Nicholas S. Kern

Contact Information

MIT Kavli Institute for Astrophysics & Space Research
77 Massachusetts Ave., Building 37-241
Cambridge, MA, 02139

E-mail: nkern@mit.edu
Web: nkern.github.io

Employment

Pappalardo Fellow — September 2020 – present
Department of Physics & MIT Kavli Institute for Astrophysics and Space Research
Massachusetts Institute of Technology, Cambridge, MA, USA

Education

Ph.D., Astrophysics, University of California, Berkeley — August 2020
Advisor: Aaron R. Parsons

M.A., Astrophysics, University of California, Berkeley — May 2017

B.S., Physics, Astrophysics, University of Michigan, Ann Arbor — May 2015
Advisor: Christopher Miller

Research Focus

My research explores the frontiers of the distant universe through radio frequency observations of primordial hydrogen. I design novel data analysis techniques for processing large quantities of radio data and identifying weak signals from instrumental contaminants, and then connect them to cosmological models to understand how the first generation of stars and galaxies formed.

Honors & Awards

Pappalardo Fellow, MIT, Department of Physics	2020 – 2023
Mary Elizabeth Uhl Dissertation Prize, UC Berkeley, Department of Astronomy	2020
Teaching Effectiveness Award, UC Berkeley	2017
Outstanding Graduate Student Instructor Award, UC Berkeley	2017
Graduated with Highest Honors and Distinction, University of Michigan	2015
Excellence in Astrophysics Research Award, University of Michigan	2015
Foreign Language & Area Studies (FLAS) Fellow, University of Michigan	2014
International Institute Fellow, University of Michigan	2014
Upper-Level Writing Prize in the Natural Sciences, University of Michigan	2014

Publications Led or Co-Led

6. **Kern, N.**, Dillon, J. S., Parsons, A. R., Carilli, C., Bernardi, G. et al. 2020, *Absolute Calibration Strategies for the Hydrogen Epoch of Reionization Array and Their Impact on the 21 cm Power Spectrum*, ApJ 890 122

5. **Kern, N.**, Parsons, A. R., Dillon, J. S., Lanman, A. E., et al. 2020, *Mitigating Internal Instrument Coupling for 21cm Cosmology. II. A Method Demonstration with the Hydrogen Epoch of Reionization Array*, ApJ 888 70

4. **Kern, N.**, Parsons, A. R., Dillon, J. S., Lanman, A. E., Fagnoni, N. and de Lera Acedo, E. 2019, *Mitigating Internal Instrument Coupling for 21cm Cosmology. I. Temporal and Spectral Modeling in Simulations*, ApJ 884 105

3. **Kern, N.**, Liu, A., Parsons, A. R., Mesinger, A., & Greig, B. 2017, *Emulating Simulations of Cosmic Dawn for 21 cm Power Spectrum Constraints on Cosmology, Reionization and X-ray Heating*, ApJ 848 23

2. Gifford, D., **Kern, N.**, & Miller, C. 2016, *Stacking Caustic Masses from Galaxy Clusters*, ApJ 834 204

1. **Kern, N. S.**, Keown, J. A., Tobin, J. J., Mead, A., & Gutermuth, R. 2016, *Radio Properties of Young Stellar Objects in the Serpens South Infrared Dark Cloud*, AJ 151 42

Other Publications as a Contributing Author

13. Nunhokee, C. D., Parsons, A. R., **Kern, N.**, et al. 2020, *Measuring HERA's primary beam in-situ: methodology and first results*, arXiv:2005.12174

12. Thyagarajan, N., Carilli, C., Nikolic, B., ..., **Kern, N.**, et al. 2020, *Detection of Cosmic Structures using the Bispectrum Phase. II. First Results from Application to Cosmic Reionization Using the Hydrogen Epoch of Reionization Array*,

11. Ewall-Wice, A., **Kern, N.**, Dillon, J. S., et al. 2020, *DAYENU: A Simple Filter of Smooth Foregrounds for Intensity Mapping Power Spectra*, arXiv:2004.11397

10. Dillon, J. S., Lee, M., Ali, Z. S., ..., **Kern, N.**, et al. 2020, *Redundant-Baseline Calibration of the Hydrogen Epoch of Reionization Array*, arXiv:2003.08399

9. Ghosh, A., Mertens, F., Bernardi, G., ..., **Kern, N.**, et al. 2020, *Foreground modelling via Gaussian process regression: an application to HERA data*, arXiv:2004.06041

8. Carilli, C., Thyagarajan, N., Kent, J., ..., **Kern, N.**, et al. 2020, *Imaging and Modeling Data from the Hydrogen Epoch of Reionization Array*, ApJS 247 67

