

Abhimat Krishna Gautam

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Research Interests

Topics: Milky Way Nuclear Star Cluster, Stellar Binaries, Stellar-Mass Black Holes, Star Formation, Dynamics

Methods: Large Surveys, Time-Domain Astronomy, Computational Astronomy, Machine Learning, High-Performance Computing

Professional Positions

2020–Current: Postdoctoral Scholar, University of California, Los Angeles

Education

2014–2020: University of California, Los Angeles

Graduate | M.S.: June 2016, Ph.D.: 11 September 2020

Ph.D. Thesis: *Examining the stellar population and dynamical environment of the Milky Way Galactic center with near-infrared adaptive optics photometry*

2010–2014: University of California, Berkeley

Undergraduate | B.A.: May 2014

Majors: Astrophysics (with Honors), Physics

Publications

First Author

- **A. K. Gautam**, T. Do, A. M. Ghez, D. S. Chu, M. W. Hosek Jr., S. Sakai, S. Naoz, M. R. Morris, A. Ciurlo, Z. Haggard, J. R. Lu. *An Estimate of the Binary Star Fraction among Young Stars at the Galactic Center: Possible Evidence of a Radial Dependence*, *ApJ*, 964:164, 2024
- **A. K. Gautam**, T. Do, A. M. Ghez, M. R. Morris, G. D. Martinez, M. W. Hosek Jr., J. R. Lu, S. Sakai, G. Witzel, S. Jia, E. E. Becklin, K. Matthews. *An Adaptive Optics Survey of Stellar Variability at the Galactic Center*, *ApJ*, 871:103, 2019

Contributing

- Z. Haggard, A. M. Ghez, S. Sakai, **A. K. Gautam**, et al. *The Galactic Center in Color: Measuring Extinction with High-Proper-Motion Stars*, *AJ* [in press]
- G. C. Weldon, et al., incl. **A. K. Gautam**. *Near-infrared Flux Distribution of Sgr A* from 2005–2022: Evidence for an Enhanced Accretion Episode in 2019*, *ApJL*, 954:L33, 2023

- M. S. R. Freeman, J. R. Lu, J. Lyke, **A. K. Gautam**, et al. *An Optical Distortion Solution for the Keck I OSIRIS Imager*, AJ, 166:125, 2023
- S. Jia, et al., incl. **A. K. Gautam**. *Stellar Populations in the Central 0.5 pc of Our Galaxy. III. The Dynamical Substructures*, ApJ, 949:18, 2023
- D. S. Chu, T. Do, A. M. Ghez, **A. K. Gautam**, et al. *Evidence of a Decreased Binary Fraction for Massive Stars within 20 milliparsecs of the Supermassive Black Hole at the Galactic Center*, ApJ, 948:94, 2023
- A. Ciurlo, et al., incl. **A. K. Gautam**. *The Swansong of the Galactic Center Source X7: An Extreme Example of Tidal Evolution near the Supermassive Black Hole*, ApJ, 944:136, 2023
- S. K. Terry, et al., incl. **A. K. Gautam**. *AIROPA IV: Validating point spread function reconstruction on various science cases*, JATIS, 9, 1, 018003, 2023
- E. Ramey, et al., incl. **A. K. Gautam**. *Analyzing long-term performance of the Keck-II adaptive optics system*, JATIS, 8, 2, 028004, 2022
- S. C. Rose, S. Naoz, **A. K. Gautam**, et al. *On Socially Distant Neighbors: Using Binaries to Constrain the Density of Objects in the Galactic Center*, ApJ, 904:2, 2020
- M. W. Hosek Jr., J. R. Lu, C. Y. Lam, **A. K. Gautam**, et al. *PyPopStar: A Python-Based Simple Stellar Population Synthesis Code for Star Clusters*, AJ, 160:143, 2020
- A. Hees, et al., incl. **A. K. Gautam**. *Search for a Variation of the Fine Structure around the Supermassive Black Hole in Our Galactic Center*, PRL, 124, 081101, 2020
- Z. Chen, et al., incl. **A. K. Gautam**. *Consistency of the Infrared Variability of Sgr A* over 22 years*, ApJL, 882:L28, 2019
- T. Do, G. Witzel, **A. K. Gautam**, et al. *Unprecedented variability of Sgr A* in NIR*, ApJL, 882:L27, 2019
- T. Do, et al., incl. **A. K. Gautam**. *Relativistic redshift of the star S0-2 orbiting the Galactic center supermassive black hole*, Science, 16 Aug 2019
- S. Sakai, et al., incl. **A. K. Gautam**. *The Galactic Center: An Improved Astrometric Reference Frame for Stellar Orbits around the Supermassive Black Hole*, ApJ, 873:65, 2019
- S. Jia, J. R. Lu, S. Sakai, **A. K. Gautam**, et al. *The Galactic Center: Improved Relative Astrometry for Velocities, Accelerations, and Orbits near the Supermassive Black Hole*, ApJ, 873:9, 2019

