Profile: Ph.D. student in Computational Sciences at the University of Massachusetts Dartmouth.Broadly interested in General Relatvitity and High Performance Computing. Currently working as a Distinguished Doctoral Fellow in the Engineering and Applied Sciences program with a focus on modeling gravitational waves from extreme mass ratio black hole binaries using advanced numerical and mathematical techniques.

Personal Information :

Name: Manas Vishal

Email : vishalmanas28@gmail.com, mvishal@umassd.edu
Gender : Male | Date of birth : 28/10/1997 | Nationality : Indian
http://manasvishal.github.io/

Research Experience :

2021 - current **(Ph.D. project)**

EMRI surrogate modeling and late time Kerr tails with spinning primary Black Hole using discontinuous Galerkin method
Dr. Gaurav Khanna and Dr. Scott Field, UMass Dartmouth
It is need of the hour to have a gravitational wave template bank for upcoming detectors. This project deals with one of the primary sources of the upcoming space borne detector LISA which are extreme mass ratio black hole binaries. I have written a very accurate Teukolsky solver code using discontinuous Galerkin method to model the waveform from EMRI system with a spinning primary.

June 27, 2020 - June 2021 **(MS project)**

Massless Scalar Waves in AdS Spacetime
Dr. Rajesh Nayak, IISER Kolkata
It has been shown in recent works that the non-asymptotic AdS spacetime eventually loses the curvature due to the formation of a black hole. The boundary conditions for this system are complicated, and hence very little work has been done on this topic computationally. I intend to explore the stability of the AdS spacetime when perturbed by gravitational waves. I am using the scalar perturbations to study the solution of the massless scalar wave equation in this geometry. I have started working on 4-dimensional spacetimes, but it can be extended to N-dimensions.

Aug. 2020 - Dec. 2020

Independent study on Magnetohydrodynamics (MHD) and Fluid Dynamics
Dr. Dibyendu Nandi, IISER Kolkata
The motivation for this independent study comes from General Relativistic Magnetohydrodynamic simulation of Neutron Stars. I aim to teach myself the concepts of Advection Equation and different types of flows in fluid systems. I am acquiring skills in MHD simulations so that I could learn the techniques of General Relativistic version of it.

Dec. 2019 - March 2020

Finesse (Frequency domain INterfErometer Simulation SoftwarE) Workshop and Hackathon
IUCAA Pune
Finesse is a sophisticated simulation package for modeling optics and laser interferometers. This interferometer modeling software was developed for the design of gravitational wave detectors, but is easy to use for students with simpler lab-based setups as well. It includes advanced features such as higher-order modes, quantum noise and radiation pressure effects. I used this tool to model aLIGO detector for the Hackathon.

May 15 - July 15, 2019

Reducing the flexing of the arms of LISA - a space based Gravitational Wave detector

Dr. Rajesh Nayak, IISER Kolkata

Laser Interferometer Space Antenna (LISA) will be a spaced based gravitational wave detector with an array of three spacecrafts in heliocentric orbit. I developed a 3-body model to reduce the flexing in the arms of LISA due to the breathing modes. This project helped me develop computational skills, especially in using Python notebooks and theoretical concepts like perturbation theory and celestial dynamics. The project ended with me writing a Python code that could simulate the flexing in the arms of LISA over its observing run.

Dec. 08 - Dec. 25, 2018

Deriving Geodesic equations for different types of metrics

Dr. Naresh Dadhich, IUCAA Pune

A short reading project of "**Curved Space, curved Time, and curved Space-Time in Schwarzschild geodetic geometry (arxiv:1812.03259)**. I derived and calculated all the geodesic equations for different types of metrics associated with Schwarzschild geometry, considering space and time curvatures separately. The geodesic equations can then be used to calculate the deflections due to 1 solar mass object and it turned out to be exactly half of the "curved spacetime (1.75arcsec)" in "curved space" and "curved time" metrics.

