

# Thomas W. Morris

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thomaswmorris.com

github — linkedin — google scholar

April 2024

## RESEARCH INTERESTS

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Computational physics, machine learning, cosmology, radio astronomy, x-ray optics, atmospheric modeling

## SKILLS

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- **Programming:** I code mostly in Python. I am pretty good at Bash, C, JavaScript, MATLAB, Fortran, and R.
- **Software:** Ansible, Dask, Git, Jupyter, Kafka, Linux, Mongo, PyTorch, Redis, Slurm, Tensorflow
- **Skills:** I have a strong practical and theoretical background in physics, statistics, and mathematics.

## EDUCATION

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### Princeton University

*Bachelor of Arts in Physics*

Thesis: “Modeling the Atmosphere on Cerro Toco, Chile”

Advisor: Lyman A. Page Jr.

Princeton, New Jersey

Sep. 2016 — May 2020

## WORK & RESEARCH

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### Princeton University Department of Physics

*Research Assistant*

I used ground-based experiments like ABS and ACT to study, model, and mitigate atmospheric emission and its random fluctuations due to turbulence and climatological variation.

Princeton, New Jersey

Jun. 2020 — Nov. 2021

### Brookhaven National Laboratory

*Research Engineer*

I research, design, and deploy systems which use artificial intelligence and machine learning to automatically align beams at the National Synchrotron Light Source-II (NSLS-II), a specialized particle accelerator that uses relativistic electrons to emit beams of ultrafine x-rays which are invaluable to fields like clean energy, drug discovery, materials science, and fundamental physics.

Upton, New York

Nov. 2021 — Present

### Lawrence Berkeley National Laboratory

*Affiliate Scientist*

I work to automate beamline alignment at the Advanced Light Source (ALS) and its future upgrade (ALS-U) as a part of the Dream Beam project, with an emphasis on adaptive optics for x-ray beamlines.

Berkeley, California

Nov. 2023 — Present

## COLLABORATIONS

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### ACT Collaboration

*Member*

I work on data analysis and modeling for the Atacama Cosmology Telescope (ACT), a 6-meter telescope in northern Chile that mapped the cosmic microwave background between 2013 and 2022. I also contribute to the systematic and diagnostic measurements that go into the observation-to-map pipeline for raw ACT data.

Jan. 2023 — Present

### AtLAST Collaboration

*Member*

I work on the design study for the Atacama Large Aperture Submillimetre Telescope (AtLAST), a proposed single-dish 50-meter telescope, with a consortium of researchers led by the European Southern Observatory and the University of Oslo.

Jun. 2023 — Present

### ILLUMINE

*Member*

I work on machine learning and artificial intelligence systems with ILLUMINE, a collaboration between several national labs (Argonne, Brookhaven, Berkeley, Oak Ridge, and SLAC) that focuses on using advanced computing methods to streamline experimentation and data collection at different x-ray and neutron source facilities.

Feb. 2024 — Present

## PROJECTS

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### maria

<https://thomaswmorris.com/maria>

#### Lead Developer

Simulation tools for generating mock observations of celestial signals with ground-based radio and microwave telescopes. Development is focused on simulations of ACT, ALMA, AtLAST, and MUSTANG-2, and planned collaborations include MISTRAL and the Greenland Telescope.

### blop

<https://nsls-ii.github.io/blop>

#### Lead Developer

An AI-powered command-and-control agent that uses Bayesian inference to align optical and electron beamlines at accelerator facilities. Currently used at ALS, ATF, and NSLS-II.

## SELECTED PUBLICATIONS

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All of my publications

### As first author

- [pdf] T. W. Morris et al. “A General Bayesian Algorithm for the Autonomous Alignment of Beamlines.” arXiv preprint arXiv:2402.16716 (2024).
- [pdf] J. van Marrewijk, T. W. Morris, et al. “maria: A novel simulator for forecasting (sub-)mm observations.” arXiv preprint arXiv:2402.10731 (2024).
- [pdf] Morris, T. W., et al. “Latent Bayesian optimization for the autonomous alignment of synchrotron beamlines.” *Advances in Computational Methods for X-Ray Optics VI*. Vol. 12697. SPIE, 2023.
- [pdf] Morris, T. W., et al. “On-the-fly optimization of synchrotron beamlines using machine learning.” *Optical System Alignment, Tolerancing, and Verification XIV*. Vol. 12222. SPIE, 2022.
- [pdf] Morris, Thomas W., et al. “The Atacama Cosmology Telescope: Modeling bulk atmospheric motion.” *Physical Review D* 105.4 (2022): 042004.

### As coauthor

- [pdf] Madhavacheril, Mathew S., et al. “The Atacama Cosmology Telescope: DR6 gravitational lensing map and cosmological parameters.” *The Astrophysical Journal* 962.2 (2024): 113.
- [pdf] Qu, Frank J., et al. “The Atacama Cosmology Telescope: A measurement of the DR6 CMB lensing power spectrum and its implications for structure growth.” *The Astrophysical Journal* 962.2 (2024): 112.
- [pdf] Kreisch, Christina D., et al. “The Atacama Cosmology Telescope: The Persistence of Neutrino Self-Interaction in Cosmological Measurements.” *Physical Review D* 109, 043501 (2024)
- [pdf] Coulton, William R., et al. “The Atacama Cosmology Telescope: High-resolution component-separated maps across one-third of the sky.” arXiv preprint arXiv:2307.01258 (2023)
- [pdf] Nash, Boaz, et al. “Online models for X-ray Beamlines.” *Bulletin of the American Physical Society* (2022).

## REFERENCES

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### Prof. Lyman A. Page Jr.

*Professor, Department of Physics, Princeton University, Princeton, New Jersey, USA*

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### Dr. Max Rakitin

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### Dr. Tony Mroczkowski

*Astronomer/(Sub)millimeter Instrument Scientist, European Southern Observatory, Garching, Bavaria, Germany*

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