SUKRIT JAISWAL

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EDUCATION

Indian Institute of Science Education and Research, Pune *August 2018 - May 2023*
BS-MS Dual Degree

Nehru Smaraka Vidyalaya (BIA), Bengaluru *2016-2018*
Higher Secondary Education 12th Standard (CBSE) **Overall score: 91/100**
Physics, Chemistry, Biology, Mathematics, English

Little Flower School, Gorakhpur *2016*
Secondary Education 10th Standard (ICSE) **Overall Score 95/100**

PUBLICATIONS

Constraining dense matter physics using f mode oscillations in neutron stars, **S Jaiswal, D Chatterjee, 2020 ; Preprint arxiv 2007.10069 ; Physics 2021, 3(2), 302-319**

RESEARCH EXPERIENCE

Max Planck Institute for Plant Breeding Research **Cologne, Germany**
A Continuum Mechanical Approach to model Leaf Growth
(with Prof. Dr. Miltos Tsiantis)
Master's Thesis Project *June 2022 - May 2023*

- **This is a physics led approach to the understanding and generating computational models of leaf development in *Arabidopsis Thaliana* at different levels of abstraction or to characterize mechanical properties of leaf cells that underlie their growth**
- **Using concepts of biomechanics and solid continuum mechanics connected to morphogenesis in plants, gene expression and/or cell-level development and morphology will be quantified as part of the study.**
- **FEM-based mechanical simulations (development of C++ software) for multicellular and continuous structures (steady state mechanics and growth)**

IISER Pune **Pune, India**
Forbush decreases in the context of a diffusion-expansion model
(with Prof. Prasad Subramanian) *January 2022 - July 2022*

- **Galactic cosmic rays detected at the Earth exhibit a transient decrease in intensity followed by a gradual recovery in response to the passage of a solar coronal mass ejection. These are called Forbush decreases, for which there are extensive observational databases available**
- **We examined Forbush decrease data (with special emphasis on the recovery) in the context of a diffusion-expansion model, with a view to constraining the diffusion coefficients for energetic particles across magnetic fields**

IISER Pune **Pune, India**
Climate and Surface Modelling by CLiMT
(with Prof. Joy Merwin Monteiro) *August 2021 - December 2021*

- **I started by getting a broad overview of the topics in climate science**

- We aimed to implement a realistic boundary layer and land surface in CLiMT. Once these were written and tested, they were used to understand the effects of "large scale forcing" on the surface energy balance. This work was done to create a stepper model for calculating surface fluxes and iteratively calculate the new values of near-surface temperature and humidity
- We successfully created a model and presented a simplified physical parameterization scheme, designed to be used with other componentis in CliMT to bridge the gap between Global Climate Models and idealized dry models

IUCAA **Pune, India**
Study of Nuclear Parameter dependence on Neutron Star p-modes
(with Prof. Debarati Chatterjee) *February 2021 - October 2021*

- In our recent work Physics 2021, 3(2), 302-319, we conducted a detailed sensitivity study and determined that the saturation density ρ_{sat} and effective nuclear mass m^*/m are the dominant nuclear parameters of the EoS which affect the mode frequencies. This study was later extended to include hyperons which also showed the same
- It has been theorised that p-modes exhibit similar properties to f-modes. We undertook a comprehensive study of dependence of said parameters for p-modes and provide new exciting asteroseismology relations to further constraint the EoS of a neutron star

IISER Kolkata **Kolkata, India**
Aspects Of BCS Theory of Superconductivity
(with Prof. Amit Ghosal) *May 2021 - August 2021*

- The aim of this work was to get the understanding the language of quantum many body systems and its connection in the development of BCS Theory - a hallmark in Condensed Matter physics
- We do a recap of first quantisation: the regular description of Quantum Mechanics. We later develop the language of second quantisation which is the language for Quantum many-body Systems. We discuss the history of superconductivity phenomenon and its classical description
- We extend Ginzburg Landau Theory of second order phase transitions which is a very powerful tool to describe Superconductivity. We discuss BCS Theory and its development from Fermi description of electron lattices

IIT Roorkee **Roorkee, India**
A detailed study of Neutron Star Equation of States in Relativistic Mean Field Formalism
(with Prof. P Arumugam) *Feb 2021 - August 2021*

- This work was done to understand the quantitative and qualitative analysis of Relativistic Mean Theory and its application to model the interior of Neutron Stars
- The theory was implemented to write a Python Program for the Quantum Hadrodynamic Sigma-Omega and Sigma-Omega-Rho Models. The results were matched with different works

IISER Kolkata **Kolkata, India**
Ginzburg Landau Description Of Superconductivity
(with Prof. Amit Ghosal) *May 2020 - August 2020*

