E. Ford, et al., *Beyond Two-dimensional Mass-Radius Relationships: A Nonparametric and Probabilistic Framework for Characterizing Planetary Samples in Higher Dimensions*, ApJ, 956, 2, 2023 [ADS]
11. **S. Kanodia**, A. Lin, E. Lubar, et al., *Stable Fiber-illumination for Extremely Precise Radial Velocities with NEID*, AJ, 166, 3, 2023 [ADS]
10. **S. Kanodia**, S. Mahadevan, J. Libby-Roberts, et al., *TOI-5205b: A Short-period Jovian Planet Transiting a Mid-M Dwarf*, AJ, 165, 3, 2023 [ADS]
9. **S. Kanodia**, L. Ramsey, M. Maney, et al., *High-resolution Near-infrared Spectroscopy of a Flare around the Ultracool Dwarf vB 10*, ApJ, 925, 2, 2022 [ADS]
8. **S. Kanodia**, J. Libby-Roberts, C. Cañas, et al., *TOI-3757 b: A Low-density Gas Giant Orbiting a Solar-metallicity M Dwarf*, AJ, 164, 3, 2022 [ADS]
7. **S. Kanodia**, G. Stefansson, C. Cañas, et al., *TOI-532b: The Habitable-zone Planet Finder confirms a Large Super Neptune in the Neptune Desert orbiting a metal-rich M-dwarf host*, AJ, 162, 4, 2021 [ADS]
6. **S. Kanodia**, S. Halverson, J. Ninan, et al., *A Harsh Test of Far-field Scrambling with the Habitable-zone Planet Finder and the Hobby-Eberly Telescope*, ApJ, 912, 1, 2021 [ADS]
5. **S. Kanodia**, C. Cañas, G. Stefansson, et al., *TOI-1728b: The Habitable-zone Planet Finder Confirms a Warm Super-Neptune Orbiting an M-dwarf Host*, ApJ, 899, 1, 2020 [ADS]
4. **S. Kanodia**, J. Ninan, A. Monson, et al., *Ghosts of NEID's past*, SPIE, 11447, 2020 [ADS]
3. **S. Kanodia**, A. Wolfgang, G. Stefansson, et al., *Mass-Radius Relationship for M Dwarf Exoplanets: Comparing Nonparametric and Parametric Methods*, ApJ, 882, 1, 2019 [ADS]
2. **S. Kanodia**, and J. Wright, *Python Leap Second Management and Implementation of Precise Barycentric Correction (barycorrpy)*, RNAAS, 2, 1, 2018 [ADS]
1. **S. Kanodia**, S. Mahadevan, L. Ramsey, et al., *Overview of the spectrometer optical fiber feed for the habitable-zone planet finder*, SPIE, 10702, 2018 [ADS]

Significant Contributions

17. A. Boss, and **S. Kanodia**, *Forming Gas Giants around a Range of Protostellar M-dwarfs by Gas Disk Gravitational Instability*, ApJ, 956, 1, 2023 [ADS]
16. *T. Han, P. Robertson, **S. Kanodia**, et al., *TOI-5344 b: A Saturn-like planet orbiting a super-Solar metallicity M0 dwarf*, arXiv e-prints, None, 2023 [ADS]

