Riya

Curriculum Vitae

(+91) 84549-30220
160100097@iitb.ac.in

Education

2016–2020 **Bachelor of Technology**, *Department of Mechanical Engineering, Indian Institute of Technology, Bombay, India.*
CGPA: 9.33/10

Minor: Physics.

2016 **Intermediate**, *Jawahar Vidya Mandir, Shyamali, Ranchi, India*, Percentage: 93%.

2014 **Matriculation**, *Bridgeford School, Ranchi, India*, CGPA: 10/10.

Research Interests

Astro-Particle Detectors: Simulation-framework, Material Characterization, Data-analysis

Conference Talks and Publications

- V. Rentala, **Riya** (preprint)
  "Neutrinos from the Cosmic Noon", (in preparation)
- **Riya**, S. Chirame et al. (preprint)
  "Closed Loop Simulation for Attitude Control of Nano-Satellite", (Submitted to Springer)
  International Conference on Small Satellites and Systems 2019, Hyderabad, India
- *"Star Formation Rate using Diffused Supernova Neutrino Background"*, (Oral Presentation)
  20^{th} National Space Science Symposium 2019, Pune, India

Research Experience

2018-Present **Star Formation Rate using Diffused Supernova Neutrino Background**
Supervisor *Prof. Vikram Rentala, Department of Physics, Indian Institute of Technology (IIT), Bombay*

- Analyzed the use of Diffused Supernova Neutrino Background (DSNB) in resolution of discrepancy in Global Star Formation Rate due to difference in peak values inferred using UV+IR and H_α
- Reviewed the existing probes for measuring star formation rate and analyzed the **best-fit models**.
- Simulated expected **positron spectrum** at Hyper-Kamiokande **neutrino detector** due to DSNB
- Critically examined the **confidence level** of rejecting H_α-SFR, if UV+IR SFR is true, using χ^2 **test**
- Evaluated scope of χ^2 test results, after consideration of various backgrounds using **likelihood test**

2019 **Scintillator Material Characterisation for SABRE Dark Matter Detector** (Report)
Supervisor *Dr Lindsey Bignell, Department of Nuclear Physics, Australian National University*

- Involved in the characterization of **liquid scintillator veto** for SABRE; a direct detection experiment to search an annual modulation in signal for verifying the claim of **WIMP** detection by **DAMA/Libra**
- Performed weekly measurements of **relative light yields** of scintillator samples (kept in contact with detector materials) for determining the degradation of scintillator due to material-contact
- Outlined a methodology for measurement of the **scintillation decay time** (needed for simulation)
- Assisted in **purification and storage** of scintillator and detector-materials for the compatibility test

Academic Achievements

2019 Awarded **Undergraduate Research Award** for the verification of global star formation rate using expected detection rate of diffused supernova neutrino background at Super-Kamiokande.

2019 Selected as **Future Research Talent** scholar to pursue research at ANU for a period of 11 weeks

2019 Ranked 7^{th} amongst **150** students in Mechanical Engineering Department

2016 Awarded the prestigious Kishore Vaigyanik Protsahan Yojna **(KVPY)** fellowship by **IISc**

Technical Experience

2017-Present **IIT Bombay Student Satellite Project**

Advitiy - Second Generation Student Satellite of IIT Bombay

Subsystem Leader, Attitude Determination and Control Subsystem

- Spearheaded a team of 8 members to develop quality assured **simulation frame-work** to determine the in-orbit attitude deviation of satellite for the ground-verification of chosen control-algorithms.
- Contributed to **Satellite 101 wiki** - a pro bono outreach effort as a part of social goal of the team to facilitate knowledge sharing; **47.1k** pageviews and **18.4k** users around the globe within 1.5 years
- Executed three step recruitment process to select **8** students for the subsystem from **50+** applicants evaluating their technical ability, practical approach and team work

Payload Subsystem

- Explored different applications of **cubesat based telescope** such as studying sun's chromosphere, correlating solar-flares and energetic particles etc.; inspected their implementation-feasiblity
- Analyzed the electrical, mechanical and control law requirements of **star-tracker** to determine the feasibility of its application as an attitude sensor for cubesats as per the guidelines of **ISRO**
- Worked on the design of **electron emission circuit** of tether - a cable used for deorbiting a satellite
- Coordinated a team of 4 to select a payload for **GLEE** - a mission to send chip-satellites to moon
- Evaluated the use of **photovoltaic modules** (used in solar panels) for the sun vector measurement; **rejected the idea** as improvement in mass and power budget is negligible compared to increase in failure probability of satellite due to increased complexity of required electric circuit

