Jamie McCullough

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Education & Work

- **Princeton University: Postdoctoral researcher in observational cosmology** — Princeton, NJ
  Department of Astrophysical Sciences — *Sept 2024 - present*
- **Stanford University / Ludwig-Maximilians-Universität München** — Palo Alto, CA / Munich, Germany
  Ph.D. & M.S. in Physics — *Aug 2018 - Aug 2024*
- **University of Texas at Austin** — Austin, TX
  Bachelor of Aerospace Engineering / Astronomy Minor with highest honors — *Aug 2014 - May 2018*
- **Research assistant in weak lensing and cosmology**: Stanford University / SLAC / LMU, 2018-2024
- **Field engineering intern in RF, communications, systems engineering**: USG, Chantilly, VA, summers 2016, 2017, 2018
- **Research assistant in orbital mechanics, image simulation, and astronomy**: University of Texas, 2016-2018

Research Highlights

The Dark Energy Survey (DES) Year 3 Analysis

- Led an end-to-end cosmology analysis demonstrating proof of concept for *blue galaxy* cosmic shear, which eliminates the impact of intrinsic alignment, increases cosmological precision, and reduces tension with early universe probes (see McCullough, Amon, Legnani+ 2024).
- Developed redshift calibration for survey image simulations and characterized uncertainty across tomographic bin variations, measuring shear bias with redshift dependence (see MacCrann, Becker, McCullough+ 2022), contributing to state-of-the-art weak lensing cosmology results (see DES Collaboration+ 2022).

The Dark Energy Spectroscopic Instrument (DESI)

- Advising the direct measurement of intrinsic alignment in the DESI spectroscopic galaxies with available shape measurements (KiDS+HSC+DES+SDSS) (Siegel, McCullough, Amon+ 2025).
- Led the target selection and analysis of spare-fiber observed spectroscopic redshifts, for the purpose of optimizing weak lensing photometric redshifts (distance estimation) and cosmology (see McCullough+ 2023).
- Co-leading the photo-z topical group (∼40 people) to enable the creation of unbiased, high-confidence catalogs, calibrated redshift distributions for cosmology, and drive proposal efforts for dedicated observing time.

The 4-metre Multi-Object Spectroscopic Telescope (4MOST)

- Co-Principal Investigator for a community survey that will map the color-redshift relation for future photometric surveys down to $z < 1.55$ with even spectroscopic coverage and an unprecedented knowledge of the full selection function of our observations (see 4C3R2, Gruen & McCullough+ 2023, McCullough & Gammel+, in prep).
- Project office member survey planning and selecting targets for an ambitious galaxy evolution survey that will fully describe galaxy populations in the nearby universe ($z < 0.2$) (see WAVES).

The Legacy Survey of Space and Time (LSST)

- Leading a declared project to develop tailored intrinsic alignment priors for cosmic shear that are driven by color-magnitude-redshift dependent priors from direct observations (McCullough, Siegel+, in prep).
- Leading efforts to directly measure intrinsic alignments with early Rubin shape catalogs (McCullough+, in prep), and to produce estimates of early redshift distributions for Y1 cosmology (Myles & McCullough+, in prep).

Talks

Given dozens of talks on topics spanning cosmology, weak lensing, machine learning, spectroscopic surveys, and photometric redshifts.

Selected conference talks

- *Demographic intrinsic alignment modeling for next-generation cosmic shear* — Roman Symposium, STScI, 07/25
- *(Invited) Plenary: Photometric Redshifts with DESI* — DESI conf., Berkeley, 07/25
- *Cosmic shear with data-driven intrinsic alignment: Uniting spectroscopic & imaging surveys* — MIAPbP, Munich, 07/25

- *(Invited) Weak lensing parallel: Cosmic shear and intrinsic alignment in color* DES conf., Urbana-Champaign, 10/23
- *(Invited)DESI-II: Training on visual inspection of spectroscopic data* DESI conf., Durham, 07/23
- *Color-redshift relationship calibration needs for Euclid and LSST* WST conf., Vienna, 05/23
- *(Invited) 4MOST complete calibration of the color-redshift relation* DESC conf., Spec-z parallel, 03/23
- *(Invited) Spectroscopic follow up for redshift calibration* Key challenges in galaxy lensing, Cambridge, 07/22
- *(Invited) The role of DESI in photo-z inference for stage IV cosmology* APS conf., New York, 04/22

Selected seminars/colloquia

- *Next-generation weak lensing with spectroscopy and imaging surveys* UC Berkeley, 03/25
- *Mapping cosmic structure in the next decade* Michigan State / UMichigan, 03/25
- *Cosmic shear with blue DES galaxies in an uncertain intrinsic alignment landscape* Weak lensing WG, DESC, 10/24
- *4MOST and weak lensing with stage IV cosmology* Photo-z WG, DESC, 07/23
- *Spectroscopic searches and weak lensing cosmology* Astrophysics, cosmology, and artificial intelligence, USM, 06/23
- *DESI complete calibration of the color-redshift relation* DESI clustering, clusters, and cross-correlations, 05/23
- *4MOST complete calibration of the color-redshift relation* Euclid collab., 02/22
- *The redshift distribution: In the context of DES, DESI, and future surveys* Grav. lensing group, USM, 11/21
- *Needs of future weak lensing surveys: Blending, redshifts and their intersection* Dark Sector, JPL, 08/21
- *Dark energy survey year 3: Large scale structure & weak lensing results* KIPAC, SLAC, 06/21

