Bhawna Mukhija

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Professional summary and Research interests

My current research focuses on astrophysics, particularly the evolution of massive stars. In the early stages of my Ph.D., I explored the fundamental properties of stars by reading numerous papers and gained experience with several stellar evolution codes to study their structure and evolution. So far, I have worked on topics such as giant eruptions in massive stars, accretion phenomena in binary systems, and the effects of metallicity on these evolutionary scenarios. During my M.Sc. in physics, I studied the detection of the 21 cm hydrogen line from the galactic plane and analyzed the galaxy's rotation curve using a self-constructed horn antenna.

During my research on the evolution of massive stars, I explored the critical role of mass loss mechanisms, particularly found in luminous blue variables (LBVs) undergoing a short-lived giant eruption phase. Similarly, other accretion mechanics occur in binary systems, where the companion star can accrete part of the ejected mass, influencing its evolution. We also explore the dynamics of rapidly rotating Be stars and their line-driven winds. Our work examined the effects of gravity darkening and oblateness on wind solutions in these fast rotators. My research interest lies in further investigating the post-main sequence behaviour of massive stars, focusing on the physical mechanisms governing their evolution.

Phd Projects

1.	**"Giant eruptions in massive stars and their effect on the stellar structure"** with A. Kashi `https://ui.adsabs.harvard.edu/abs/2024ApJ...974..124M/abstract`	APJ
2.	**"Accretion and Recovery in Giant Eruptions of Massive Stars"** with A. Kashi `https://ui.adsabs.harvard.edu/abs/2025arXiv250419884M/abstract`	APJ
3.	**"Pre-Supernova Multiple Giant Eruptions in Massive Stars"** with A. Kashi	under review (APJ)
4.	**"High power accretion in massive binary systems and impact of the metallicity"** with A. Kashi	under review (New Astronomy)
5.	**"Effect of gravity darkening and oblate factor in rapidly rotating massive stars"** with M.Cure, and I. Araya	under review (A&A)
6.	**"Stellar envelope response to the energy deposition in the massive stars "** with A. Kashi	under review APJ
7.	**"A grid of massive binary systems during the wind accretion"** with Myself	Ready to submit
8.	**"Studies the Synthetic Spectrum of Massive stars during the Accretion phase "** with E. Almeida and A. Kashi	Ongoing with collaborator
9.	**"Exploring the Structural Response of HR 8752 to Eruptive Events via Stellar Evolution Simulations"** with Michaela Kruas	Ongoing with collaborator

Education

PhD **(Ariel University, Israel)** with focus on theoretical astrophysics — 2022 – today

- **Coursework: Stellar physics, General relativity, light and matter interactions**

M. Sc. **(National Institute of Technology, Tiruchirappalli)** in physics with a focus on — 2018 – 2020

stellar physics (grade: 8.67)
Master's thesis title: "Experimental setup for the detection of 21cm line Hydrogen spectrum from the galactic the plane"
"Evolution of probability distribution function in redshift space"
Advisor: Dr. R. Justin Joseyphus,

B. Sc. **(University of Maharani College, Jaipur, Rajasthan)** in physics (grade: 6.8) 2012 - 2015

School (B.A.V.P, Sikri) (grade: 8.9) 2011-2012

Teaching Experience

I have previously taught undergraduate courses and continue to mentor students in physics today. Teaching remains a valuable and active part of my academic work.

Attended programs

- **A visit to Astronomical Institute of the Czech Academy of Sciences**, Czech Republic (2025)
- **High energy theory, cosmology, and Multi-messenger Astrophysics (flash talk)**, Israel (2025)
- **POEMS- Physics of Extreme Massive stars (contributed talk)**, Brazil (2024)
- **Stellar Wind and Outflow of Massive Stars School (mini talk)** , Czech Republic (2023)
- **MESA summer school**, Budapest (2023)
- **Is-Ko-Space (flash talk)** , Israel (2023)
- **ASCOS III (contributed talk)**, Israel (2023)
- **ASCOS IV**, Israel (2024)
- **Workshop Introductory Astronomy and Astrophysics (2019)**,
  Amateur Astronomer's Society Dr. Chandan Joshi, Professor, Poornima University, Jaipur
- **Camps on hands-on experience on Radio Astronomy (CHERA-2019**),
  Gauribidanur Observatory, Raman Research Institute, Bangalore
- **Conference of modern engineering trends in astronomy (2019)**,
  Indian Institute of Astrophysics, Bangalore
- **Evolution of galaxy : periodic table 2019**,
  Indian Institute of Astrophysics, Bangalore
- **Cosmology summer school (2020)**,
  Michigan University USA (online).
- **3rd global 21 cm workshop (2020)**,
  University of Cambridge (online)
- **UVIT 5 years of operation (2020)**,
  Indian Institute of Astrophysics, Bangalore

Achievements

- Excellence award for the outstanding research in the Department of Physics, Ariel University, Israel (2025),
- Vikram Sarabhai Innovation Competition (VISION)-2019, Physical Research Laboratory, Ahmedabad,
- Innovation in Science Pursuit for Inspired Research(INSPIRE), Department of Science and Technology, Government of India.
- JEST Exam, Rak-116
- Gate Exam - Qualified
- Awarded by Rajiv Gandhi Laptop Yojana - awarded a Laptop
- Gargi Award 2 times,

Skills

Codes

MESA = stellar evolution code

CMFGEN, Tlusty - atmospheric synthesis spectrum code

Hydwind - solution of line driven winds

Geneva - stellar evolution code

Programming

- Python 3
- Matlab

References

Amit Kashi PhD. supervisor

- Department of Physics, Ariel University
- email: kashi@ariel.ac.il

Noam Soker

- Techion, Israel
- email: soker@physics.technion.ac.il

Dina Prialnik

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Michel Cure

- Instituto de Física y Astronomía, Universidad de Valparaíso, Chile
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Ignacio Araya

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- email: ignacio.araya@umayor.cl

Michela Kraus

- Astronomical Institute of the Czech Academy of Sciences
- email: michaela.kraus@asu.cas.cz