VANSHAJ KERNI

https://vanshaj18.github.io/ | vkerni@ph.iitr.ac.in | vanshaj kerni

EDUCATION

Indian Institute of Technology Roorkee *Fall 2018–Spring 2023 (tentative)*
Integrated Master (BS + MS) Physics *8.72/10 (92.2%)*
MS Thesis: Constraining Cosmological Model with current and future observational data
Advisor: Eleonora Di Valentino, Moumita Maiti (co-advisor)

COLLABORATIONS

Associate Member – Indian Pulsar Timing Arrary–InPTA May'22 - present
Student Member – Astronomical Society of India May'22 - present
Student Member – American Physical Society Aug'21 - Aug'22

MAJOR PROJECTS

Noise Analysis on InPTA dataset Spring'22-Ongoing
InPTA *collaboration work*

- Objective: To characterize the common red noise present due to the nano-Hz Gravitational waves emitted by supermassive black hole binary systems.
- Working in team of four to develop codes for parallel processing of samplers codes.

Statistical analysis of optical nebular properties of WRPNe and non-WRPNe May'22 - Ongoing
Advised by Prof Muthumariappan C *Indian Institute of Astrophysics*

- Objective : To see any statistical correlation among PG1159, *WELS*, [WR] hydrogen deficit stars.
- Performed literature survey to develop the first catalogue for confirmed and prospective PG 1159-035 type candidate stars.

The spherical evolution of cosmic voids in Chaplygin gas dark energy models Nov'21 - Ongoing
Advised by Dr.Geetanjali Sethi *Delhi University*

- Objective: To understand the evolution of void structures in the Chaplygin Gas dark energy model.
- Studied various research papers and books on Cosmic Voids, Structure formation, Chaplygin Gas dark energy model.

Modelling hemodynamics in stenosed microchannels *Spring 2021 – Fall 2021*
Advised by Dr.Ameeya K. Nayak *IIT Roorkee*

- Objective: To understand the blood flow in a stenosed part of blood vessel modelled as a tube with sudden expansion and contraction regions.
- Derived analytical solutions of Navier-Stokes equations with electric potential and pressure gradient acting as source terms.
- Work resulted in a peer-reviewed conference paper. Currently working on extending the work and submitting to journal.

Analysis of stellar and orbital parameters of OGLE-UCXB-01 *Fall 2021*
Advised by Ms.Feven Markos Hunde *SSERD*

- Objective: Analyzed stellar and orbital parameters of the first discovered Ultra-Compact X-Ray binary, OGLE-UCXB-01, in the OGLE data with aim to explore the high energy astrophysics field.
- Studied and reproduced the only two published works on OGLE-UCXB-01 by Dr. Shuai Peng and Dr.Rong-Feng Shen.

Verification of Bethe-Bloch formula using Geant4 toolkit *Summer 2020*
Advised by Dr.Jyothsna Rani Komaragiri. *IISC Bangalore*

- Objective: To verify the Bethe-Bloch energy loss relation for charged particle moving through different medium.
- Studied background theory on particle interactions, energy loss mechanisms and detecting methods.
- Analysed data from Geant4 simulations. Used NIST standard database for electron, proton and alpha to validate the results.

Asteroseismology of Solar Type Stars *Fall 2019-Spring 2020*
Advised by Dr.Anwesh Mazumdar. *HBCSE Mumbai*

- Objective: Studied stellar evolution, stellar pulsations and asteroseismology techniques from J.C.Dalsgaard notes and Sarbani Basu's book.

- Analysed modelled data for five stars ageing from 73 million to 82 billion years.

MINOR PROJECTS

Building 5m aperture radio telescope at IIT Roorkee August 2020 - May 2022
Club project *RTP-PaAC, IIT Roorkee*

- Written abstract, introduction and conclusion in the poster presented as part of the collaboration's work in the Instrumentation and Techniques section.
- Acted as collaboration's presenter at the 2022 Astronomical Society of India conference.

Calculation of Local Dark Matter Density Oct 2021
competition submission *Hyperion, IIT Kanpur*

- Re-derived the theoretical framework for the calculation of local dark matter density. Used it to arrive at an experimental value for the same after analysing the data given as part of the competition.

Study of relativistic effects on WD-WD binary star systems and Neutron stars. Sept 2020
competition submission *Researchathon, NIT Surat*

- Reviewed the effects of General Relativity on orbital motion and equation of states of the WD-WD star system and Neutron stars.

