BHAGYA M. SUBRAYAN

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Citizenship : Indian

RESEARCH INTERESTS

• Multi-wavelength observations of astrophysical transients in time-domain astronomy • Electromagnetic counterparts of gravitational wave (GW) events • Maximizing scientific return from ongoing and upcoming all-sky surveys with state-of-the-art technologies • Dust reservoirs in core-collapse supernovae • Investigating precursor activities and mass-loss mechanisms in massive stars • Early photometric and spectroscopic observations of young transients • Radiative transport in stellar atmospheres with CMFGEN

CURRENT POSITION

Postdoctoral Research Associate **Sep. 2024 – Present**
Steward Observatory, University of Arizona, Tucson, AZ , USA

EDUCATION

Ph. D. Astrophysics, Purdue University, West Lafayette, Indiana, USA **Aug. 2018 – Aug 2024**
Thesis Title: Constraining Explosion Physics and Progenitors of Transients via Statistical Inferencing of All Sky Survey Data Streams
Advisor: Prof. Danny Milisavljevic

M. S. Physics, Indian Institute of Science Education and Research (IISER), India **Aug. 2013 – May 2018**
Integrated B. S - M. S Program
Major in Physics and Minor in Chemistry
CGPA: 8.59 / 10

RESEARCH EXPERIENCE

Graduate Research Assistant, Purdue University, West Lafayette, Indiana, USA **Spring 2021 – Aug 2024**
Advisor: Prof. Danny Milisavljevic

· Real-time characterization of transients for Recommender Engine For Intelligent Transient Tracking (REFITT). Inferencing Progenitor and Explosion Properties of Evolving Core-collapse Supernovae from Zwicky Transient Facility Light Curves.
· Multi-wavelength studies of anomalous transients. Scary Barbie: An Extremely Energetic, Long-duration Tidal Disruption Event Candidate without a Detected Host Galaxy at z = 0.995
· Working on MIRI IFU data cubes of supernova remnant Cassiopeia A obtained through JWST Cycle 1 GO Proposal (PI: Prof. Danny Milisavljevic) to understand elemental abundances, explosion mechanisms and progenitor systems involved in the core-collapse supernova explosion.

Master Thesis, IISER, Trivandrum, India **May 2017 – April 2018**
Advisor: Prof. Anil Shaji

· Worked on a theoretical project that analyzes Non-Markovianity and memory effects in open quantum systems by exploring the time evolution and its dynamics.

Research Scholar, Indian Institute of Astrophysics (IIA), Bangalore, India **Summer 2016**
Advisor: Dr. C. S. Stalin

· Formulated safety conditions for filters (NUV, FUV and Visible) of UVIT instrument in India's ASTROSAT mission. Developed software that analyzes FITS images (from GALEX) of astronomical sources and validates brightness threshold for UV and optical filters.

Research Intern, Indian Institute of Space Sciences and Technology (IIST), Trivandrum, India **Summer 2014**
Advisor: Dr. Anand Narayanan

· Developed a user-friendly interface for the spectral synthesis code CLOUDY using python. Simulated conditions in interstellar matter by calculating ionization, radiation transport and dynamics.

HONORS AND AWARDS

- George W. Tautfest Award for Outstanding Graduate Student in High Energy, Nuclear or Astrophysics, Purdue — April 2024
- Karl Lark-Horvitz Award for Outstanding Research Accomplishments, Purdue — April 2024
- Charlotte Ida Litman Tubis Award for Excellence in Scientific Communication, Purdue — April 2024
- Lijuan Wang Memorial Award, Physics and Astronomy, Purdue — April 2021, April 2023
- Women in Science Program (WISP) Travel Grant, Purdue — Fall 2022
- Summer Research Grant, Physics and Astronomy, Purdue — July – Aug. 2020
- Innovation in Science Pursuit for Inspired Research (INSPIRE) Scholar, Govt. of India — Aug. 2013 – May 2018
- Indian Institute of Astrophysics (IIA) Summer Scholar — May – July 2016