Leadership, Awards, and Telescope Time

- **Co-PI and Co-I**: successful proposals for 980k+ fiber hours for ground based spectroscopic instruments
- **Co-lead**: for the photometric redshift topical group in DESI, 2023-present
- **Simons Emmy Noether Visiting Postdoctoral Fellow**: Perimeter Institute, 2025-2026
- **Deutscher Akademischer Austauschdienst (DAAD)**: Fellowship awardee, LMU/USM Munich, 2021-2022
- **Stanford EDGE**: Fellowship awardee, Stanford University, 2018-2024
- **T.W. Whaley Scholar**: Full-ride awardee, University of Texas, 2014-2018
- **Distinguished College Scholar**: University of Texas, Cockrell School of Engineering, 2014-2018
- **National Merit Scholar**: 2014

Teaching and Mentoring Experience

- Co-advising Jared Siegel, intrinsic alignments and weak lensing, Ph.D. *Princeton, 2024-present*
- Mentoring Moritz Gammel, spectroscopic and photometric calibration, B.S. and M.S. *LMU/USM, 2021-present*
- Mentored Tom Liu, survey planning for massively multiplexed spectroscopy, rotation project *Stanford, 2020*
- Guest Lecturer, Seminar in Astrophysics (graduate) *Princeton, 2024*
- Teaching Assistant, Observational and instrumental astrophysical lab (graduate) *LMU/USM, 2023*
- Teaching Assistant, Essentials of advanced astrophysics (graduate) *LMU/USM, 2021*
- Teaching Assistant, Physics 16: Origin and development of the cosmos (undergraduate) *Stanford, 2020*
- Teaching Assistant, Physics 100: Introduction to observational astronomy (undergraduate) *Stanford, 2019*

Outreach & Service

- **Reviewer**: Astronomy & Astrophysics; *internal review*: DESI & DES Collaborations
- **Member**: Early Career Science Committee in DESI, 2024-present
- **Member**: Professional Development Committee in DESI, 2024-present
- **Lead Observer**: Public observing at Peyton Hall, Princeton, 2024-present
- **SAGE-S**: Camp volunteer, observatory guide, star party emcee and speaker to highschool girls interested in STEM careers, summers 2020-2022
- **Stanford Physics Identity and Equity (PIE)**: Mentor and resource to assist undergraduates across the country with their graduate school applications, 2021-2023
- **GSAPP**: Mentor for incoming graduate students in applied physics and physics
- **EDGE**: Mentor for incoming doctoral students from diverse backgrounds
- **Women in Aerospace for Leadership and Development (WIALD)**: Mentor and project team lead, 2014-2018
- **Tour Guide**: NASA Johnson Space Center (JSC), 2015

Publications (see ADS)

Since the start of my Ph.D. in Sept. 2018, I have authored/co-authored a total of 60+ papers in international peer-reviewed journals with a total of 4,395 citations (h-index of 33).

Selected papers led or with substantial contribution:

[1] J. Siegel, J. McCullough, A. Amon, *et al.*, "Intrinsic alignment demographics for next-generation lensing: Revealing galaxy property trends with DESI Y1 direct measurements," *arXiv e-prints*, arXiv:2507.11530, arXiv:2507.11530, Jul. 2025. DOI: 10.48550/arXiv.2507.11530. arXiv: 2507.11530 [astro-ph.CO].

[2] J. McCullough, A. Amon, E. Legnani, *et al.*, "Dark Energy Survey Year 3: Blue Shear," *arXiv e-prints*, arXiv:2410.22272, arXiv:2410.22272, Oct. 2024. DOI: 10.48550/arXiv.2410.22272. arXiv: 2410.22272 [astro-ph.CO].

[3] J. McCullough, D. Gruen, A. Amon, *et al.*, "DESI complete calibration of the colour-redshift relation (DC3R2): results from early DESI data,", vol. 531, no. 2, pp. 2582–2602, Jun. 2024. DOI: 10.1093/mnras/stae1316. arXiv: 2309.13109 [astro-ph.CO].

[4] D. Gruen, J. McCullough, A. Amon, *et al.*, "4MOST Complete Calibration of the Colour-Redshift Relation (4C3R2)," *The Messenger*, vol. 190, pp. 28–30, Mar. 2023. DOI: 10.18727/0722-6691/5307.

[5] N. MacCrann, M. R. Becker, J. McCullough, *et al.*, "Dark Energy Survey Y3 results: blending shear and redshift biases in image simulations,", vol. 509, no. 3, pp. 3371–3394, Jan. 2022. DOI: 10.1093/mnras/stab2870. arXiv: 2012.08567 [astro-ph.CO].