PEER REVIEWED CONFERENCE PROCEEDINGS

- Julie Jacob Thomas, **Vanshaj Kerni**, Geetanjali Sethi - **The spherical evolution of cosmic voids in Chaplygin gas dark energy models.** *In the* 40^{th} *Meeting of the Astronomical Society of India.* (General Relativity and Cosmology section)
- M.Majhi, A.K.Nayak, **Vanshaj Kerni** - **Flow characteristics and platelet adhesion of blood flow in a corrugated micro-channel with the reduction and extension of shear effects.**
  In 26^{th} *National &* 4^{th} *International ISHMT-ASTFE Heat and Mass Transfer, December 17-20, 2021, IIT Madras, Chennai.* (DOI: 10.1615/IHMTC-2021.1110, pages 739-745).
- **Vanshaj Kerni** (presenter) on behalf of the Radio Telescope Project Team - **Building a 5m aperture small radio telescope at IIT Roorkee.** *In the* 40^{th} *Meeting of the Astronomical Society of India* (Instrumentation and Techniques).

ELECTRONIC PRINTS

- On arXiv - **V.Kerni**, J.Komaragiri - **Verification of Bethe-Bloch formula using Geant4 toolkit**.
- On Research-Gate - A.Rawat et.al (all equally authored) - **Analysis of Stellar Parameters of Ultra Compact X-Ray Binary-OGLE-UCXB-01**.
- On Research-Gate - R Mehta, **V Kerni**, P Marmat - **Lightening up the Dark Matter**

TECHNICAL SKILLS

Languages: Python, MATLAB, Gnuplot, HTML5, CSS3, LaTeX
Management system: Git, Github, Conda, Excel, MS Office
Computing: HPC(Slrum), Centos7.9, Linux, Windows
Libraries: Scipy, Pandas, scikit-learn, mpi4py, MPI
Softwares: VS Studio, Jupyter lab, DS9, COMSOL, GeoGebra, Canva, Figma

AWARDS & FELLOWSHIP

NTU Summer Research Student	May'22 - July'22.
Indian Institute of Astrophysics Visiting Student Fellowship	May'22 - Aug'22
Gold Medal in IIT Kanpur Hyperion Case Study	Oct'21
Silver Medal Inter IIT Tech Meet 9.0	March'21
Indian Academy of Science, Summer Research Fellowship	June'20 - Aug'20
IIT Roorkee Merit-cum-Means Scholarship (five semesters)	Spring'20 - Spring'22
Bronze Honour in International Astronomy and Astrophysics Competition	July'20
Recipient of 2019 Chittal Arasakesari Annual Excellence Award	2019

CONFERENCE & SUMMER SCHOOLS

Attended IIA Online Summer School.	July 2022
Attended ICTP Summer School on Cosmology.	July'22
Attended Introductory Summer School in Astronomy and Astrophysics (ISSAA) by IUCAA.	June 2022
Attended in Sagan Exoplanet Summer Workshop.	July'21
Attended Dark Matter 2021: From the Smallest to the Largest Scales.	Sept 21
Attended SLAC Summer School: Higgs Fair.	Aug 2021
Co-Organised Mysteries of Universe II Colloquium.	Jan - May 2021
Co-Organised Mysteries of Universe Colloquium.	Oct - Nov 2020
Attended NIUS Summer school.	June 2019

LEADERSHIP & EXTRA CURRICULARS

Student Mentor, Student Mentorship program, IIT Roorkee	Dec 2022 - present
Volunteer, 40^{th} Astronomical Society of India (ASI) conference	Mar 2022
Additional Secretary, Physics and Astronomy Club, IIT Roorkee	May 2021 - May 2022
Co-leader, Radio telescope project, IIT Roorkee	Jan 2019 - May 2022
Team Member, Hyperion Astronomy Competition by IIT Kanpur.	Oct 2021
Website designer, Mysteries of Universe online colloquiums	Oct 2020 - May 2021
Indian Ambassador at International Astronomy and Astrophysics Competition (IAAC)	July 2020 - present
ETS English Language Research Study participant.	Feb - May 2021
Team co-leader, NIT Surat Researchathon	Sept 2020
Joint Secretary, Physics and Astronomy Club, IIT Roorkee	2020-2021
Executive Member, Physics and Astronomy Club, IIT Roorkee	2019-2020
Member of SOPAN Society, IIT Roorkee	2019 - present
Volunteer Teacher, National Service Scheme	2018 - 2019

MOOCS TAKEN (*AUDIT)

- Introduction to High performance and Parallel Computing* (University of Colorado, Boulder), Fundamentals of Deep Learning (NVIDIA Deep Learning Institute), Python For everybody(University of Michigan), From Big Bang to Dark Energy(University of Tokyo), Astro 101: Black Holes (University of Alberta), Astrobiology: Exploring Other Worlds(University of Arizona), Introduction to Philosophy(University of Edinburgh), Astrobiology and search for extraterrestrial life(University of Edinburgh), CPP.PGR1. Introduction to C++(NYUx).

REFERENCES

Anil Gourishetty
Associate Professor
Department of Physics
IIT Roorkee
anil.gourishetty@ph.iitr.ac.in

C. Muthumariappan
Professor
Star and Galactic Group
Indian Institute of Astrophysics
muthu@iiap.res.in

H.S. Nataraj
Assistant Professor
Department of Physics
IIT Roorkee
hsnataraj@ph.iitr.ac.in