15. *M. Delamer, **S. Kanodia**, C. Cañas, et al., *TOI-4201: An Early M-dwarf Hosting a Massive Transiting Jupiter Stretching Theories of Core-Accretion*, arXiv e-prints, None, 2023 [ADS]
14. S. Sheikh, **S. Kanodia**, E. Lubar, et al., *A Green Bank Telescope Search for Narrowband Technosignatures between 1.1 and 1.9 GHz During 12 Kepler Planetary Transits*, AJ, 165, 2, 2023 [ADS]
13. C. Cañas, **S. Kanodia**, J. Libby-Roberts, et al., *TOI-3984 A b and TOI-5293 A b: Two Temperate Gas Giants Transiting Mid-M Dwarfs in Wide Binary Systems*, AJ, 166, 1, 2023 [ADS]
12. *M. Lambert, C. Bender, **S. Kanodia**, et al., *TOI-5375 B: A Very Low Mass Star at the Hydrogen-burning Limit Orbiting an Early M-type Star*, AJ, 165, 5, 2023 [ADS]
11. J. Libby-Roberts, M. Schutte, L. Hebb, et al., *An In-depth Look at TOI-3884b: A Super-Neptune Transiting an M4Dwarf with Persistent Starspot Crossings*, AJ, 165, 6, 2023 [ADS]
10. C. Beard, P. Robertson, **S. Kanodia**, et al., *GJ 3929: High-precision Photometric and Doppler Characterization of an Exo-Venus and Its Hot, Mini-Neptune-mass Companion*, ApJ, 936, 1, 2022 [ADS]
9. C. Cañas, **S. Kanodia**, C. Bender, et al., *TOI-3714 b and TOI-3629 b: Two Gas Giants Transiting M Dwarfs Confirmed with the Habitable-zone Planet Finder and NEID*, AJ, 164, 2, 2022 [ADS]
8. C. Beard, P. Robertson, **S. Kanodia**, et al., *TOI-1696 and TOI-2136: Constraining the Masses of Two Mini-Neptunes with the Habitable-Zone Planet Finder*, AJ, 163, 6, 2022 [ADS]
7. A. Lin, A. Monson, S. Mahadevan, et al., *Observing the Sun as a Star: Design and Early Results from the NEID Solar Feed*, AJ, 163, 4, 2022 [ADS]
6. C. Cañas, G. Stefansson, **S. Kanodia**, et al., *A Warm Jupiter Transiting an M Dwarf: A TESS Single-transit Event Confirmed with the Habitable-zone Planet Finder*, AJ, 160, 3, 2020 [ADS]
5. G. Stefánsson, R. Kopparapu, A. Lin, et al., *A Mini-Neptune and a Radius Valley Planet Orbiting the Nearby M2 Dwarf TOI-1266 in Its Venus Zone: Validation with the Habitable-zone Planet Finder*, AJ, 160, 6, 2020 [ADS]
4. C. Schwab, A. Monson, **S. Kanodia**, et al., *The NEID spectrometer: fibre injection system design*, SPIE, 11447, 2020 [ADS]
3. J. Wright, and **S. Kanodia**, *Barycentric Corrections for Precise Radial Velocity Measurements of Sunlight*, PSJ, 1, 2, 2020 [ADS]
2. A. Metcalf, T. Anderson, C. Bender, et al., *Stellar spectroscopy in the near-infrared with a laser frequency comb*, Optica, 6, 2, 2019 [ADS]
1. J. Wright, **S. Kanodia**, and E. Lubar, *How Much SETI Has Been Done? Finding Needles in the n-dimensional Cosmic Haystack*, AJ, 156, 6, 2018 [ADS]

Co-Author

32. S. Jones, G. Stefansson, K. Masuda, et al., *TOI-2015b: A Warm Neptune with Transit Timing Variations Orbiting an Active mid M Dwarf*, arXiv e-prints, None, 2023 [ADS]
31. G. Stefansson, S. Mahadevan, Y. Miguel, et al., *An extreme test case for planet formation: a close-in Neptune orbiting an ultracool star*, arXiv e-prints, None, 2023 [ADS]
30. E. Fitzmaurice, G. Stefánsson, R. Kavanagh, et al., *Astrometry and Precise Radial Velocities Yield a Complete Orbital Solution for the Nearby Eccentric Brown Dwarf LHS 1610 b*, arXiv e-prints, None, 2023 [ADS]
29. L. Zhao, X. Dumusque, E. Ford, et al., *The Extreme Stellar-signals Project. III. Combining Solar Data from HARPS, HARPS-N, EXPRES, and NEID*, AJ, 166, 4, 2023 [ADS]
28. A. Gupta, J. Jackson, G. Hébrard, et al., *A High-Eccentricity Warm Jupiter Orbiting TOI-4127*, AJ, 165, 6, 2023 [ADS]
27. J. Dong, S. Wang, M. Rice, et al., *TOI-1859b: A 64 Day Warm Jupiter on an Eccentric and Misaligned Orbit*, ApJ, 951, 2, 2023 [ADS]
26. R. Frazier, G. Stefánsson, S. Mahadevan, et al., *NEID Reveals That the Young Warm Neptune TOI-2076 b Has a Low Obliquity*, ApJ, 944, 2, 2023 [ADS]
25. A. Lin, J. Libby-Roberts, J. Alvarado-Montes, et al., *The Unusual M-dwarf Warm Jupiter TOI-1899 b: Refinement of Orbital and Planetary Parameters*, AJ, 166, 3, 2023 [ADS]
24. L. Powers, J. Libby-Roberts, A. Lin, et al., *TOI-3785 b: A Low-density Neptune Orbiting an M2-dwarf Star*, AJ, 166, 2, 2023 [ADS]
23. J. Dong, C. Huang, G. Zhou, et al., *NEID Rossiter-McLaughlin Measurement of TOI-1268b: A Young Warm Saturn Aligned with Its Cool Host Star*, ApJ, 926, 2, 2022 [ADS]
22. S. Logsdon, M. Wolf, D. Li, et al., *The NEID port adapter: on-sky performance*, SPIE, 12184, 2022 [ADS]
21. A. Gupta, C. Bender, J. Ninan, et al., *Real-time exposure control and instrument operation with the NEID spectrograph GUI*, SPIE, 12189, 2022 [ADS]
20. R. Terrien, A. Keen, K. Oda, et al., *Rotational Modulation of Spectroscopic Zeeman Signatures in Low-mass Stars*, ApJ, 927, 1, 2022 [ADS]
19. C. Cañas, S. Mahadevan, C. Bender, et al., *An Eccentric Brown Dwarf Eclipsing an M dwarf*, AJ, 163, 2, 2022 [ADS]
18. M. Reefe, R. Luque, E. Gaidos, et al., *A Close-in Puffy Neptune with Hidden Friends: The Enigma of TOI 620*, AJ, 163, 6, 2022 [ADS]
17. G. Stefànsson, S. Mahadevan, C. Petrovich, et al., *The Warm Neptune GJ 3470b Has a Polar Orbit*, ApJ, 931, 2, 2022 [ADS]
16. A. Gupta, J. Luhn, J. Wright, et al., *Detection of p-mode Oscillations in HD 35833 with NEID and TESS*, AJ, 164, 6, 2022 [ADS]
15. A. Ghosh, S. Sharma, J. Ninan, et al., *Gaia 20eae: A Newly Discovered Episodically Accreting Young Star*, ApJ, 926, 1, 2022 [ADS]
14. C. Cañas, S. Mahadevan, W. Cochran, et al., *A Hot Mars-sized Exoplanet Transiting an M Dwarf*, AJ, 163, 1, 2022 [ADS]
13. V. Krishnamurthy, T. Hirano, G. Stefánsson, et al., *Nondetection of Helium in the Upper Atmospheres of TRAPPIST-1b, e, and f*, AJ, 162, 3, 2021 [ADS]

