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RICHARD M. FEDER

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RESEARCH INTERESTS

I work on a number of topics in **observational cosmology**, with a broad interest in developing and applying **computational techniques rooted in astrostatistics** that enhance studies of large-scale structure formation for **galaxy surveys** and **intensity mapping**. I am a member of the *SPHEREx*, *DESI* and *CIBER* collaborations.

EDUCATION AND RESEARCH POSITIONS

Berkeley Center for Cosmological Physics Postdoctoral Fellow <i>Supervisor: Uros Seljak</i>	September 2024 - Present
California Institute of Technology MA/PhD in Physics Division of Physics, Mathematics and Astronomy <i>Advisor: Jamie Bock</i> <i>Dissertation title: Dissecting the Cosmic Infrared Background using Spaceborne Experiments</i>	September 2018 - August 2024
Harvard University Bachelor of Arts, Physics and Astrophysics, with Honors <i>Advisor: Douglas Finkbeiner</i>	August 2014 - May 2018

OTHER RESEARCH POSITIONS/AFFILIATIONS

Harvard-Smithsonian Center for Astrophysics <i>Research Assistant with work contributing to Senior Thesis in Astrophysics, supervised by Prof. Douglas Finkbeiner, Tansu Daylan and Stephen Portillo. Concurrent project supervised by Prof. Daniel Eisenstein (supported by the Harvard College Research Program and Harvard Physics Department)</i>	June 2017 - October 2017
Columbia University <i>Research Assistant, supervised by Dr. Glenn Jones and Prof. Amber Miller</i>	June 2015 - August 2015
Harvard-Smithsonian Center for Astrophysics <i>Research Assistant, supervised by Dr. Francesca Civano</i>	July 2013 - September 2013

AWARDS AND ACADEMIC ACHIEVEMENTS

- *Sylvia A. Earle Award for Exploration Excellence by the Explorers Club* (2026). Awarded to the SPHEREx mission team.
- *ASA Astrostatistics Student Paper Finalist*, 2020 Joint Statistical Meetings

PROFESSIONAL ACTIVITIES AND SERVICE

Grants Review

- Panel Chair, NASA Astrophysics Grants Review Panel (2026)

Seminar and Event Organization

- Organizer of Bakar Institute of Digital Materials for the Planet ([BIDMaP](#)) AI × Science seminar (speaker schedule [here](#)), UC Berkeley July 2025 - Present.
- Co-organizer of Cahill Cosmology Journal Club, Caltech (2023-2024)

Manuscript Referee

- *Journals*: The Astrophysical Journal; Astronomy and Astrophysics; Astronomy and Computing; Journal of Astronomical Telescopes, Instruments and Systems
- *Conferences/Proceedings*: Conference on Neural Information Processing Systems – Machine Learning and the Physical Sciences workshop; International Society for Optics and Photonics (SPIE)

Mentoring experience

- Two graduate students (Caltech)
- Three undergraduate/Masters students (RIT, UC Berkeley)
- Three high school students (Summer 2023 and Summer 2025)

Teaching

- Volunteer teaching assistant and visiting lecturer in physics at Gabrelino High School (September 2022 - June 2024)
- Volunteer teacher for STARS science enrichment program (February 2021 - February 2022)

Other Outreach/Service

- Volunteer judge for Caltech Science Olympiad (October 2018 - October 2021)
- Member of Scholarship and Financial Aid Committee (Caltech, October 2018 - 2019)
- Caltech Physics graduate student representative (October 2019 - September 2020)

PUBLICATIONS AND PROCEEDINGS

I am an author on **30** papers, of which I am a lead author on **9**. My current h-index is **10** and my ORCID ID is [0000-0002-9330-8738](#). My full list of publications can be found on [NASA ADS](#).

