Surendra Bhattarai

Website, Youtube, Github, Linkedin, ORCID, Google Scholar
Kline Tower 301, Dep. of Astronomy, Yale University, 06511, CT, USA, Email: surendra.bhattarai@yale.edu

EDUCATION

Yale University *August 2024 - Present*
PhD, Department of Astronomy

Indian Institute of Science (IISc.) Bangalore *August 2023 - May 2024*
MS Thesis Project, Department of Physical Sciences

Indian Institute of Science Education and Research (IISER) Kolkata *August 2019 - May 2024*
BS-MS Dual Degree, Department of Physical Sciences

PUBLICATIONS (H-INDEX: 3)

- **Published; Contributing Author:** *VaTEST III: Validation of 8 Potential Super-Earths from TESS Data.* - P. Mistry, A. Prasad, M. Maiti, K. Pathak, S. Gharat, G. Lekkas, **S. Bhattarai**, D. Kumar, et al. 2024, **PASA**, 41, e030, URL

- **Published; Contributing Author:** *VaTEST II: Statistical Validation of 11 TESS-Detected Exoplanets Orbiting K-type Stars.* - P. Mistry, K. Pathak, A. Prasad, G. Lekkas, **S. Bhattarai**, S. Gharat, et al. 2023, **The Astronomical Journal**, 166, 9, URL

- **Published; Contributing Author:** *VaTEST I: Validation of Sub-Saturn Exoplanet TOI-181b in Narrow Orbit from its Host Star.* - P. Mistry, K. Pathak, G. Lekkas, A. Prasad, **S. Bhattarai**, M. Maity, et al. 2023, **MNRAS**, 521, 1066-1078, URL

AWARDS / FELLOWSHIPS / ACHIEVEMENTS

- Discovered 1 main-belt asteroid: ***2021 LH10***, in the International Asteroid Search Campaign Link *2021*
- **INSPIRE-DST Fellowship** for being among top 1% students in India in Higher Secondary Link *2019 – 2024*
- **Anundoram Borooah Award** for securing excellent scores in Secondary education Link *2017*

PRESS RELEASE

Our discovery of 12 Exoplanets using statistical tools got coverage in the *Times Of India* newspaper. Newspaper link

RESEARCH EXPERIENCE

Simulation of Mass Enhancement Mechanisms in White Dwarfs: Magnetic Fields, Rotation and Modified Gravity Effects (Master's Thesis Project) *May, 2023 – May, 2024*

Indian Institute of Science (IISc.) Bangalore
Advisor: **Prof. Banibrata Mukhopadhyay**, Department of Physics, IISc. Bangalore (Group Website)

- Modified the stellar evolution code `MESA` and `STARS` to simulate a magnetized WD, incorporating the magnetic field pressure to enhance White Dwarfs' (WDs) mass retention due to the extra classical magnetic pressure.
- Investigated the potential maximum mass attainable by WD and checked if they could be *super-Chandrasekhar WD.*
- Further plan is to explore the influence of various magnetic field profiles on this mass limit, while also examining the impacts of WD's rotation and modified gravity on the WD's maximum mass.

VaTEST Project: Detection of Exoplanets using Statistical Tools. *April, 2022 - Present*

(Independent students-led project) (Project website)

- Detected 12 exoplanets (see the publication section for results) in an independent (and ongoing) project undertaken by 7 students including me using statistical tools like `TRICERATOPS`, and Python packages such as `lightkurve` with the implementation of Bayesian methods. Our new project on detection of 8 new super-Earths has made **headlines** in numerous news sites (WION, UniverseToday, Space.com). Here, we have also used the radial velocity data from HARPS.
- Studied the atmospheric properties of these exoplanets using transmission and emission spectroscopy metrics (TSM and ESM) analysis.

Investigation of the effect of stellar populations on the estimate of Galaxy spin parameter. *July, 2023 – Dec, 2023*

International Centre for Radio Astronomy Research (ICRAR), University of Western Australia
Advisor: **Prof. Luca Cortese**, Interim Director, Science (UWA) (Group Website)

- Enhanced the current methodology for determining the galaxy spin parameter from SDSS-MaNGA data.
- Investigated the impact of recalibrating velocity and velocity dispersion by weighting them with respect to stellar mass, as opposed to the conventional approach of weighting them by luminosities.

Simulating Sedov-Taylor Spherical Blast Waves *Jan – May, 2023*

IISER Kolkata

Advisor: **Dr. Sudip Kumar Garain**, Department of Physics, IISER Kolkata

- Simulated the Sedov-Taylor blast wave problem in 3-D and identified the shock surface.
- Verified that the shock was indeed spherical in shape and determined the radius of the spherical blast and the velocity of expansion of the shock. Finally, the relation between radius vs time and velocity vs time was determined, and it was found that the size of the spherical blast increases as $t^{2/5}$, while the velocity of the shock decreases as $t^{-3/5}$.

