Som Dev Bishoyi

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Linkedin Profile

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RESEARCH INTERESTS

I am primarily interested in the dynamics of **black holes**, since they are a rich source of insight for a theory of **quantum gravity**. In particular, understanding how quantum gravitational and quantum mechanical effects can determine the dynamics in the interior and vicinity of black holes.

RESEARCH EXPERIENCE

Scalar Perturbations of a Quantum Corrected Kruskal Black Hole
with Prof. Gaurav Khanna and Prof. Scott Field at UMass Dartmouth   *March 2021-present*

- **Nodal DG code for solving Advection and Maxwell's equations**: Used Nodal Discontinuous Galerkin code to solve the Heat equation and 1D Maxwell's equation.
- **Routines for coordinate conversion and Regge-Wheeler Potential**: Constructed the routines for converting tortoise to radial coordinates for the AOS metric and the quantum AOS Regge-Wheeler potential.
- **Ringdown Waveforms for the Quantum Corrected Potential**: Waveforms of scalar perturbations were generated by solving the Quasi-normal mode equation for an initial Gaussian perturbation and compared for different values of the LQG parameters.

Covariant Generalization of Feynman's proof of Maxwell's equations
with Prof. Saurya Das at University of Lethbridge   *May 2021-present*

- **Review of the Feynman Dyson Formalism for Maxwell's equations**: Revisited the original proof given by Dyson, that shows the existence of fields $\vec{E}$ and $\vec{B}$ that satisfy the Lorentz force equation and the homogeneous Maxwell's equations.
- **Generalization to Maxwell's equations for arbitrary curved backgrounds**: The homogeneous Maxwell's equation were generalized by using a covariant form of the commutator and Lorentz force equation.
- **Obtain Einstein Field equations using a suitable commutator**: Present work focuses on designing a suitable commutator that can produce the Vacuum Einstein field equations in the linear/weak gravity limit or uniform gravitational fields.

Time Evolution of Density contrast using N-Body Simulations
with Prof. Suman Majumdar at DAASE, IIT Indore   *April 2020-July 2020*

- **Time evolution of overdensity**: Used an N Body simulation to simulate the evolution of the density contrast by employing the Particle - Particle Particle Mesh algorithm.
- **GADGET 2.0.7 and CAMB Codes**: Used the CAMB code to find out parameters like comoving distance and apparent magnitude of supernovae for models like ΛCDM, WCDM with discursion into Bayesian methods and inference.
- **ΛCDM Model**: Self study of topics like power spectrum, redshift space distortion, Gaussian nature of primordial density fluctuations and their role in large scale structure formation.

EDUCATION

Indian Institute of Science Education and Research Kolkata
Major in Physical Sciences, Minor in Mathematics; GPA: 8.96   *August 2017 to Present*

Masters Thesis/Dissertation
Space-times of rotating relativistic compact objects   *August 2021 to Present*

- ○ **Grades in Relevant Courses**:

General Theory of Relativity - A+	Quantum Field Theory II - A
High Energy Particle Physics - A	Quantum Field Theory I - A
Astrophysics and Cosmology - A	Symmetries in Physics - A+
Study of QFT in Cosmology - A	Advanced Math Methods - A

- ○ **Computational Skills**: MatLab, Mathematica, Python

PROJECTS

- ○ **Diffraction through helical structures**: Led the team on this project on **diffraction patterns** by single and double helices that simulate the original diffraction pattern of DNA discovered by Rosalind Franklin.

- ○ **Quantum Mechanics Lecture Notes**: Prepared a set of latex typed **lecture notes** for the course on Introductory Quantum Mechanics **PH2201** which was eventually used for instruction and course resource.

- ○ **Industrial Application of Seebeck effect**: A submission for the scientific innovation competition in high school based on the **thermoelectric effects** of current that could be used in the exhaust pipes of cars.

RESPONSIBILITIES

- ○ **TA for PH2102, PH1101, PH1102**: Scheduled tutorials, discussions, doubt clearing and grading for the sophomore level course on Special theory of Relativity, Lagrangian and Hamiltonian mechanics.

- ○ **Photomath Contributor**: A Photomath expert in calculus and algebra. Tasks include solving, reviewing and submitting solutions to problems in these topics for usage on the Photomath app.

- ○ **Coursera Translator**: A member of the global translator community on coursera, providing high quality subtitles through word to word non-machine translation to assist non-English speaking learners.

SUPRACURRICULAR

Seminars, webinars, conferences:
- The Noise of Gravitons by Maulikh Parikh, Arizona state University
- 14th International Conference of Gravitation, Astrophysics and Cosmology
- NEB-19 Recent Developments in Gravity, Athens (Online)

Relevant Summer Schools:
- Applications of Quantum Information in QFT and Cosmology(Online)
- Vienna online summer school in Gravitational Quantum Physics
- University of Michigan online cosmology summer school

ACHIEVEMENTS

- ○ **IISER-K Summer Fellowship**
  fellowship of 10,000 rupees for summer research project on advanced quantum mechanics.

- ○ **IIT Indore Research Internship**
  Internship at Discipline of Astronomy , Astrophysics and Space Engineering, IIT Indore for two months

- ○ **Entrepreneurship Idea selection**
  Top 50 finish at "Catch Them Young", one of the largest entrepreneurial idea contests in eastern India.

- ○ **IIIT Hyderabad ML Summer School**
  Selected for attending the competitive machine learning summer school at IIIT Hyderabad in July 2019.

- ○ **1st Prize in Scientific Innovation**
  For completion of project titled "Industrial applications of Seebeck effect" in high school.