Lead Author

Feder R., Parker, L., Seljak, U. *A Probabilistic Autoencoder for Galaxy SED Reconstruction and Redshift Estimation: Application to Mock SPHEREx Spectrophotometry* (2026). Submitted to *JCAP*, arXiv:[2603.24668](#)

Feder R. and White, M. *Angular BAO Forecasts for the IBIS Medium-Band Survey* (2025). Submitted to *MNRAS*, arXiv:[2512.06568](#)

Feder R.; ... ; et al. *CIBER-1 4th flight fluctuation analysis: Measurements of near-IR auto- and cross-power spectra on arcminute to sub-degree scales* (2025). *The Astrophysical Journal* (accepted), arXiv:[2501.17933](#)

Feder R.; ... ; et al. *CIBER-1 4th flight fluctuation analysis: Pseudo-power spectrum formalism, improved source masking and validation on mocks* (2025). *The Astrophysical Journal* (accepted), arXiv:[2501.17932](#)

Feder R.; ... ; et al. *The Universe SPHEREx Will See: Empirically Based Galaxy Simulations and Redshift Predictions* (2024). *The Astrophysical Journal*, 972:68
arXiv:[2312.04636](#)

Feder R.; ... ; et al. *PCAT-DE: Reconstructing Pointlike and Diffuse Signals in Astronomical Images Using Spatial and Spectral Information* (2023). *The Astronomical Journal*, 166:98
arXiv:[2307.10385](#)

Feder R.; **Butler V.**; et al. *Measurement of the Relativistic Sunyaev-Zel'dovich Correction in RX J1347.5-1145* (2021). *The Astrophysical Journal*, 932:55.
arXiv:[2110.13932](#)

Feder R., Berger, P., Stein, G. *Nonlinear 3D Cosmic Web Simulation with Heavy-Tailed Generative Adversarial Networks* (2020). *Physical Review D*: 102, Art. No. 103504.
arXiv:[2005.03050](#)

Feder R., Portillo, S., Daylan, T., Finkbeiner, D. P. *Multiband Probabilistic Cataloging: A Joint Fitting Approach to Point Source Detection and Deblending* (2020). *The Astronomical Journal*, 159:4. arXiv:[1907.04929](#), press release [here](#).

Contributing Author (significant contributions)

Saydjari, A.; ...; **Feder, R.**; et al. *PRIM (All): A PRIMA All-Sky, Polarized, Dust Map and Point Source Catalog* (2025). PRIMA General Observer Science Book Volume 2.

Huai, Z.; ...; **Feder, R.**; et al. *Simulating spectral confusion in SPHEREx photometry and redshifts* (2025). *The Astrophysical Journal* (in review), arXiv:[2501.07420](#)

Hall, K.; Hassan, J.; **Feder, R.**; Marriage, T.; et al. *A flux-limited sample of dusty star-forming galaxies from the Atacama Cosmology Telescope: physical properties and the case for multiplicity* (2025). *The Astrophysical Journal* (in review), arXiv:[2501.07420](#)

Takimoto, K.; Matsuura, S.; Sano, K.; **Feder, R.** *Near-infrared Polarization Characteristics of the Zodiacal Light Observed with DIRBE/COBE* (2023). *The Astrophysical Journal*, 944:229.
arXiv:[2303.01458](#)

Takimoto, K.; Bang, S.-C.; ...; **Feder, R.**; et al. *Polarization Spectrum of Near-Infrared Zodiacal Light Observed with CIBER* (2022). *The Astrophysical Journal*, 926:6. arXiv:[2112.05350](#)

Cheng, Y-T.; ...; **Feder, R.**; et al. *Probing Intra-Halo Light with Galaxy Stacking in CIBER Images* (2021). *The Astrophysical Journal*, 919:69. arXiv:[2103.03882](#)

Korngut, P.; ...; **Feder, R.**; et al. *Inferred Measurements of the Zodiacal Light Absolute Intensity through Fraunhofer Absorption Line Spectroscopy with CIBER* (2022). *The Astrophysical Journal*, 926:2. arXiv:[2104.07104](#)

Takimoto, K.; Bang, S.-C.; ...; **Feder, R.**; et al. *Pre-flight optical test and calibration for the Cosmic Infrared Background Experiment 2 (CIBER-2)* (2020). Proceedings Volume 11443,

Space Telescopes and Instrumentation (2020). [SPIE link](#)

Civano, F., Fabbiano, G., Pellegrini, S., Kim, D., **Feder, R.**, Elvis, M. *Early-Type Galaxies in the Chandra COSMOS Survey* (2014). *The Astrophysical Journal*, 790:16. arXiv:1405.7039

Software and Data release

Feder, R. PAESpec: Probabilistic Autoencoder for Spectra. [Link to Github repository](#).

