

Cail M. Daley

Département d'Astrophysique
CEA Paris-Saclay
Orme des Merisiers, Building 709
F-91191 Gif-sur-Yvette, France

Email: cail.daley@cea.fr
Phone: +33 07 75 72 18 07
GitHub: <https://github.com/cailmdaley>

RESEARCH INTERESTS

- Gravitational lensing
- Large-scale structure
- Cosmic shear
- Cross-correlations
- CMB data analysis
- Radio astronomy & interferometry
- Millimeter-wavelength transients
- Circumstellar disks

CURRENT POSITION

2024–Present **Postdoctoral Researcher** | [TOSCA Project](#)
CEA Paris-Saclay, CosmoStat Laboratory

EDUCATION

2018–2024 **Ph.D.** | Astronomy
University of Illinois Urbana-Champaign (UIUC)
Thesis: *CMB Lensing Measurements with Two Years of Data from the SPT-3G Survey*

2014–2018 **B.A.** | Astronomy & Physics (Dual Major)
Wesleyan University, Middletown, CT
Honors Thesis: *Using Vertical Structure to Infer the Dynamical Mass Hidden in the AU Mic Debris Disk*

RESEARCH EXPERIENCE

2024–Present **CEA Paris-Saclay** | advised by Martin Kilbinger
· Working on the TOSCA project exploring weak lensing synergies between optical and radio datasets, particularly Euclid, UNIONS, and SKAO.

2019–2024 **University of Illinois Urbana-Champaign** | advised by Gil Holder
· Member of the South Pole Telescope project, studied gravitational lensing of the CMB and mm-wavelength transients. Lead one of three pipelines in the SPT-3G 2019+2020 CMB lensing analysis, producing the deepest CMB lensing maps to date.

2014–2018 **Wesleyan University** | advised by A. Meredith Hughes
· Studied debris disks at sub-mm wavelengths, led reduction and analysis of observations of the debris disk around AU Mic to measure its vertical structure at mm wavelengths for the first time.

2016–2017 **Leiden University** | advised by Catherine Walsh
· Modeled the kinematic structure of the circumstellar disk HD 100546. Selected for Leiden's LEAPS program from a pool of 450 applicants.

OUTREACH

- 2020-2023 **SPT First Discoveries:** Participated in SPT’s premier outreach program that brings together pre-K and elementary students with scientists in classrooms to encourage participation in science from a young age. Planned and remotely led ~5 lessons at the predominantly-Black Fiske Elementary in Chicago.
- 2020-2022 **UIUC Astronomy on Tap:** Organized monthly all-ages outreach events featuring conversations between astronomers and the public in informal settings. Involved in all aspects of program—giving talks, finding speakers, venue booking, etc. Livestreamed on [YouTube](#) during the pandemic, and held in-person at several establishments in the Urbana-Champaign area.
- 2019 **UIUC Education Justice Project:** Worked with the university’s college-in-prison program and led a workshop on programming and astronomy data analysis at the Danville Correctional Center.

MENTORSHIP

- 2022-2023 **Research Mentor:** Zimo Qu (undergraduate, transferred to UC Berkeley). Supported student in a search for stellar flares observed simultaneously by the SPT and TESS telescopes. Zimo presented a poster at the 2023 Illinois Astrofest.
- 2022-2023 **Undergraduate Tutor:** Participated in the department tutoring program and worked with three students on math, physics, and programming coursework.
- 2020-2021 **Undergraduate Mentor:** Participated in the Society for Equity in Astronomy mentorship program, with monthly meetings to discuss research, graduate school, and other topics. Mentored three students.