PUBLICATIONS

15. **Subrayan, B.**, Sand, D. J., Bostroem, K. , A. et al. Probing the Shock Cooling Emission in Stripped Envelope Supernovae: Early Photometric and Spectroscopic Observations of SN 2024uwq, 2025 (*in prep*)

14. **Subrayan, B.**, Milisavljevic, D., Garretson, B. et al. Probing Progenitors and Explosion Characteristics in a sample of Double-Peaked Stripped-Envelope Supernovae from ZTF, 2025 (*in prep*)

13. Dickinson, D. Milisavljevic, D., Garretson, B. et al. (*incl.* **Subrayan, B.**) Impressive, eXtreme, Fleeting: Rapid Follow-up Echelle Spectra of CSM Interaction in SN 2023ixf, 2025 (*in prep*)

12. Garretson, B. et al. (*incl.* **Subrayan, B.**) Population Study of Supernovae and their Host Galaxy Environments using Amortized Posterior Inference, 2025 (*in prep*)

11. Ravi, P. A., Valenti, S., Dong, Y., et al. 2024 (*incl.* **Subrayan, B.**) Luminous Type II Short-Plateau SN 2023ufx: Asymmetric Explosion of a Partially-Stripped Massive Progenitor (*submitted to ApJ*)

10. Wiseman, P., D., Williams, R.D, Arcavi, I. et al. (*incl.* **Subrayan, B.**) A systematically-selected sample of luminous, long-duration, ambiguous nuclear transients (*submitted to MNRAS*)

9. Jacobson-Galán, W., V., Davis, K., W., Kilpatrick, C., D., et al. 2024 (*incl.* **Subrayan, B.**) SN 2024ggi in NGC 3621: Rising Ionization in a Nearby, Circumstellar-material interacting Type II Supernova, ApJ, 972, 177

8. Milisavljevic, D. Temim, T., Looze, I. D., et al. 2024 (*incl.* **Subrayan, B.**) JWST Survey of the Supernova Remnant Cassiopeia A, ApJL, 965, L27

7. **Subrayan, B.**, Milisavljevic, D., Chornock, R., et al., 2023. Scary Barbie: An Extremely Energetic, Long-duration Tidal Disruption Event Candidate without a Detected Host Galaxy at z = 0.995, ApJL, 914, L9

6. **Subrayan, B.**, Milisavljevic, D., Moriya, T. J., et al. 2023. Inferencing Progenitor and Explosion Properties of Evolving Core-collapse Supernovae from Zwicky Transient Facility Light Curves, ApJ, 945, 4

5. Moriya, T. J., **Subrayan, B.**, Milisavljevic, D., Blinnikov, S., I. 2023. Synthetic red supergiant explosion model grid for systematic characterization of Type II supernovae, PASJ, psad024

4. Banovetz J., Milisavljevic, D., Sravan, N. et al. (*incl.* **Subrayan, B.**) 2023. Hubble Space Telescope Proper Motion Measurements of Supernova Remnant N132D: Center of Expansion and Age, ApJ, 948, 33

3. Dong Y., Milisavljevic, D., Leja, J. et al. (*incl.* **Subrayan, B.**) 2022. Physical Properties of the Host Galaxies of Ca-rich Transients, ApJ, 927, 199

2. Fesen R., Marcel, D., Weil, K., E. et al. (*incl.* **Subrayan, B.**) 2021. Far-UV and Optical Emissions from Three Very Large Supernova Remnants Located at Unusually High Galactic Latitudes, ApJ, 920, 90

1. Garretson, B., Milisavljevic, D., Reynolds, J. et al. (*incl.* **Subrayan, B.**) 2021. Supernova Host Galaxy Association and Photometric Classification of over 10,000 Light Curves from the Zwicky Transient Facility, Res. Notes AAS, 5 283

Transient Name Server AstroNote (TNSAN): 2021 : 30, 182, 222, 2020 : 225, 227, 232, 242, 243, 266
Transient Name Server Classification Reports (TNSCR): 2021 : 270, 812, 2270, 2756, 3224, 4157, 2020 : 3912