- D. S. Chu, et al., incl. **A. K. Gautam**. *Investigating the Binarity of S0-2: Implications for Its Origins and Robustness as a Probe of the Laws of Gravity around a Supermassive Black Hole*, ApJ, 854:12, 2018

Conference Talks, Proceedings, and Posters

- Talk: *A high stellar binary fraction among the young, massive stars in the central half parsec*: GCWS 2023, Granada, Spain, 2023.
- Talk: *Understanding the star formation and dynamical histories of the Milky Way Galactic center with stellar binaries*: AAS 235, 2020.
- Poster: *Constraints on dark cusp around Galactic center supermassive black hole from a newly detected old, 79 day period stellar binary*, GCWS 2019, Yokohama, Japan, 2019.
- Talk: *Photometric detection of a candidate low-mass giant binary system at the Milky Way Galactic Center*: AAS 231, 2018.
- Poster: *Constraining the Variability and Binary Fraction of Galactic Center Young Stars*, IAUS, 322: 237–238, 2017.
- Talk: *SETI Searches for Radio Transients from Kepler Field Planets and Astropulse Candidates*: AAS 224, 2014.
- Poster: *Multiple epoch analysis of the Guitar Nebula and PSR B2224+65 in Radio, Optical, and X-Ray wavelengths*: AAS 221, 2013.

Research Projects

Current

- Photometric search for compact object-luminous star binaries in the Milky Way nuclear star cluster (2023–Now)
- Characterization of a massive stellar binary with evidence of tidal stripping with NIR imaging and spectroscopy (2022–Now)
- Photometric study of stellar population and dynamical environment of the Milky Way Galactic center (2015–Now)
- Characterization of PSF fitting performance on AO imaging data of the Milky Way Galactic Center (2020–2023)

Previous

- Search for Radio Transients and SETI Signals in Kepler Field and Astropulse Candidates (2011–2014)

- Multi-Wavelength and Epoch Analysis of the Guitar Nebula/PSR B2224+65 (2012)
- Calibration of Sgr A* VLBI Observations: (2011–2012)

Grants, Fellowships, Telescope Time Awarded

- 2022: Principal Investigator: HST Cycle 30 AR Program: Photometric search for BH-Star Binaries in Milky Way Nuclear Star Cluster
- 2020: Michael A. Jura Memorial Graduate Award
- 2014: UCLA Astronomy Scholar Fellowship
- 2024: Contributing: JWST Cycle 3 GO Program: Proper motion survey of nuclear star cluster
- 2024B – 2015B: Contributing: Keck Observatory, UCLA Galactic Center Group
- 2022: Contributing: HST Cycle 30 GO Program: Nuclear star cluster proper motion