7. Lanman, A. E., Pober, J. C., **Kern, N.**, et al. 2019, *Quantifying EoR delay spectrum contamination from diffuse radio emission*, arixv:1910.10573

6. Monsalve, R. A., Greig, B., Bowman, J. D., ..., **Kern, N.**, et al. 2018, *Results from EDGES High-Band: II. Constraints on Parameters of Early Galaxies*, ApJ 863 11

5. Kohn, S. A., Aguirre, J. E., La Plante, P., ..., **Kern, N.**, et al. 2018, *The HERA-19 Commissioning Array: Direction Dependent Effects*, ApJ 882 58K

4. Dillon, J. S., Kohn, S. A., Parsons, A. R., ..., **Kern, N.**, et al. 2017, *Polarized redundant-baseline calibration for 21 cm cosmology without adding spectral structure*, MNRAS 477 5670

3. Miller, C. J., Stark, A., Gifford D., & **Kern, N.** 2016, *Inferring Gravitational Potentials from Mass Densities in Cluster-Sized Halos*, ApJ 822 41

2. Stark, A., Miller, C. J., **Kern, N.**, Gifford, D., et al. 2016, *Probing Theories of Gravity with Phase Space-Inferred Potentials of Galaxy Clusters*, Phys. Rev. D 93, 084036

1. Gifford, D., Miller, C. J., & **Kern, N.** 2013, *A Systematic Analysis of Caustic Methods for Galaxy Cluster Masses*, ApJ 773 116

Collaboration Publications

2. Fagnoni, N., de Lera Acedo, E., ..., **Kern, N.**, et al. 2019, *Electrical and electromagnetic co-simulations of the HERA Phase I receiver system including the effects of mutual coupling, and impact on the EoR window*, In Review, ApJ, arxiv:1908.02383

1. Kerrigan, J., La Plante, P., ..., **Kern, N.**, et al. 2019, *Optimizing sparse RFI prediction using deep learning*, MNRAS 488 2605

Teaching Experience

At the University of California, Berkeley, Department of Astronomy:

As a Head Instructor

- Astro 9: Python Programming in Astronomy — Summer 2017

As a Graduate Student Instructor

- Astro 7A: Introduction to Astrophysics — Fall 2016
- Astro 160: Stellar Structure & Evolution — Fall 2015

At the University of Michigan, Ann Arbor, Department of Physics:

As an Undergraduate Learning Assistant

- Physics 140: Introduction to Mechanics — Spring 2015

Talks and Presentations

Observing the First Billion Years, Invited Talk — January 2020
IIT Indore, Indore, India

Science at Low Frequencies VI, Contributed Talk — December 2019
Arizona State University, Tempe, AZ

Observational Cosmology Seminar, Contributed Talk — December 2019
California Institute of Technology, Pasadena, CA

Center for Astrophysics SMA Seminar, Contributed Talk — November 2019
Center for Astrophysics, Cambridge, MA

MIT Kavli Institute Brown Bag Lunch Talks, Contributed Talk — November 2019
Massachusetts Institute of Technology, Cambridge, MA

Intergalactic Medium 2018, Contributed Talk — September 2018
University of Tokyo, Tokyo, Japan

BCCP Cosmology Workshop, Invited Talk — January 2018
University of California, Berkeley, CA

JILA Astrophysics Seminar, Invited Talk — October 2017
University of Colorado, Boulder, CO

NASA Machine Learning Workshop, Invited Talk — August 2017
NASA Ames, Mountain View, CA

Science at Low Frequencies III, Contributed Talk — December 2016
California Institute of Technology, Pasadena, CA

225th American Astronomical Society Meeting, Contributed Poster — January 2015
Seattle, WA

223rd American Astronomical Society Meeting, Contributed Poster — January 2014
Washington, D.C.

Cyber Infrastructure Days, Contributed Poster — November 2013
University of Michigan, Ann Arbor, MI

Service

To the Astrophysics Community:

- Referee, Radio Science — 2020 – present
- Referee, Monthly Notices of the Royal Astronomical Society — 2019 – present
- Referee, Astrophysical Journal — 2018 – present

At the University of California, Berkeley

- Graduate Representative, UC Berkeley Faculty Search Committee — 2020
- Instructor & Mentor, HERA Undergraduate Summer Research Bootcamp — 2017 – 2019

- Organizer, Astronomy Career Development Seminar 2016 – 2017
- Organizer, Graduate Student Colloquium Speaker Seminar 2015 – 2016