Nicholas S. Kern

Contact Information

MIT Kavli Institute for Astrophysics & Space Research
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Employment

Pappalardo Postdoctoral 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 Collaboration Equivalent

7. HERA Collaboration 2021, including **Kern, N.** *First Results from HERA Phase I: Upper Limits on the Epoch of Reionization 21 cm Power Spectrum*, arxiv:2108.02263
6. **Kern, N.** & Liu, A. 2021, *Gaussian Process Foreground Subtraction and Power Spectrum Estimation for 21 cm Cosmology*, MNRAS 501 1463K
5. **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
4. **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
3. **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

2. **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

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

17. Aguirre, J., Murray, S., ..., **Kern, N.**, et al. 2021, *Validation of the HERA Phase I Epoch of Reionization 21 cm Power Spectrum Software Pipeline*, arxiv:2104.09547

16. LaPlante, P., Williams, P. K. G., ..., **Kern, N.**, et al. 2021, *A Real Time Processing System for Big Data in Astronomy: Applications to HERA*, arxiv:2104.03990

15. Tan, J., Liu, A., **Kern, N.**, et al. 2021, *Methods of Error Estimation for Delay Power Spectra in 21cm Cosmology*, arxiv:2103.09941

14. Ewall-Wice, A., **Kern, N.**, Dillon, J. S., et al. 2021, *DAYENU: A Simple Filter of Smooth Foregrounds for Intensity Mapping Power Spectra*, MNRAS 500 5195E

13. Nunhokee, C. D., Parsons, A. R., **Kern, N.**, et al. 2020, *Measuring HERA's primary beam in-situ: methodology and first results*, ApJ 897 5N

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*, Phys. Rev. D 102, 022002

11. Dillon, J. S., Lee, M., Ali, Z. S., ..., **Kern, N.**, et al. 2020, *Redundant-Baseline Calibration of the Hydrogen Epoch of Reionization Array*, MNRAS 499 5840D

10. Ghosh, A., Mertens, F., Bernardi, G., ..., **Kern, N.**, et al. 2020, *Foreground modelling via Gaussian process regression: an application to HERA data*, MNRAS 495 2813G

9. 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

8. Lanman, A. E., Pober, J. C., **Kern, N.**, et al. 2020, *Quantifying EoR delay spectrum contamination from diffuse radio emission*, MNRAS 494 3712L

7. 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

6. 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

5. 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

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

3. 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

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

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

Collaboration Publications

3. Gehlot, B., Jacobs, D., ..., **Kern, N.**, et al. 2021, *Effects of model incompleteness on the drift-scan calibration of radio telescopes*, arxiv:2104.12240

2. Fagnoni, N., de Lera Acedo, E., ..., **Kern, N.**, et al. 2021, *Understanding the HERA Phase I receiver system with simulations and its impact on the detectability of the EoR delay power spectrum*, MNRAS 500 1232F

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

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 Massachusetts Institute of Technology

- Co-Coordinator, HERA Undergraduate Summer Research Bootcamp — 2021
- Instructor & Mentor, HERA Undergraduate Summer Research Bootcamp — 2020 – 2021

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

Talks and Presentations

MIT Pappalardo Research Symposium, Invited Talk — May 2021
Virtual

A Precursor View of the SKA Sky, Invited Talk — March 2021
Virtual

Science at Low Frequencies VII, Contributed Talk — December 2020
Virtual

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

235th American Astronomical Society Meeting, Contributed Talk — January 2020
Honolulu, HI

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 Center for Astrophysics, Cambridge, MA	November 2019
MIT Kavli Institute Brown Bag Lunch Talks, Contributed Talk Massachusetts Institute of Technology, Cambridge, MA	November 2019
Intergalactic Medium 2018, Contributed Talk University of Tokyo, Tokyo, Japan	September 2018
BCCP Cosmology Workshop, Invited Talk University of California, Berkeley, CA	January 2018
JILA Astrophysics Seminar, Invited Talk University of Colorado, Boulder, CO	October 2017
NASA Machine Learning Workshop, Invited Talk NASA Ames, Mountain View, CA	August 2017
Science at Low Frequencies III, Contributed Talk California Institute of Technology, Pasadena, CA	December 2016
225th American Astronomical Society Meeting, Contributed Poster Seattle, WA	January 2015
223rd American Astronomical Society Meeting, Contributed Poster Washington, D.C.	January 2014
Cyber Infrastructure Days, Contributed Poster University of Michigan, Ann Arbor, MI	November 2013