TEACHING & SERVICE

- 2021-2022 **UIUC Astronomy Journal Club:** Organized a weekly journal club with graduate students giving talks on their work and recent papers in the field.
- 2019 **Teaching Assistant**, ASTR 122: Stars and Galaxies
- 2018 **Teaching Assistant**, ASTR 404: Stellar Astrophysics

SCHOOLS & WORKSHOPS

- 2020 Michigan Cosmology School (*virtual*)
- 2019 La Serena School for Data Science, La Serena, Chile
- 2019 Open Science Grid School, Madison, WI

AWARDS

- 2023 **APS DAP Student/Early Career Meeting Award** (\$600)
 · Travel to APS April Meeting 2023, Minneapolis, MN
- 2021 **Chambliss Astronomy Achievement Student Award**
 · AAS 238th Meeting (*virtual*)
- 2019-2020 **Center for Astrophysical Surveys Graduate Fellowship** (\$30,000)
 · University of Illinois Urbana-Champaign
- 2018 **Thesis High Honors**
 · Wesleyan University
- 2017 **Student Travel Grant** (\$1000)
 · NASA Connecticut Space Grant Consortium
 · Travel to AAS
- 2017 **3rd Prize, Visualizing Knowledge Exhibition**
 · Wesleyan University
 · Title: *Orbital Motion of Gas in Planetary System HD 100546*
- 2017 **Siver Scholarship**
 · Wesleyan University
 · awarded to undergraduate students majoring in or demonstrating strong academic interest in physics
- 2015 **Undergraduate Research Fellowship** (\$5000)
 · NASA Connecticut Space Grant Consortium
 · Title: *Searching for Non-Axisymmetry in the Unusual Gas Disk Around a Main Sequence Star*
- 2015 **Research in Sciences Fellowship** (\$4000)
 · Wesleyan University
 · Title: *Searching for Non-Axisymmetry in the Unusual Gas Disk Around a Main Sequence Star*

SKILLS

Programming languages: Python (advanced), unix (advanced), Julia (intermediate), HTML/CSS (intermediate) C/C++ (basic), Mathematica (basic), SQL (basic).

Software: CAMB, HEALPix, NaMaster, lenstpy, emcee, git, pandas, scikit-learn.

General: Signal processing, machine learning, statistical estimators, high-performance and high-throughput (Open Science Grid) computing.

TALKS & POSTERS

- 01/2024 **American Astronomical Society 243th Meeting** (*dissertation talk*)
 · New Orleans, LA
 · *CMB Lensing Measurements with Two Years of Data from the SPT-3G Survey*
- 04/2023 **American Physical Society April Meeting 2023**
 · Minneapolis, MN
 · *CMB Lensing Measurements with Two Years of Data from the SPT-3G Survey*
- 05/2022 **Kavli Institute for Particle Physics and Cosmology Tea Talk**
 · SLAC National Accelerator Laboratory, Menlo Park, CA
 · *Lensing Maps and Transient Science with the South Pole Telescope*
- 06/2021 **American Astronomical Society 238th Meeting** (*poster, virtual*)
 · *Detection of Stellar Flares at Millimeter Wavelengths with SPT-3G*
- 04/2021 **DES Milky Way Working Group Call** (*invited, virtual*)
 · *Time-Domain Astronomy with the South Pole Telescope*
- 04/2021 **Illinois Astrofest** (*virtual*)
 · University of Illinois Urbana-Champaign
 · *Time-Domain Astronomy with the South Pole Telescope*
- 10/2019 **Center for Astrophysical Surveys Seminar**
 · University of Illinois Urbana-Champaign
 · *Gravitational Lensing of the CMB: Synergy with Optical Surveys*
- 01/2018 **American Astronomical Society 231st Meeting**
 · National Harbor, MD
 · *Using Vertical Structure to Infer the Total Mass Hidden in a Debris Disk*
- 7/2017 **Research in Sciences Poster Session**
 · Wesleyan University
 · Presented poster on AU Mic research.
- 10/2016 **Keck Northeast Astronomy Consortium**
 · Wesleyan University
 · Gave talk on HD 100546 research; published paper in conference proceedings.
- 08/2016 **LEAPS Symposium**
 · Leiden University
 · Gave talk on HD 100546 research to international audience.
- 10/2015 **Keck Northeast Astronomy Consortium**
 · Williams College
 · Gave talk on 49 Ceti research; published paper in conference proceedings.
- 07/2015 **Research in Sciences Poster Session**
 · Wesleyan University
 · Presented poster on 49 Ceti research.