- Superconductivity is a puzzling phenomenon discovered over a century ago and is one of the hallmarks of condensed matter physics. In this project, we tried to understand the physical description of the phenomenon through the Ginzburg Landau Model to understand superconductivity as a phase transition. We underwent mathematical rigor to explain physical hallmarks through this theory
- This project involves a formulation of superconductivity according to classical mechanics, the understanding of second order phase transitions and how superconductivity can be explained as one, and the description of the Ginzburg Landau Theory and its physical consequences

IUCAA **Pune, India**
Effect Of Internal Composition On Neutron Star Oscillation Modes

(with Prof. Debarati Chatterjee) *Feb 2020 - August 2020*

- The behaviour of matter in the interior of NSs is still not well understood. It is believed that the composition of its interior may have observable effects on its astrophysical properties, such as its mass and radius. Further, perturbations in NSs could generate gravitational waves and their waveforms could contain signatures of its internal composition
- The aim of this project was to calculate the effect of its internal composition on its oscillation modes by modelling different equations of state, and hence on the gravitational wave emission

IUCAA **Pune, India**
Selected And Participated in
IUCAA Summer School Of Astronomy And Astrophysics *May 2020 - July 2020*

- Explored new fields of Cosmology and Astrophysics

IISER Pune **Pune, India**
Introduction to Classical and Quantum Field Theory
(with Prof. Sudarshan Ananth) *August 2019 - Feb 2020*

- The aim of this informal project was to develop a strong background for physics

FELLOWSHIP

Department of Science and Technology (DST) Government of India – Innovation in Science Pursuit for Inspired Research (DST-INSPIRE) Fellowship

AWARDS

National Standard Examination in Physics (NSEP - IPHO 1st STAGE)

KVPY (Kishore Vaigyanik Protsahan Yojana) 2018 Aptitude Test

Joint Entrance Examination JEE-ADVANCED (2018)

JEE MAIN 2018 (TOP 1% All India)

IISER Aptitude Test (All India Rank 133)

National Science Talent Search Exam (All India Rank 656)

National Mathematics Talent Contest (Stage 1)

Science Olympiad Foundation (SOF) Medal in Physics

RELEVANT COURSES

Physics:
Foundation Courses
World of Physics I – Mechanics And Special Theory Of Relativity, World of Physics II – Waves And Matter, World of Physics III – Electricity and Magnetism, World of Physics IV – Quantum Physics, Optics, Physics Lab I, Physics Lab II, Physics Lab III
Specialised Courses
Mathematical Methods in Physics, Classical Mechanics, Quantum Mechanics I, General Relativity, Electrodynamics, Fluid Mechanics, Electronics I, Methods Of Experimental Physics, Quantum Mechanics II, Statistical Mechanics I, Electronics II, Astronomy and Astrophysics, Quantum Information, Plasma Physics, Statistical Mechanics II, Advanced Optics, Condensed Matter Physics, Computational Physics, Quantum Field Theory, Astrophysical Processes, Cosmology, Black Holes, Atomic and Molecular Physics, Nuclear and Particle Physics, Physics Lab IV, Physics Lab VII

Biology:
Foundation Courses

Introductory Biology I: Cell Biology, Introductory Biology II: Molecular Biology, Introductory Biology III: Evolution and Ecology, Introductory Biology IV: Biology of Systems, Biology Lab I: Basic Biology, Biology Lab II: Biochemistry, Genetics and Molecular Biology, Biology Lab III: Ecology and Evolution
Specialised Courses
Biostatistics, Mathematical and Computational Biology, Bioinformatics

Mathematics:
Introduction to Proofs, Single Variable Calculus, Multi Variable Calculus, Linear Algebra, Probability and Statistics, Real Analysis

Chemistry:
Introductory Quantum Chemistry, Thermodynamics, Principles of Inorganic Chemistry, Principles of Organic Chemistry, Chemistry Laboratory I – Physical Chemistry, Chemistry Laboratory II – Inorganic Chemistry, Chemistry Laboratory III – Organic Chemistry

Earth and Climate Science:
Evolution of Earth and Life, Introduction to Climate Science, Principles of Planetary Climate, Parameter Estimation and Inverse Theory

Inter Disciplinary:
Introduction to Computing, Mathematical Methods, Data Science

SKILLS

Programming skills:
Python, C++, Fortran, Java, Matlab, HTML, LaTeX
Linux, Windows
(Comfortable in quickly learning any language which might be required)
A physicist used to work in interdisciplinary teams, a fast and motivated learner with strong analytical and communication skills

Extracurriculars:

Selected as a member of National Quizzing Team in ICSE Schools

Winner of various Quizzing Leagues at School, City and Zonal Level

Winner of Science Exhibition award (8th Grade) for Slide Projector and Magnetic Gloves

Regular Teacher at Science Nurture Programme (IISER Pune Social Awareness Initiative)

Member of team created Rube Goldberg Machine at IISER Pune fest Karavaan

Member of Science Activities Team for Karavaan

Languages:
English (native/bilingual), Hindi (native/bilingual), German(Ein bisschen)