May 15 - July 15, 2018

Reading project in Cosmology, General Relativity and Dark Matter

Dr. Subhadip Mitra, IIIT Hyderabad

A reading project in General Relativity, Cosmology and Dark Matter. I studied General Relativity and Cosmology following textbooks by Scott Dodelson, Bernard F. Schutz and James Hartle. This project helped me gain the understanding of the basics of Tensor algebra and calculus, General Relativity, Cosmology, and Dark Matter

May 20 - July 20, 2017

Quantum transport in mesoscopic system

Dr. Sourin Das, IISER Kolkata

I developed a Python code using Kwant module which could model topological insulators in cubic and trapezoidal cubic geometry. This code was used to simulate quantum hall effect in the mesoscopic systems by attaching quantum gates to different sides of the cube, and measuring the resistance offered by each side.

Personal Skills

Digital Skills

Programming Languages:- C, Julia, Python (modules: AstroPy, PyCBC, SciPy, NumPy, SymPy, pandas, Kwant, QuTip), R, SQL, jQuery, HTML, PHP, TEX

Softwares : - MATLAB, Mathematica, Origin, GnuPlot, ImageJ, LATEX, Android Studio

Languages

Hindi, English [TOEFL Score - Reading (21), Listening (25), Speaking (22), Writing (21)]

Education and Training:

2021 - current

Ph.D., Computational Sciences

University of Massachusetts Dartmouth (U.S.A)

Department:- Engineering and Applied Sciences

2016 - 2021

5 Year BS-MS Dual Degree

Indian Institute of Science Education and Research, Kolkata(India)

Department:- Physics

CGPA:- 8.4

Teaching Assitantships:

1. Teaching Assistant for SS4101 (Space Astronomy) course offered by Center of Excellence in Space Sciences India (CESSI), IISER Kolkata to 4th year students in Autumn 2020.
2. Teaching Assistant for PH1201 (basic Electricity and Magnetism) course offered by Department of Physical Sciences, IISER Kolkata at freshman level in Spring 2020.

Academic Awards:

2021 - current — **Distinguished Doctoral Fellowship**, offered by the University of Massachusetts Dartmouth to pursue my research in black hole physics with Prof. Scott Field and Prof. Gaurav Khanna.

Aug. 2017 - June 2021 — **KVPY** Scholarship, India (offered by the Department of Science and Technology, Government of India, to attract exceptionally highly motivated students for pursuing basic science courses and research career in science.)

Aug. 2016 - July 2017 — **INSPIRE (Innovation in Science Pursuit for Inspired Research)** Fellowship (offered by the Department of Science & Technology to top **1%** students to pursue a career in science)

2013 — Awarded **Gold medal** for top performance in 10th standard.

Other Achievements

1. Selected for Super-30 in 2013 (a program which selects 30 talented candidates among thousands of applications each year to prepare them for **JEE,** an engineering entrance exam)
2. Qualified several Olympiads organized by Science Olympiad Foundation
3. Made an android application for Inquivesta, largest science fest of India.

Conferences and Workshops :

Attended

- Advances in Computational Relativity at ICERM, Brown University (September 9, 2020 - December 11, 2020)
- North American Einstein Toolkit Workshop 2020 (August 3-7, 2020), CCT, Louisiana State University (Virtual)
- TCAN on Binary Neutron Stars Workshop 2020 (July 6-10, 2020) CCRG, Rochester Institute of Technology (Virtual)
- 23rd Capra Meeting on Radiation Reaction in General Relativity June 22-26, 2020) University of Texas at Austin (Virtual)
- Cosmology Summer School 2020 (June 1-5, 2020), University of Michigan (Virtual)
- BHPToolkit Spring 2020 workshop (May 25-27, 2020), Astronomical Institute of the Czech Academy of Sciences (Virtual)
- Applications of Data Science in Astrophysics and Gravitational Wave Research (DSAP 2019) workshop held at IIIT Allahabad (November 1-3, 2019)
- GPU based High Performance Computing workshop at IISER Kolkata (October 14-15, 2019)
- Quantum Information and Quantum Technology (QIQT) 2019 at IISER Kolkata (June 13-July 27, 2019).

Talks given

- Presented my Ph.D. project at APS April meeting in New York City.
- Presented my work over summer of 2020 at UMassD Physics colloquium (September 3, 2020)
- Gave an introductory talk on LISA and EMRI waveforms in Mini-Astro Workshop (October 6, 2020)

References:

Available on request

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