TELESCOPE PROPOSALS

- HST GO Cycle 32: GO 17748 - 3 orbits (PI) — GO Cycle 32
- Gemini Large and Long Program (LLP) - 150 hours (coI) — 2024B - 2027A
  Title: Gemini as the Ultimate Time Domain Follow-up Machine: Understanding the Nearest Cosmic Explosions
- NASA Keck Observing Time: PID N017 - 3 nights (coI) — 2024B
- The Neil Gehrels Swift Observatory, ToO - 22 ks (PI) — 2024
- Michigan-Dartmouth-MIT (MDM) Observatory (PI: Prof. Rob Fesen) - 30 nights (coI) — 2020 - 2023
- Las Cumbres Observatory: PID - NSF2023B-018 - 30 total hours (PI) — 2023B
- Gemini-North Fast Turnaround - PID: GN-2023B-FT-106 - 2.3 total hours (coI) — 2023B
- James Webb Space Telescope (JWST) - PID: GO1947 - 56.8 total hours (coI) — GO Cycle 1, 2021
- Southern Astrophysical Research Telescope (SOAR) - PID: SOAR2021B-006 - 28 total hours (coI) — 2021B
- Las Cumbres Observatory - PID: DDT2021A-002 - 5 total hours (PI) — 2021A
- Las Cumbres Observatory - PID: DDT2021A-004 - 4 total hours (coI) — 2021A
- Las Cumbres Observatory - PID: DDT2021A-003 - 3 total hours (coI) — 2021A

TECHNICAL EXPERIENCE

Technical Expertise: Statistical Data Analysis, Machine Learning, High Performance Computing, Integrated Field Unit, Optical Image Processing, Optical Spectroscopy, Data Mining and Wrangling, Python, C , C++
Software: JWST Reduction Pipelines, spacephot, JHAT, PyRAF, IRAF, ds9, LaTeX, TensorFlow, PyTorch, ccdproc, scikit-learn, GitHub, emcee, dynesty, Astropy, MOSFiT, SuperBol, Jupyter Lab, Matplotlib, Seaborn

TALKS AND POSTERS

- Rise_Time Conference, Purdue University — Indiana, August 2024
- Rare Gems in Big Data Conference, NOIRLab — Arizona, May 2024
- Observational Astronomy Meetings, CIERA, Northwestern University — Illinois, January 2024
- 243 American Astronomical Society (AAS) Winter Meeting — New Orleans, January 2024
- The Head Frontier Seminar Series — Online, December 2023
- Transient Science @ Space Telescope (TSST) Talk, STScI — Maryland, November 2023
- AstroCoffee @ John Hopkins University — Maryland, November 2023
- Transient Group Meeting, Harvard & Smithsonian Center for Astrophysics (CfA) — MA, November 2023
- Monday Afternoon Talk (MAT), MIT Kavli Institute for Astrophysics and Space Research — MA, November 2023
- BigBoom Talk Series, University of Arizona — Online, October 2023
- The Transient and Variable Universe (poster) — Illinois, June 2023
- Statistical Challenges in Modern Astronomy (SCMA) VIII (poster) — Pennsylvania, June 2023
- 241 American Astronomical Society (AAS) Winter Meeting (poster) — Washington, January 2023
- Super Virtual 2022 Conference — Online, November 2022
- Spoken-WERDD Symposium — Online, November 2022
- BOOM! An LSST Workshop — Illinois, July 2022
- Spoken-WERRD Symposium — Online, November 2021

LEADERSHIP

Women In Science Program (WISP, College of Science, Purdue University): Summer 2020 – 2023

· Designed and hosted a monthly series of events with invited speakers to discuss life-skill and science based topics to support women and non-binary STEM graduate students.

President, Physics Graduate Student Association (Purdue University) April 2022 – 2023

· Establishing PGSA's overall objectives, mission statement and value system. Liaison to Physics Faculty representing graduate student community.