PUBLICATIONS

Lead-Author or Substantial Contribution

- Daley, C.**, & the SPT-3G Collaboration. 2023, *CMB Lensing Measurements with Two Years of Data from the SPT-3G Survey*, in prep.
- Millea, M., **Daley, C.**, Chou, T. L., et al. 2021, *Optimal Cosmic Microwave Background Lensing Reconstruction and Parameter Estimation with SPTpol Data*, ApJ, 922, 259, [arXiv:2012.01709](#)
- Guns, S., Foster, A., **Daley, C.**, et al. 2021, *Detection of Galactic and Extragalactic Millimeter-wavelength Transient Sources with SPT-3G*, ApJ, 916, 98, [arXiv:2103.06166](#)
- Daley, C.**, Hughes, A. M., Carter, E. S., et al. 2019, *The Mass of Stirring Bodies in the AU Mic Debris Disk Inferred from Resolved Vertical Structure*, ApJ, 875, 87, [arXiv:1904.00027](#)
- Walsh, C., **Daley, C.**, Facchini, S., & Juhász, A. 2017, *CO emission tracing a warp or radial flow within $\lesssim 100$ au in the HD 100546 protoplanetary disk*, A&A, 607, A114, [arXiv:1710.00703](#)
- Hughes, A. M., Lieman-Sifry, J., Flaherty, K. M., et al. 2017, *Radial Surface Density Profiles of Gas and Dust in the Debris Disk around 49 Ceti*, ApJ, 839, 86, [arXiv:1704.01972](#)

Collaboration Papers

- Pan, Z., Bianchini, F., Wu, W. L. K., et al. 2023, *A Measurement of Gravitational Lensing of the Cosmic Microwave Background Using SPT-3G 2018 Data*, arXiv e-prints, arXiv:2308.11608, [arXiv:2308.11608](#)
- Balkenhol, L., Dutcher, D., Spurio Mancini, A., et al. 2023, *Measurement of the CMB temperature power spectrum and constraints on cosmology from the SPT-3G 2018 TT, TE, and EE dataset*, Phys. Rev. D, 108, 023510, [arXiv:2212.05642](#)
- Schiappucci, E., Bianchini, F., Aguena, M., et al. 2023, *Measurement of the mean central optical depth of galaxy clusters via the pairwise kinematic Sunyaev-Zel'dovich effect with SPT-3G and DES*, Phys. Rev. D, 107, 042004, [arXiv:2207.11937](#)
- Chichura, P. M., Foster, A., Patel, C., et al. 2022, *Asteroid Measurements at Millimeter Wavelengths with the South Pole Telescope*, ApJ, 936, 173, [arXiv:2202.01406](#)
- Ferguson, K. R., Anderson, A. J., Whitehorn, N., et al. 2022, *Searching for axionlike time-dependent cosmic birefringence with data from SPT-3G*, Phys. Rev. D, 106, 042011, [arXiv:2203.16567](#)
- Sobrin, J. A., Anderson, A. J., Bender, A. N., et al. 2022, *The Design and Integrated Performance of SPT-3G*, ApJS, 258, 42, [arXiv:2106.11202](#)
- Montgomery, J., Ade, P. A. R., Ahmed, Z., et al. 2022, *Performance and characterization of the SPT-3G digital frequency-domain multiplexed readout system using an improved noise and crosstalk model*, Journal of Astronomical Telescopes, Instruments, and Systems, 8, 014001, [arXiv:2103.16017](#)
- Balkenhol, L., Dutcher, D., Ade, P. A. R., et al. 2021, *Constraints on Λ CDM extensions from the SPT-3G 2018 EE and TE power spectra*, Phys. Rev. D, 104, 083509, [arXiv:2103.13618](#)

Dutcher, D., Balkenhol, L., Ade, P. A. R., et al. 2021, *Measurements of the E-mode polarization and temperature-E-mode correlation of the CMB from SPT-3G 2018 data*, Phys. Rev. D, 104, 022003, [arXiv:2101.01684](#)

Gif-sur-Yvette, France, November 12, 2024