Teaching Experience

Summer 2018 **Teaching Assistant - Engineering Mechanics**

Prof. D M Dewaikar, Department of Civil Engineering, IIT Bombay

- Entrusted with responsibility of tutoring **35** undergraduate students having a backlog in the course
- Helped students get better insight of the course, clarified doubts and assisted in solving numericals

Summer/Winter School

2018 **GROWTH Winter School** - *A three-day intense program with short lectures followed by interactive hands-on sessions to introduce students to techniques and strategies for multiwavelength observations*

- Acquainted with analysis of X-ray and radio data, lightcurve analysis and optical and IR spectroscopy
- Planned the **observing run** and observed various supernovae using GROWTH-India telescope; Processed the obtained raw images and performed **photometric analysis** to discover transients

2017 & 2018 **Summer of Science** - *An initiative by Maths and Physics Club, IIT Bombay to boost knowledge of pure sciences where one can study any topic under the guidance of a proficient mentor*

Relativity Studied **special theory of relativity** and **tensor analysis** to lay the foundation of general theory

Cosmology Studied basics such as Friedmann equation, acceleration equation etc., and used them to understand higher concepts such as **dark matter, neutrino cosmology**, inflation etc. using newtonian approach

Key Course Projects

Spring 2018 **Big Bang Nucleosynthesis** (Course: Astrophysics)
Prof. Vikram Rentala, Department of Physics, IIT Bombay

- Obtained an overview of big bang nucleosynthesis, searched the open problems and further studied the problem of **discrepancy** between predicted and measured amount of **lithium**
- Reviewed the prediction of **H, D, He** and **Li** abundances in the universe using currently accepted Maxwell Boltzmann distribution and then compared them to **Tsallis nonextensive statistics** model

Autumn 2018 **Microlens arrays using Spin Coating Process** (Course: Manufacturing Processes II)
Prof. Amber Srivastava, Department of Mechanical Engineering, IIT Bombay

- Developed a **mathematical model** to predict the shape of final lens based on the chosen parameters
- **Manufactured** different microlens arrays varying the parameters of spin-coating process
- Interpreted the effects of changing the parameter values by characterizing the manufactured-arrays

Internship

Winter 2017 **Aerostat for Military Surveillance**
Manastu Space Technologies Private Limited

- Developed two dimensional **gore-profile** for construction of 3D envelope for given design of aerostat
- Manufactured a **prototype** using Low Density Polyethylene to experimentally determine the increase in lift for **kytoon** which is a combination of heavier than air kite and lighter than air balloon

Positions of Responsibility

Autumn 2017 **Associate Secretary**
- Spring 2018 *Department of Mechanical Engineering, IIT Bombay*

- Responsible for facilitating the interaction of **140+ freshmen** with department faculties and seniors
- Successfully organized events like convocation, department trip etc. catering to **500+ students**

Technical Skills

Languages Python, C++, LaTeX, HTML
Simulation MATLAB, Mathematica, Simulink

Relevant Courses

Physics Astrophysics, Methods in Experimental and Nuclear Physics, Statistical Physics, Quantum Mechanics, Classical Mechanics, Data Analysis & Interpretation, Basics of Electricity and Magnetism
Mathematics Introduction to Numerical Analysis, Linear Algebra, Differential Equations, Calculus
Mechanical Heat Transfer, Thermodynamics, Fluid Mechanics, Nuclear Reactor, Mechanical Measurements

Extra-Curricular

Social Service

- Taught **basic mathematics** to students belonging to classes **6-9** at Abhyasika, an NGO which provides free and quality education to underprivileged children of nearby slums, for **4 months**
- Assisted in execution of 'SHE' an initiative by **Techfest** to promote Sanitary and Health Education through a network of distribution of **200000+** sanitary pads through a route covering **37** villages

Public Outreach

- Organized and conducted a **Ground Station Workshop** under Advitiy attended by **50+** students and presented the use and working of rotor and rotor-interface for precise alignment of antenna
- Exhibited Pratham in engineers' conclave held at sixth **Inter-IIT Technical Meet**