

# T. Dex Bhadra

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## EDUCATION

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### University of Toronto, PhD

*Astronomy and Astrophysics*

September 2026 – Present

### University of California, Berkeley, BA

*Physics and Astrophysics*

August 2021 – May 2025

Graduated with Honors in Astrophysics

## PUBLICATIONS

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**Bhadra, T. D.** et al. “Modeling Binary Lenses and Sources with the BAGLE Python Package.” *The Astrophysical Journal Vol. 1002* (2026)

**Bhadra, T. D.** et al. “You Shall Not Pass (Without Modeling): High-Resolution Analysis of KMT-2019-BLG-0253 using MORIA.”  
(Submitted to the *Astronomical Journal*)

Lu, J. et al. (includes **Bhadra, T.D.**) “The BAGLE Python Package for Bayesian Analysis of Gravitational Lensing Events.” (Accepted to the *Astronomical Journal*)

Wright, M. et al. (includes **Bhadra, T.D.**), “Accretion and Outflow in Orion-KL Source I.”, *The Astrophysical Journal Vol. 974* (2024)

Terry, S.K, et al. (includes **Bhadra, T.D.**) “Predictions of the Nancy Grace Roman Space Telescope Galactic Exoplanet Survey. IV. Lens Mass and Distance Measurements.” *The Astronomical Journal Vol. 171* (2026)

## RESEARCH EXPERIENCE

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### Researcher: Roman Galactic Exoplanet Survey (RGES) at NASA

(Aug'25-Current)

#### Supervisor: Dr. Sean Terry

- Developed an automated image analysis pipeline called Microlensing Object high-Resolution Imaging Analysis (MORIA) for microlensing targets in the Roman Galactic Bulge Time Domain Survey (GBTDS), enabling direct measurements of lens flux, lens-source separation and mass constraints for exoplanets.
- Tested MORIA on HST images of the microlensing event KMT-2019-BLG-0253, reducing the number of degenerate solutions by a factor of two and finding evidence for three distinct blended stars that comprise the target.

### Researcher: Binary Microlensing Events at Berkeley Moving Universe Lab (MULab)

(Sep'23-Current)

#### Supervisor: Dr. Jessica Lu

- Integrated new models into the Bayesian Analysis of Gravitational Lensing Events (BAGLE) microlensing package to correctly replicate photometric and astrometric signals from binary systems (sources and lenses) with orbital motion.
- Developed new Jax-driven Python routines to calculate the microlensing amplification and resolved images of finite sources (with point and binary lenses) that holds in any amplification regime.
- Compared the runtime performances of different microlensing modeling software (BAGLE, VBmicrolensing, pyLIMA, MuLensModel) on mock Roman datasets to prepare a black hole microlensing pipeline for the Roman GBTDS and upcoming Gaia Data Releases.
- Observed four nights at Lick using KAST.

### Researcher: Bondi-Hoyle-Lyttleton (BHL) Accretion in Orion Source I's Circumbinary Disk

(Jan'23-Apr'24)

#### Supervisor: Dr. Melvyn Wright

- Developed a 3D kinematic model to fit the velocity profiles of SiS, <sup>28</sup>SiO, <sup>29</sup>SiO, NaCl, SO and H<sub>2</sub>O molecular line emissions present in the disk-driven, rotating, bi-polar outflow of Orion Source I.
- Used MIRIAD tools like VELPLOT and UVPLOT to analyze the spectral composition and position-velocity slices of Orion Source I.
- Calculated the BHL rate for accretion onto Orion Source I's circumbinary disk as  $\sim 10^{-7} M_{\odot} \text{ yr}^{-1}$ ; predicted that the disk is being depleted on a timescale of 200-2000 years.

### Astrophysics Data Analyst at B612 Foundation

(Aug'22-May'23)

#### Supervisor: Nate Tellis

- Optimized the Precovery Algorithm (used to identify asteroid observation) to down-sample in the HEALPix space, reducing the uncertainty in the detection of an asteroid's orbit by 58%.

- Corrected inconsistencies in observation times for asteroids' orbit data submitted from the NOIRLab Source Catalog (NSC) to the Minor Planet Center (MPC).