Feder, R. SPIRE HeRS/HeLMS Combined SHIM Maps (2024). Access to maps [here](#). arXiv:2410.00252

Feder, R.; Portillo, S.; Daylan, T. D. Probabilistic CATaloger in the presence of Diffuse Emission (PCAT-DE). [Link to Github repository](#), [Read the Docs page](#). DOI:10.5281/zenodo.8067131

AWARDED GRANTS/COMPUTING ALLOCATIONS

AI-Enabled Bayesian Photometric Redshifts at Scale for the SPHEREx All-Sky Galaxy Survey. NERSC AI4Science computing proposal (Principal Investigator). Total Award Amount: 8000 GPU compute-node-hours; 8000 CPU compute-node-hours, received June 2026.

Characterizing the Distributions and Interactions of Gas and Dust in the Intra-cluster Medium Using Novel Analysis Techniques Applied to Multi-probe Observations. NASA ADAP, received October 2023. Total Award Amount: \$599,913. PI: Dr. Michael Zemcov (Co-Investigator, contributed to proposal development/writing)

SELECTED TALKS

PSA AI/ML Seminar, Lawrence Berkeley National Laboratory, April 2026. *A Probabilistic Autoencoder for Galaxy SED Reconstruction and Redshift Estimation: Application to SPHEREx spectrophotometry*. (**invited talk**)

Astrophysics, Relativity and Cosmology Seminar, University of Illinois Urbana-Champaign, November 2025. *From Pixels to Primordial Non-Gaussianity and Beyond: Cosmology and Intensity Mapping with the SPHEREx All-Sky Survey* (**invited talk**)

DESI Collaboration Meeting, July 2025. *Synergies between DESI and SPHEREx* (**invited plenary talk**)

Infrared Science and Technology Integration Group (IR STIG), May 2025. *Uncovering Surface Brightness Anisotropies with CIBER: Measurements of NIR auto- and cross-power spectra on arcminute to sub-degree scales* (**invited talk**).

KIPAC Seminar, Lawrence Berkeley National Laboratory, January 2025. *Science with the SPHEREx All-Sky Galaxy Survey* (**invited talk**).

INPA Seminar, Lawrence Berkeley National Laboratory, December 2023. *Uncovering the Near-Infrared Universe through Galaxy Surveys and Intensity Mapping* (**invited talk**).

Astrophysics Seminar, Laboratoire d'Astrophysique de Marseille, May 2023. *PCAT-DE: Reconstructing point-like and diffuse signals in astronomical images using spatial and spectral information* (**invited talk**).

Present and Future of Line Intensity Mapping, MPIA, April 2023. *The Universe SPHEREx Will See: Empirically-Based Galaxy Simulations and Redshift Predictions* (**selected talk**).

- Astrophysics Student Seminar Series, University of Montreal, June 2022. *Predicting the Universe SPHEREx Will See through Empirically-Based Galaxy Simulations* (**invited talk**).
- Astrophysics Seminar, University of Southern California, March 2022. *Measuring the Intracluster Medium Temperature of RX J1347.5-1145 through Relativistic Corrections to the Sunyaev-Zeldovich effect* (**invited talk**).
- Greater IPAC Technology Seminar, October 2021. *Dissecting the Near Infrared Universe with the Cosmic Infrared Background Experiment* (**invited talk**).
- Observing the millimeter universe with the NIKA-2 camera, July 2021. *Bridging the gap between large and small scales in astronomical images with simultaneous modeling of pointlike and diffuse emission* (**selected talk**).
- Zemcov Group Meeting, Rochester Institute of Technology, February 2021. *Photometric methods in astronomy and probabilistic cataloging* (**invited talk**).
- Joint Statistical Meetings (Astrostatistics Interest Group), August 2020. *Multiband probabilistic cataloging: a joint fitting approach to improved source detection and deblending* (**invited talk**).
- Great Lakes Cosmology Workshop, August 2019. *Multiband probabilistic cataloging: a joint fitting approach to improved source detection and deblending* (**selected talk**).