Som Dev Bishoyi

Contact Information

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Education

University of Massachusetts Dartmouth
Ph.D. in Computational Science and Engineering, *Sept 2022-present*
Concentration in Numerical Partial Differential Equations,
Gravitational waves, GPA : 4.00/4.00
Dissertation Advisor : Professor Scott Field

IISER Kolkata
BS-MS in Physics, Minor in Mathematics, *August 2017-July 2022*
GPA : 9.05/10
Thesis : Studies on the spacetime of slowly rotating stars

Research Interests

General relativity, Black hole perturbation theory, black holes, gravitational waves, extreme mass ratio inspiral simulations, discontinuous Galerkin methods. Specifically, using spectrally accurate methods to construct simulations of EMRIs. Also interested in mathematical general relativity, Aretakis extremal instability, no hair theorem, price's law and decay rates of perturbations in extremal black holes.

Publications

1. Som Dev Bishoyi, Subir Sabharwal, Gaurav Khanna,
Numerical Evidence for Non-Axisymmetric Gravitational "Hair" for Extremal Kerr Black Hole Spacetimes with Hyperboloidal Foliations, 10.1007/s10714-025-03378-1, arxiv.org/abs/2407.06926

Research Experience

General spin-weight time domain Teukolsky equation solver

- Discontinuous Galerkin(DG) solver for gravitational perturbations in the time domain having spectral convergence.
- Computing the Teukolsky source term for gravitational perturbations.
- Formulating a symmetric hyperbolic system of coupled PDEs using different choices of auxilliary variables and hyperboloidal coordinates.

Extremality in Reissner Nordstrom(RN) and Kerr BHs

- Used Discontinuous Galerkin method to numerically solve the massless scalar wave equation in RN and extremal RN spacetime.
- Implemented hyperboloidal slices in the DG method for calculating local tail decay rates for static and generic initial data at some finite distance and at $\mathscr{I}^+$ for RN and extremal RN black holes.

Awards

- **UMass Dartmouth Doctoral Fellowship**, Research fellowship for a period of 1 year. *September 2022 to May 2023*
- **APS DGRAV Travel Grant**, Travel grant of $300 for presenting at APS april meeting 2024. *April 3 2024 - April 6 2024*
- **IISER-K Summer Fellowship** Fellowship of 10,000 rupees for summer research project on Ahoronov-Bohm effect. *May 2019 - July 2019*
- **IIT Indore Research Internship** Internship for two months on N Body Simulations. *May 2020 - July 2020*

Contributed Talks

1. Determining extremality of Reissner-Nordstrom BHs using late time tails at $\mathscr{I}^+$, *APS April meeting 2024*

Teaching Experience

Department of Mathematics, UMass Dartmouth

- TA for High Performance Computing — *September 2024 to December 2024*

Department of Physical Sciences, IISER Kolkata

- TA for Mechanics II — *August 2020 to December 2020*
- TA for Mechanics II — *August 2021 to December 2021*
- TA for Introductory EM — *January 2021 to May 2021*

Computation and Data Sciences, IISER Kolkata

- TA for Scientific Computing in Python — *January 2022 to May 2022*

Additional Expertise

Computing : C, Python(scipy, numpy, sympy), numerical PDE solvers, pseudo-spectral methods, finite difference methods, Matplotlib, Mathematica xAct, LaTeX, git

Research Mentorship : Provided mentorship for the research project **Scalar perturbations in an LQG corrected BH spacetime** to the following students :

- Scott Shaw, MS-Physics student at UMass Dartmouth
- Ansh Gupta, MS-Physics student at IISER Mohali
- Varenya Upadhaya, 1st year PhD student at UMass Dartmouth