GABRIEL P. LYNCH

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RESEARCH INTERESTS

- Cosmic microwave background anisotropies
- Cosmological recombination
- Hubble tension
- Generative modeling
- Neutrino cosmology
- Early universe

EDUCATION

University of California, Davis *2020-Present*
Ph.D. in Physics (expected Winter 2026)
Thesis: *Data-driven explorations of cosmic tensions*
Advisor: Prof. Lloyd Knox

The University of Chicago *2014-2018*
Bachelor of Arts in Mathematics, Physics with Honors

TECHNICAL SKILLS

Data analysis Bayesian analysis MCMC Neural networks
Normalizing flows Diffusion models Differentiable programming

Computing `Numpy` `JAX` `TensorFlow` `PyTorch` `ForwardDiff.jl` MPI

Languages `Python` `C` `Julia` `Fortran 77/90`

PUBLICATIONS

ADS

PRIMARY CONTRIBUTIONS

[5] E. Camphuis, W. Quan, L. Balkenhol, A. R. Khalife, F. Ge, F. Guidi, N. Huang, **G. Lynch**, Y. Omori, C. Trendafilova, et. al. [97 authors]
SPT-3G D1: CMB temperature and polarization power spectra and cosmology from 2019 and 2020 observations of the SPT-3G Main field. (arxiv:2506.20707)

[4] **G. Lynch** and L. Knox
What's the matter with Σm_ν? Phys.Rev.D 112 (2025) 8, 083543 (arxiv:2503.14470)

[3] **G. Lynch**, L. Knox, and J. Chluba
DESI observations and the Hubble tension in light of modified recombination. Phys.Rev.D 110 (2024) 8, 083538 (arxiv:2406.10202)

[2] **G. Lynch**, L. Knox, and J. Chluba
Reconstructing the recombination history by combining early and late cosmological probes. Phys. Rev. D 110 (2024) 6, 063518 (arxiv:2404.05715)

[1] K. Prabhu, S. Raghunathan, M. Millea, **G. Lynch**, et. al. [103 authors]
Testing the ΛCDM Cosmological Model with Forthcoming Measurements of the Cosmic Microwave Background with SPT-3G. Astrophys. J. 973 (2024) 1, 4 (arxiv:2403.17925)

COLLABORATION WORK

I am a co-author of the following publications as part of the SPT-3G collaboration.

[5] A. Vitrier et al. (SPT-3G collaboration) [98 authors including **G. Lynch**]
Towards constraining cosmological parameters with SPT-3G observations of 25% of the sky (arxiv:2510.24669)

[4] A. Khalife et al. (SPT-3G collaboration) [95 authors including **G. Lynch**]
SPT-3G D1: Axion Early Dark Energy with CMB experiments and DESI (arxiv:2507.23355)

[3] M. Archipley et al. (SPT-3G collaboration) [111 authors including **G. Lynch**]
Millimeter-wave observations of Euclid Deep Field South using the South Pole Telescope: A data release of temperature maps and catalogs (arxiv:2506.00298)

[2] J. Zebrowski et al. (SPT-3G collaboration) [98 authors including **G. Lynch**]
Constraints on Inflationary Gravitational Waves with Two Years of SPT-3G Data (arxiv:2505.02827)

[1] F. Qu et al. (SPT-3G & ACT collaborations) [145 authors, including **G. Lynch**]
Unified and consistent structure growth measurements from joint ACT, SPT and Planck CMB lensing (arxiv: 2504.20038)

WHITE PAPERS

I have made small contributions to the following whitepapers.

[1] E. Di Valentino (CosmoVerse Network Collaboration) [543 authors, including **G. Lynch**]
The CosmoVerse White Paper: Addressing observational tensions in cosmology with systematics and fundamental physics. Phys.Dark Univ. 49 (2025), 101965 (arxiv:2504.01669)

PRESENTATIONS

Con.=Conference; Sem. = Seminar; ⋆ = Invited

2025

Con. *Neutrino constraints and the CMB-BAO tension*
COSMO-25, Carnegie Mellon University

Sem.⋆ *Data-driven explorations of cosmic tensions*
Astrophysics and Cosmology seminar, University of California, Davis

Sem.⋆ *What's the matter with Σm_ν?*
KIPAC Tea Talk, Stanford

Sem.⋆ *What's the matter with Σm_ν?*
Cambridge PhD Journal Club, Cambridge, UK (virtual)

Con. *What's the matter with Σm_ν?*
CMB-S4 Spring Collaboration Meeting, University of California, Berkeley

Sem. *The negative m_ν mystery tour*
Dark Universe Consortium talk series, University of California, Davis

2024

Con. *DESI, excess lensing, and the Hubble tension in light of modified recombination*
Essential Cosmology for the Next Generation IX, Playa del Carmen, MX

Con. *Reconstructing recombination with cosmic microwave background and baryon acoustic oscillation data*
APS April Meeting, Sacramento

2023

Sem. *Probing the recombination era with CMB Anisotropies*
N3AS Summer School student talk, University of California, Santa Cruz

2020

Con. *High-resolution cosmological simulations of fuzzy dark matter*
APS April Meeting, Washington, D.C. (virtual)

OTHER RESEARCH ACTIVITY

Post-baccalaureate research associate *2018-2020*
Argonne National Laboratory, Lemont, IL

Worked on simulations of fuzzy dark matter using petascale computing platforms. Began development of a Schrödinger-Poisson solver using spectral methods.

PROFESSIONAL ACTIVITY

Collaboration memberships

SPT-3G collaboration junior member *2025 — Present*

Workshop attendance

Advanced topics in AI for Science on student training series *Fall 2025*
Argonne National Laboratory (virtual)

N3AS Summer School on Multi-messenger Astrophysics *Summer 2023*
University of California, Santa Cruz

AI for Science on Supercomputers student training series *Fall 2022*
Argonne National Laboratory (virtual)

Muench-Woltjer Observational Astronomy Workshop *Fall 2021*
Lick Observatory

Academic services

Co-organizer, Dark Universe Consortium talk series *Winter 2025*
University of California, Davis

Journal reviewer

Nature Astronomy

TEACHING

Graduate teaching assistant *2020-2024*
University of California, Davis

Introduction to Cosmology *Winter 2021*

Principles of Physics in Astrophysics *Spring 2022*

Classical Mechanics (graduate level) *Fall 2022*

Introduction to General Physics I *Multiple*

Private physics tutor *2023-2024*
Davis, California

Junior tutor *2017-2018*
University of Chicago, Department of Mathematics

OUTREACH

Volunteer, Astronomy on Tap

Assisted with setup and break down for events featuring public astrophysics-themed talks in the Davis area

Media engagement

Answered interview questions for popular science article *(Scientific American)*

Wrote popular science article about black holes and Greek philosophy *(Nautilus)*
(Black Hole Institute essay contest, 3rd place prize)