Comparison between Eccentric GW signals & micro-lensed GW signals *July – Oct, 2022*

Inter-University Centre for Astronomy and Astrophysics (IUCAA) Pune

Advisor: **Dr. Apratim Ganguly**, IUCAA

- Worked with `TaylorF2Ecc` waveform, which is a `TaylorF2` post-Newtonian (PN) waveform model with eccentric corrections that incorporates the effects of eccentricity only in the phase and not in the amplitude.
- Finally, we obtained a parameter space (y vs. M_{lens}) where the match between the eccentric and the micro-lensed waveforms was significant.

IAstro Summer Internship 2022 *July - Sep, 2022*

Instituto de Astrofísica e Ciências do Espaço (IA), Lisbon

Advisor: **Prof. Cirino Pappalardo** and **Dr. Israel Matute**, IA

- This was a remote internship on "**Passive, but not resigned**" where I studied blue star-forming and red passive galaxies, and a new type of galaxies migrating from blue star-forming cloud to red passive zone.
- Compared the outcomes from different selection methods applied to Cosmic Evolution Survey (COSMOS).
- From observations, we understood that finding a better selection method for identifying passive galaxies is important to make use of telescope time effectively.

SKILLS

Programming skills:

Languages: Python (marvin, pycbc, bilby, lightkurve, triceratops, astropy, matplotlib, numpy, pandas), C, Fortran, MATLAB, shell scripting

Tools/Softwares: High Performance Computing (HPC), `MESA`, `STARS`, Astrometrica, LaTeX, Gnuplot, ORIGIN, Stellarium, VizieR, `sdss-marvin`

Statistical Techniques: Bayesian analysis, Machine Learning, MCMC

PRESENTATIONS / POSTERS

- "***Can Eccentric GW signals mimic Microlensed signals?***" at GWRG meeting at IUCAA Pune. *02 Aug, 2022* Presentation video link
- "***Passive, but not Resigned - Galaxies that are transforming from active star forming to passive (quiescent).***" at iAstro Summer Internship, Portugal *31 July, 2022*

CONFERENCES / WORKSHOPS ATTENDED

- 2024 Tinsley Workshop at Yale University (*27 - 29 Oct, 2024*)
- 2023 Sagan Exoplanet Summer Hybrid Workshop - NExScI (*24 - 28 July, 2023*)
- 32nd meeting of Indian Association for General Relativity and Gravitation (IAGRG32) at IISER Kolkata (*19 - 21 Dec, 2022*)
- SPARC WORKSHOP on "*Machine Learning in Solar Physics and Space Weather*" at Center of Excellence in Space Sciences India (CESSI), IISER Kolkata (*28 June - 02 July, 2022*)
- ngEHT (Next-Generation Event Horizon Telescope) meeting on *"From Vision to Instrument: Designing the Next-Generation EHT to Transform Black Hole Science"* (*01 - 05 Nov, 2021*)
- National Science Camp (VIJYOSHI) at IISER Kolkata (*08 - 10 Dec, 2019*)

TEACHING EXPERIENCE / VOLUNTEERING SERVICES

- **Teaching Assistant** for **Introduction to Astronomical Observing (ASTR155)** course at Yale University. *Aug - Dec 2024*
- **Teaching Assistant** for **Computational Physics (PH3205)** course at IISER Kolkata. *Jan - May 2023*
- Science outreach volunteer at National Space Science Exhibition at Science City, Kolkata. *06 - 11 Dec 2022*
- Subject matter **expert** in "Other Maths" subject at Chegg.com. *Oct, 2022 - Present*
- Basic mathematics and science tutor at *Ek Pehal*, IISER Kolkata. *Aug, 2019 – Apr, 2020*

SUMMER / WINTER SCHOOLS ATTENDED

■ Introductory Summer School in Astronomy and Astrophysics (ISSAA) at IUCAA.

Inter-University Centre for Astronomy and Astrophysics (IUCAA) Pune *16 May - 17 June, 2022*

Mentor: Prof. Sanjit Mitra, Prof. Ajit Kembhavi, Prof. Somak Raychaudhury, Prof. Sukanta Bose, Prof. Kanak Saha

Got exposure to the research going on in radio astronomy, solar physics, galaxy evolution and gravitational waves including upcoming projects of LIGO, LISA and Square Kilometer Array.

■ Radio Astronomy Winter School at NCRA Pune.

20 Dec, 2021 to 01 Jan, 2022

National Centre for Radio Astrophysics (NCRA) Pune

Mentor : Prof. Nissim Kanekar, Prof. Dhruba J. Saikia, Prof. Avinash Deshpande, Dr. Ruta Kale

Detected pulse profile of the Vela pulsar from the Ooty radio telescope (ORT) data. We also detected radio frequency interference (RFI) in Giant Metrewave Radio Telescope (GMRT) data and determined HI line parameters.