12. S. Vissapragada, G. Stefánsson, M. Greklek-McKeon, et al., *A Search for Planetary Metastable Helium Absorption in the V1298 Tau System*, AJ, 162, 5, 2021 [ADS]
11. J. Lubin, P. Robertson, G. Stefansson, et al., *Stellar Activity Manifesting at a One-year Alias Explains Barnard b as a False Positive*, AJ, 162, 2, 2021 [ADS]
10. S. Mahadevan, G. Stefánsson, P. Robertson, et al., *The Habitable-zone Planet Finder Detects a Terrestrial-mass Planet Candidate Closely Orbiting Gliese 1151: The Likely Source of Coherent Low-frequency Radio Emission from an Inactive Star*, ApJ, 919, 1, 2021 [ADS]
9. A. Gupta, J. Wright, P. Robertson, et al., *Target Prioritization and Observing Strategies for the NEID Earth Twin Survey*, AJ, 161, 3, 2021 [ADS]
8. G. Stefansson, S. Mahadevan, M. Maney, et al., *The Habitable Zone Planet Finder Reveals a High Mass and Low Obliquity for the Young Neptune K2-25b*, AJ, 160, 4, 2020 [ADS]
7. J. Ninan, G. Stefansson, S. Mahadevan, et al., *Evidence for He I 10830 Å Absorption during the Transit of a Warm Neptune around the M-dwarf GJ 3470 with the Habitable-zone Planet Finder*, ApJ, 894, 2, 2020 [ADS]
6. P. Robertson, G. Stefansson, S. Mahadevan, et al., *Persistent Starspot Signals on M Dwarfs: Multiwavelength Doppler Observations with the Habitable-zone Planet Finder and Keck/HIRES*, ApJ, 897, 2, 2020 [ADS]
5. A. Roy, S. Halverson, S. Mahadevan, et al., *Solar Contamination in Extreme-precision Radial-velocity Measurements: Deleterious Effects and Prospects for Mitigation*, AJ, 159, 4, 2020 [ADS]
4. G. Stefansson, C. Cañas, J. Wisniewski, et al., *A Sub-Neptune-sized Planet Transiting the M2.5 Dwarf G 9-40: Validation with the Habitable-zone Planet Finder*, AJ, 159, 3, 2020 [ADS]
3. P. Robertson, T. Anderson, G. Stefansson, et al., *Ultrastable environment control for the NEID spectrometer: design and performance demonstration*, JATIS, 5, 2019 [ADS]
2. J. Ninan, C. Bender, S. Mahadevan, et al., *The Habitable-Zone Planet Finder: improved flux image generation algorithms for H2RG up-the-ramp data*, SPIE, 10709, 2018 [ADS]
1. G. Stefansson, S. Mahadevan, L. Hebb, et al., *Toward Space-like Photometric Precision from the Ground with Beam-shaping Diffusers*, ApJ, 848, 1, 2017 [ADS]