Viraj Karambelkar

viraj@astro.caltech.edu | virajkaram.github.io

Education

PhD, California Institute of Technology — Expected 2025
Astrophysics, Field : Time-domain astrophysics

MS, California Institute of Technology — 2019-2021
Astrophysics

B.Tech, Indian Institute of Technology, Bombay — 2015-2019
Engineering Physics with Honors, Minor in Mathematics

Research Experience

Graduate Research Assistant — 2019-present
Thesis Advisor: Prof. Mansi Kasliwal — *Caltech, USA*

Caltech Visiting Undergraduate Research Program (VURP) Fellow — Summer 2018
Ultra-long period infrared variable stars, Mentors: Dr. Scott Adams, Prof. Mansi Kasliwal — *Caltech, USA*

Undergraduate Research Assistant — 2018-2019
A cosmological signal from dark-matter spin flip interactions, Advisor: Prof. Vikram Rentala — *IIT Bombay*

Undergraduate Research Assistant — 2017-2018
Roboticizing the GROWTH-India Telescope, Advisor: Prof. Varun Bhalerao — *IIT Bombay*

Sakura Science Fellow — Summer 2017
Calibrating the CMB detector KUMODES-II, Mentor: Dr. Taketo Nagasaki — *KEK, Japan*

National Initiative for Undergraduate Studies Research Fellow — Winter 2016
A geometric measure of quantum entanglement, Advisor: Prof. Prasanta Panigrahi — *IISER Kolkata*

Awards

Neugebauer Scholar of Astrophysics, Caltech, USA (2023-present)

Finalist, 3-Minute Thesis Competition, Caltech (2024)

Visiting Undergraduate Research Program Fellow, Caltech, USA (2018)

Institute Academic Prize for exceptional academic performance at IIT Bombay. (2017)

Secured an **All India Rank 65**-JEE Mains, **AIR 196**-JEE Advanced among 1 million students for entry to IITs. (2015)

INSPIRE fellowship, awarded to the top 1 percentile of students by the Govt. of India. (2015)

Kishore Vaigyanik Protsahan Yojna (KVPY) fellowship awarded by the Department of Science and Technology, Govt. of India (2015)

National Talent Search Scholarship (NTSE) awarded by the National Center for Education, Research and Training, Govt. of India (2011)

Successful Telescope proposals

James Webb Space Telescope

- PI : 10.4 hours, Cycle 2 : *Are LRNe Major factories of cosmic dust?*

Hubble Space Telescope

- PI : 2 orbits Cycle 30 : *In search of the remnant of SN 2021fcg – detonation, deflagration or merger?*
- co-I : SNAP program Cycle 29 : *UV Spectroscopy of Astronomical Transients through Rolling Snapshots*

NASA - Infrared Telescope Facility

- PI : 2 nights, 2022B : *Telling them apart - Identifying the first chemical differences between R Coronae Borealis and dustless HdC stars*
- PI : 4 nights 2021B : *An Infrared census of R Coronae Borealis stars*
- co-I : 2 nights 2023B : *Luminous mid-infrared transients in M31*
- co-I : 2 nights 2021B : *Uncovering the peculiar mass loss histories of Symbiotic X-ray binaries*

Palomar 200-inch telescope

- PI: 2 nights 2023B : *Completing the census of large amplitude variable stars identified by Palomar-Gattini IR*
- co-I: 35 nights (2021-2023) : *The Dynamic Infrared Sky*

Keck I+II telescopes

- co-I: 20 nights (2022-2024) : *Census of the local universe with ZTF*

Very Large Array (VLA)

- co-I: 6 hours DDT : *Chasing a very bright GRB at VLA frequencies - GRB 230812B*
- co-I: 1 hour DDT : *IRAS 19148+1138: an Asymptotic Giant Branch star candidate in VLASS*

Sub-mm Array (SMA)

- Awarded 4 hours as part of the SMA-Interferometry School 2021 for the proposal *Tracing molecular gas in the envelope of R Coronae Borealis*

Swift telescope

- Total 10 ks of approved ToO time for early time UV followup of transients.

Publications

Full list here. Total refereed: 49, Total citations: 1503; h-index:22

Select publications with major contributions

- **V. Karambelkar**, M. Kasliwal, P. Tisserand et al. "Census of R Coronae Borealis Stars II : Spectroscopic classifications and implications for the rate of low mass white-dwarf mergers" In PASP (July 2024)
- A. Suresh [1], **V. Karambelkar**, M. Kasliwal et al. "An automated catalog of long-period variables from Palomar Gattini IR" In PASP (April 2024)