Mentoring Experience

- 2023–Now: S. Vashist (UCLA Undergraduate Student): Measurement of massive star binary fraction in the central parsec of the Milky Way Galactic center (2024–Now). Analysis of PSF-fitting techniques on AO imaging data of the Galactic center (2023).
- 2021–2024: Z. Haggard (UCLA Graduate Student): Analysis of Galactic center stellar population with L' -band imaging (2021–2024).
- 2019–2021: E. Cochran (UCLA Undergraduate Student): Characterizing the color variability of Galactic center stars (Gautam, Cochran, et al., in prep.). Search for Near-Infrared counterparts to X-ray sources in the central half parsec of the Galactic center (Cochran, Do, Gautam et al., in prep.).
- 2017: A. Mangian (UCLA REU Student): Analysis of holography PSF fitting improvements on Galactic center speckle imaging data.
- 2016: C. O'Connor (UCLA Undergraduate Student): Near-infrared search for Mira variables and characterization of stellar variability near Sgr A*.

Teaching Experience

- 2021–2024: ISEE AstroTech, Software Specialist Lead: Designed and taught activity to introduce undergraduate- and graduate-level students to software development for astronomical instrumentation.
- 2024: ISEE AstroTech, Introduction to Spectroscopic Gratings: Co-designed and taught activity to introduce undergraduate- and graduate-level students to spectroscopic gratings.

- 2014–2015: Teaching Assistant for undergraduate courses: UCLA Astronomy 4, 3, 82

Public Software Projects

Lead Development

- **Phitter**: Open-source python package to simulate observables (fluxes and radial velocities) from stellar binary systems and fit to observation data.
 - Description and Documentation: <https://abhimat.net/phitter/>
 - Git Repository: <https://github.com/abhimat/phitter>

Significant Contributions

- **KAI**: The Keck AO Imaging (KAI) data reduction pipeline, a tool to reduce imaging observations taken with the NIRC2 and OSIRIS near-infrared imagers at the W. M. Keck Observatory.
 - Documentation: <https://keck-datareductionpipelines.github.io/KAI/>
 - Git Repository: <https://github.com/keck-datareductionpipelines/kai>
- **SPISEA**: Stellar Population Interface for Stellar Evolution and Atmospheres
 - Description and Documentation: <https://spisea.readthedocs.io/en/stable/index.html>
 - Git Repository: <https://github.com/astropy/SPISEA>

Software Experience

- **Significant** Python: Numerical Analysis and Data Science, Astrophysical Modeling, Data Visualization, Machine Learning (e.g. with TensorFlow, PyTorch)
- **Moderate** Java, IDL, MATLAB, C
- **Basic** CUDA, Swift

Scientific Community Service

- **Paper Reviewer** Nature, Nature Communications

Science Outreach

Outreach Leadership Positions

- 2022: Organizer of UCLA Galactic Center Group Booth for UCLA Exploring Your Universe
- 2015–2020: UCLA Planetarium Coordinator
- 2015–2018: Exploring Your Universe Design Coordinator and Organizing Committee Member

Outreach Experience

- 2021–2023: Exploring Your Universe: Volunteer at UCLA Galactic Center Group booth.

- 2022 September: **Skylark Lecture, Orange Coast College: Our Milky Way Galaxy and the Supermassive Black Hole at the Center of the Galaxy!**
- 2022: **Journey Through the Universe:** Science presentations for Hawaiian school groups.
- 2014–2020: **UCLA Planetarium:** Hosting shows for public audiences and K–12 school groups.
- 2014–2019: **UCLA Astronomy Live!:** Leading astronomy demonstrations at LA area schools.
- 2014–2019: **Exploring Your Universe:** Volunteering at astronomy booths and planetarium during UCLA's science public outreach event.
- 2011–2013: **Bay Area Science Festival, San Francisco, CA**
- 2013: **California Academy of Sciences NightLife, San Francisco, CA**
- 2013: **Cal Day, Berkeley, CA**
- 2012: **Sunday Streets, Berkeley, CA**
- 2012: **Focus for Teens, Ithaca, NY**