TEACHING AND MENTORING

Teaching

· Guest Lecture: AST 567 - Observational Techniques in Astronomy — Fall 2023
· Guest Lecture: AST 364 - Stars and Galaxies — Spring 2023
· Guest Lecture: AST 567 - Observational Techniques in Astronomy — Fall 2022
· Guest Lecture: AST 567 - Observational Techniques in Astronomy — Fall 2021
· Lab Teaching Assistant : AST 263 - Descriptive Astronomy: The Solar System — Fall 2018/2019/2020
· Lab Manual Development for AST 263/AST 264 — Summer 2019

Mentorship : Graduate

· Danielle Dickinson, Purdue University — 2021 - present
Project: Analyzing JWST Mid-Infrared Integral Field Unit (IFU) Cubes of Supernova Remnant Cassiopeia A.
· Ziwei (Charles) Ding, Purdue University — 2022 - present
Project: 3 - Dimensional Reconstruction of Crab Nebula with SITELLE data.
· Kaustub Pavir Anand, Purdue University — 2021 - 2022
Bi-weekly meetings for research advice and professional development in graduate school.

Mentorship : Undergraduate

· Braden Garretson, Purdue University — 2020 - present
Project: Machine Learning Frameworks for Rapid Inference of Light Curves from All-Sky Surveys.
· Ethan Pinarski, Purdue University — 2022 - 23
Project: Classification of Transients in Search of Anomalous Supernovae using the ALeRCE Client
· Moira Andrews (current graduate student at University of California, Santa Barbara) — 2022
Provided guidance to revise application materials for graduate school.
· Yuxin (Vic) Dong (current graduate student at Northwestern University) — 2020
Provided detailed, constructive feedback on National Science Foundation (NSF) Graduate Fellowship Application.

ACADEMIC SERVICE AND OUTREACH

National Public Radio (NPR) 1A Show Guest Speaker 2023

· Invited as guest speaker for the prestigious National Public Radio (NPR) 1A show to discuss the latest work on AT 2021lwx aka Scary Barbie to a broad general audience.

Spoken-WERDD Symposium Scientific Organizing Committee (SOC) 2022

· Served as a core team member, responsible for tasks such as collecting abstracts, scheduling talks, and developing a code of conduct to ensure the successful execution of the symposium.

Astro On Tap Talk - Cradle of Astronauts 2022

· Invited to give a talk titled "Unraveling the mysteries of the Universe with JWST" at the Astro On Tap - Cradle of Astronauts series at Purdue.

Master of Ceremony (MC) for JWST Virtual Launch Party (Purdue University): December 25, 2021

· Moderated a virtual launch party with 6 science experts to celebrate launch of NASA's prestigious James Web Space Telescope Mission organized by Department of Physics and Astronomy.

Saturday Morning Astrophysics Outreach at Purdue (Purdue University): Spring 2021 – Present

· Presented virtual lessons for 7-12 graders about current topics in astronomy and fundamental astrophysics. Coordinated public observing nights at Cumberland Observatory.

SELECTED MEDIA

· Why does a leap year have 366 days?, 2024, Curious Kids, The Conversation
· Scientific Method: When a supermassive black hole devours a star, 2023, NPR 1A Podcast
· No Theory Can Explain Terrifying Cosmic Explosion Called Scary Barbie, 2023, YouTube
· Astronomers detect "Scary Barbie" supermassive black hole ripping apart huge star in "terrifying" spaghettification event, 2023, CBS
· 'Terrifying': Why the universe's largest cosmic explosion is called 'Scary Barbie', 2023, USA Today
· "Scary Barbie" Is The Brightest, Most Energetic, And Longest Spaghettification Yet, 2023, IFL Science
· Uncovering a star's demise: Supermassive black hole tears apart a giant star in a display brighter, more energetic and longer lasting than any observed before, 2023, Purdue News
· Master of Ceremony - First Light: A Discussion of the first images returned from the JWST, 2022, YouTube
· Master of Ceremony - JWST Launch Party, 2021, YouTube
· Saturday Morning Astrophysics Outreach, 2021, YouTube

REFERENCES

Prof. Danny Milisavljevic
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