[1] mentored

- K. De, M. MacLeod, **V. Karambelkar** et al. "An infrared transient from a star engulfing a planet". In Nature 617.7959 (May 2023)
- G. Dimitriadis, K. Maguire, **V. Karambelkar** et al. "SN 2021zny: an early flux excess combined with late-time oxygen emission suggests a double white dwarf merger event" In MNRAS (May 2023)
- **V. Karambelkar**, M. Kasliwal, N. Blagorodnova et al. "Volumetric Rates of Luminous Red Novae and Intermediate-luminosity Red Transients with the Zwicky Transient Facility" In ApJ (May 2023)
- **V. Karambelkar**, M. M. Kasliwal, P. Tisserand et al. "R Coronae Borealis and dustless hydrogen-deficient carbon stars likely have different oxygen isotope ratios". In A& A (Nov. 2022)
- D. Frostig, S. Biscoveanu, G. Mo, **V. Karambelkar** et al. "An Infrared Search for Kilonovae with the WINTER Telescope. I. Binary Neutron Star Mergers". In ApJ (Feb. 2022)
- **V. Karambelkar**, M. Kasliwal, K. Maguire et al. "Faintest of Them All: ZTF 21aaoryiz/SN 2021fcg-Discovery of an Extremely Low Luminosity Type Iax Supernova". In ApJ (Nov. 2021)
- M. Dhuria, **V. Karambelkar**, V. Rentala, and P. Sarmah "A strong broadband 21 cm cosmological signal from dark matter spin-flip interactions". In JCAP (Aug 2021)
- **V. Karambelkar**, M. Kasliwal, P. Tisserand et al. "Census of R Coronae Borealis Stars. I. Infrared Light Curves from Palomar Gattini IR". In ApJ (Apr. 2021)
- N. Blagorodnova, **V. Karambelkar**, S. M. Adams et al. "Progenitor, precursor, and evolution of the dusty remnant of the stellar merger M31-LRN-2015". In MNRAS (Aug. 2020)
- **V. Karambelkar**, S. M. Adams, P. A. Whitelock et al. "SPIRITS Catalog of Infrared Variables: Identification of Extremely Luminous Long Period Variables". In ApJ (June 2019)

Software skills

Advanced proficiency in Python, C++, SQL, HTML, git, Tensorflow and PyTorch.

Select open source softwares :

- mirar : Image processing software used by WINTER, SEDMv2 and DREAMS surveys.
- kowalski : An alert broker for time-domain astronomy.
- pydusty : MCMC-software for modeling dust around transients.

Service, Mentorship and Outreach

Peer review

- Reviewer for ApJ, AJ, A&A and MNRAS
- Proposal reviewer for 2025 Fondecyt Research Initiation Competition, Ministry of Science, Chile

Teaching

- TA: Graduate courses Interstellar Medium, Radiative Processes, Radio Astronomy (Caltech, 2021)
- TA: Undergrad courses on Electromagnetism and Calculus (IIT Bombay, 2016, 2019)
- Lecturer: ZTF Summer School (2021)
- Tutor: GROWTH Summer Schools (2018, 2020)

Mentorship

- Caltech SURF 2024 : Advait Mehla, Physics Postbac, IIT Bombay
  Project : *Measuring elemental abundances for RCB and dlHdC stars* (paper in prep)
- Caltech SURF 2023 : Aswin Suresh, Engineering Physics Junior, IIT Bombay
  Project: *An ML-based catalog of Long Period Variables from Palomar Gattini IR* (paper published)
- Caltech SURF 2022 : Sulekha Kishore, Computer Science Sophomore, Caltech
  Project: *Developing an alert-broker for WINTER* (paper with contributions published)
- Caltech SURF 2021 : Kayton Truong, Computer Science Freshman, Caltech
  Project: *Searching for periodic variables in Palomar Gattini IR* (paper with contributions published)
- Department Academic Mentor, IIT Bombay (2017 - 2019)

Outreach

- **Astrobites writer** (2020-2022) Published 13 articles summarizing research papers at a level accessible to undergraduates.
- Co-manager - Cahill Rooftop Observatory, Caltech (2021 - 2023)
- Volunteer at regular public lectures and stagazing events organized by Caltech Astro Outreach.
- Head, Students Association Physics Department, IIT Bombay (2017-2018)

Professional responsibilities

- Chair - Common envelope transient observers' collaboration (2023 - present)
- Co-convener - ZTF Multi-Messenger Astronomy working group meetings (2023 - 2024)

Talks, conferences and workshops

Invited talks

- Carnegie Observatories Seminar, Pasadena, USA (2024)
- Caltech/IPAC Seminar, Pasadena, USA (2024)
- MIT Seminar, Boston, USA (2024)
- Columbia University THEA Seminar (2024)
- Center for Computational Astrophysics Seminar (2024)
- University of Barcelona Seminar, Barcelona, Spain (2024)
- Princeton University Seminar, Princeton, USA (2023)
- Raman Research Institute Colloquium, Bangalore, India (2023)
- International Center for Theoretical Studies, Bangalore, India (2023)
- Indian Institute of Astrophysics, Bangalore, India (2023)
- Tata Institute of Fundamental Research (2023)
- Inter-University Center for Astronomy and Astrophysics (2021)

Contributed Talks and Posters

- Talk - 360^{o} approach to common envelope evolution - University of Barcelona (2024)
- Talk - Symposium on common envelope evolution, EAS meeting, Krakow (2023)
- Talk - The Transient and Variable Universe, UIUC (2023)

- Talk - White dwarfs from physics to astrophysics, KITP, UCSB (2022)
- Talk - 240th meeting of the American Astronomical Society, Pasadena (2023)
- Talk - Zwicky Transient Facility Team Meeting, Paris (2022)
- Talk - Exploring the transient universe with the Roman Space Telescope, Pasadena (2022)
- Poster - Keck Science Meeting 2021, San Diego (2021)
- Poster - Super Virtual Conference (2021)
- Talk - 235th meeting of the American Astronomical Society, Hawaii (2020)
- Poster - GROWTH conference, Mumbai (2018)
- Poster - Nobel Prize Lectures, IIT Bombay, Mumbai (2017)

Workshops

- Sub-mm Array Interferometry School for sub-mm astronomy (2021)
- ComSciCon Workshop for science communication, Los Angeles (2021)
- ZTF Summer Undergraduate Astronomy School, Pasadena (2018)
- National Initiative for Undergraduate Studies Physics Camp, Mumbai (2016)
- National Talent Search Scholars Nurtutance Camp, Mumbai (2012)