Raagini Patki — CV

PhD CANDIDATE IN ASTRONOMY
rp585@cornell.edu

Education

Cornell University *Sept 2020- Aug 2026 (Exp.)*
Ph.D. in Astronomy *Ithaca, USA*

Cornell University *Sept 2020-Mar 2023*
Master of Science in Astronomy: **CGPA - 4.0/4.0** *Ithaca, USA*

Indian Institute of Science Education and Research (IISER), Pune *Aug 2015-Jun 2020*
BS-MS with Major in Physics: **CGPA - 9.8/10.0** *Pune, India*
Bachelor of Science and Master of Science

Scuola Internazionale Superiore di Studi Avanzati (SISSA) *Aug 2019-Dec 2019*
Master's thesis internship student *Trieste, Italy*

Publications and Preprints

First Author:

- **Patki, R.**, Battaglia, N. and Hill, J.C. (2024), "A Novel Bispectrum Estimator of the Kinematic Sunyaev-Zel'dovich Effect using Projected Fields", arXiv.org. Available at: https://arxiv.org/abs/2411.11974. (to appear in Physical Review D).

- **Patki, R.**, Battaglia, N. and Ferraro, S. (2023) "Improved modeling of the Kinematic Sunyaev-Zel'dovich projected-fields signal and its cosmological dependence", Physical Review D, 108(4). doi:10.1103/physrevd.108.043507. arXiv:2306.03127.

Other:

- The Simons Observatory Collaboration (2025), "The Simons Observatory: Science Goals and Forecasts for the Enhanced Large Aperture Telescope", arXiv.org. Available at: https://arxiv.org/abs/2503.00636.

- **Patki, R.A.** (2020) "Investigation of polarized Synchrotron frequency dependence for CMB observations", MS thesis; submitted in partial fulfillment of BS-MS Dual Degree. Supervised by Baccigalupi, C., Krachmalnicoff, N. and Souradeep, T. Available at: http://dr.iiserpune.ac.in:8080/xmlui/handle/123456789/4752

Research Experience

- **Probing beyond-ΛCDM cosmology with high-order kSZ statistics** [*ongoing*]
  Ph.D. Research advised by Prof. Nicholas Battaglia *Cornell University*
  * Developing high-order (3-point) statistical estimators for extracting the kinematic SZ effect from current and upcoming CMB experiments and LSS surveys.
  * Making forecasts for these kSZ estimators as probes of modified gravity and neutrinos.
- **Diffuse Synchrotron Contamination to B-mode of the CMB** [*Aug 2019-Mar 2020*]
  with Prof. Carlo Baccigalupi (SISSA), Prof. Tarun Souradeep (IUCAA, Pune)
  * Characterizing frequency dependence of Diffuse Galactic synchrotron radiation, as a contaminant to the CMB Polarization
  * Developing a computational pipeline using Bayesian techniques, with application to simulations and real data maps.
- **Weak lensing and Statistical Isotropy violation of the CMB** [*Oct 2018-Jan 2019*]
  with Prof. Tarun Souradeep (IUCAA, Pune)
  * Studying possibly observable SI violation signatures in the CMB due to weak lensing.
  * Testing these predictions and their observability using computational tools.

Scholarships and Honors

- **Best Poster Award** at the 'B-mode from Space' conference, *Dec 2019*
  Max Planck Institute for Astrophysics (MPA), Garching, Germany
  Poster: "Reconstructing the Synchrotron Spectral Index in CMB Foregrounds"
- **Undergraduate Research Fellowship** *Aug-Dec 2019*
  Awarded by SISSA, Trieste, Italy for conducting MS thesis research
- **DAAD-WISE fellowship** *May-Jul 2018*
  Fellowship for conducting a summer research project in Germany
- **C.N.R. Rao Education Foundation Prize** *2015, 2016, 2017*
  For the best annual academic performance at IISER Pune
- **Bronze Medal in the 26th Asian Pacific Mathematical Olympiad** *2015*
  Member of the national team, representing India
- **Kishore Vaigyanik Protsahan Yojana (KVPY) Scholarship** *2013*
  Awarded by the Government of India for excellence in Pure Sciences

Skills

- **Programming Languages and Tools:** Python (proficient; including NumPy, Scikit-learn, PyTorch), C++ (basic), Fortran 90 (basic). Linux, Git, Vim (proficient).
- **Techniques:** Bayesian and statistical analysis (e.g., MCMC, Fisher), Perturbation theory, Machine Learning fundamentals: supervised and unsupervised learning. Cosmological packages used (CAMB, pixel, hmvec, PySM), etc.

Teaching Experience

Teaching Assistant for Undergraduate Courses: *Cornell University*

- The History of the Universe (Astro 2201) *Spring 2022, 2024, and 2025*
- From New Worlds to Black Holes (Astro 1101); Head TA. *Fall 2024, 2025*
- From New Worlds to Black Holes (Astro 1101); led discussion sections. *Fall 2021*
- Our Solar System (Astro 1102); led discussion sections. *Spring 2021*

Selected Talks

- *A Novel Bispectrum extracting the Kinematic SZ effect as a Cosmological Probe*, Special Seminar, The Center for Cosmology and Particle Physics, NYU April 2025.
- *A Novel Bispectrum extracting the Kinematic SZ effect as a Cosmological Probe*, Journal Club Talk, Carnegie Mellon University April 2025.
- *A Novel Bispectrum extracting the Kinematic SZ effect as a Cosmological Probe*, Journal Club Talk, University of Pennsylvania April 2025.
- *A Novel Bispectrum extracting the Kinematic SZ effect as a Cosmological Probe*, Workshop Presentation: 'New Physics from Old Light', Cambridge Univ. Sept 2024.
- *Overview of kSZ detection methods using projected-fields* for the SZ-AWG, Simons Observatory Collaboration Meeting, UChicago July 2024.
- *Improved modeling of the kSZ projected-fields signal and its cosmological dependence*, Conference Presentation: 'mm Universe 2023', Grenoble June 2023.
- *Improved modeling of the kSZ projected-fields signal and its cosmological dependence*, Special Seminar, Harvard University May 2023.
- *Improved modeling of the kSZ projected-fields signal and its cosmological dependence*, SZ Workshop Talk, Flatiron Institute May 2022.
- *Reconstructing the Synchrotron Spectral index in CMB Foregrounds*, Conference Poster Presentation, B-modes from Space, MPA Garching Dec 2019.

Service and Outreach

- **Peer Mentor** for a first-year graduate student in the Department of Astronomy, within the AGN mentoring program (*Aug 2024 - July 2025*)
- **Treasurer and Board member of Astronomy Graduate Network** (AGN) at Cornell (*May 2022-May 2023*): Managed annual budget for the graduate club, organized grad student seminars, journal clubs, and social events within the Department of Astronomy.
- **Outreach**: Answering cosmology questions from the general public through the (A) Ask an Astronomer webpage of AGN, and (B) Friends of Astronomy events in Ithaca.
- **Outreach**: (*Dec 2022, Dec 2023*) Presented talks in and helped organizing 'Cosmology Day' at Cornell, an annual outreach event for local high-school students.