## PRESENTATIONS

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- 247<sup>th</sup> American Astronomical Society (AAS) Annual Meeting** (Spring 2026)
- Poster: "Modeling Binary Lenses and Sources with the BAGLE Python Package to Measure Microlensing Signals of Black Hole Candidates."
- 12<sup>th</sup> Chesapeake Bay Area Exoplanets (CHEXO) Meeting** (Fall 2025)
- Lightning talk: "Image-constrained microlensing study of KMT-2019-BLG-0253 – a potential binary-source, binary-lens planetary candidate."
- 3<sup>rd</sup> RGS PIT Annual Meeting** (Fall 2025)
- Oral Presentation: "Introducing the BAGLE Python Package and Its Impact on Improving Joint Photometric and Astrometric Fitting of Black Hole Microlensing Events."
- Berkeley Astronomy Lunch Talks** (Fall 2024)
- Oral Presentation: "Impact of Keplerian Orbital Motion on Astrometric Microlensing Signals from Binary lenses and Sources."
- Bay Area Microlensing Meeting** (Spring 2024)
- Oral Presentation: "Impact of Keplerian Orbital Motion on Astrometric Microlensing Signals from Binary Sources."
- 26<sup>th</sup> International Microlensing Conference** (Spring 2024)
- Poster: "New Binary Orbit Models Introduced to BAGLE and Its Impact on Microlensing Events with Binary Sources."
- Berkeley Physics Undergraduate Research Scholars (BPURS) Symposium** (Spring 2024)
- Poster: "Impact of Keplerian Orbital Motion on Astrometric Microlensing Signals from Binary Sources."
- Data Discovery Symposium** (Fall 2022 and Spring 2023)
- Poster: "Developing the Asteroid Discovery Analysis and Mapping (ADAM) Project with the B612 Foundation."
- Berkeley Physics and Astrophysics Research Fair** (Fall 2021)
- Poster: "Correlation Between the Anomalous Transport of Energetic Particles and Interplanetary Shocks Using Shock Data from SWEPAM And EPAM. "

## TEACHING AND OUTREACH

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- Undergraduate Research Mentor for Undergraduate Lab at Berkeley, Physics Division** (Aug'23-Apr'24)
- Mentored a group of 6 in 2023-2024 on a project probing for BHL accretion onto Orion Source I using NaCl emissions.
  - Mentored a group of 6 in 2024-2025 on a project re-evaluating compact object OGLE-2011-BLG-0462 as a binary source candidate.
- Curriculum Manager for Undergraduate Lab at Berkeley, Physics Division** (May'22-Apr'24)
- Designed assignments on Python, LaTeX, Statistics and Git; conducted Python workshops for 100+ students participating in various research projects on topics in physics and astronomy.
- Astrophysics/Physics Drop-In Tutor and Course Reader in the Department of Astronomy** (Aug'24-May'25)
- Provided drop-in tutoring services for PHYSICS 137A (Quantum Mechanics I) and ASTRON C161 (Relativistic Astrophysics and Cosmology). Graded assignments for ASTRON 160 (Stellar Physics)
- CS 61A (Structure and Interpretation of Programs) Academic Intern** (Jan'22-May'22)
- Facilitated weekly lab sections of 25+ students to assist with conceptual understanding of trees, linked lists, recursions, object-oriented programming, and scheme.

## HONORS AND AWARDS

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- University of Toronto Graduate Entrance Fellowship** (Sept'26-Present)
- Astrophysics Honors Graduate** (May'25)
- Undergraduate Research Apprentice Program (URAP) Summer Fellow** (Summer 2024)
- Berkeley Physics Undergraduate Research Scholar** (Spring 2024)
- Data Discovery Ribbon of Excellence** (Fall 2022)

## SKILLS

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Programming Languages: Python (Matplotlib, HealPy, SciPy, Pandas, Numpy, Astropy), BASH (Linux Shell Script), Scheme, SQL, Java,

JavaScript, Fortran, C++  
Software and Frameworks: LaTeX, Git, SAOImage DS9, hst1passm IBM Qiskit, MATLAB