Devesh Giri

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Education

Indian Institute of Science Education and Research, Pune **December 2021 – Present**
B.S.-M.S. in Physics *Pune, Maharashtra, IN*

Disha Delphi Public School **2021**
AISSCE *Kota, Rajasthan, IN*

H. P. Children's Academy **2019**
ICSE *Gorakhpur, Uttar Pradesh, IN*

Publications

- D. Giri and B. Gadre, "Understanding SSM-IMRIs with LIGO-Virgo and ET", [in prep.]

Presentations/Seminars

33^{rd} IAGRG conference **January'25, 02 - January'25, 04**
Poster presentation *BITS-Pilani, Pilani, IN*

- Presented a poster on GWs from SSM-IMRIs and displayed some of the results from the research carried during the internship at Nikhef.

Experience

Visiting Master's Thesis Student **June'25-**
Guide: Prof. Suvodip Mukherjee *TIFR, Mumbai, IN*

∗ Working on the imprints of primordial black holes on gravitational waves.

GW Summer School on Cosmology **July'25**
Lecturers: Prof. Surhud More, Prof. Chiara Caprini, Prof. Tirthankar Roy Choudhury *ICTS-TIFR, Bengaluru, IN*

∗ Undertook three courses: Probing the early universe using GW observations; Cosmography using GW standard sirens; and, Probing large-scale structure using GW observations
∗ Besides the rigorous theoretical lectures, gained practical experience in GW Population Analysis, Cosmological Parameter Inference and N-Body Cosmological Simulations. Hands-on experience with different softwares/codes used for such studies: GWCOSMO, ICAROGW and GADGET-4
∗ Delivered a flash talk and presented a poster on SSM-IMRIs.

Research Internship **October'23 - December'24**
Guide: Dr. Bhooshan Gadre *Nikhef, Netherlands*

∗ Worked on understanding sub-solar mass black holes (SSM-BHs) intermediate-mass ratio inspirals (IMRIs) in the frequency band of the present and upcoming ground-based GW detectors.
∗ Showed the detectability of SSM-IMRIs based on (matched-filter) signal-to-noise ratio calculations.
∗ Performed in-depth fitting factor studies using global optimiser methods (particle swarm optimisation and differential evolution) and Bayesian parameter estimation studies to understand parameter biases/error, waveform systematics and template bank size. Familiarized with IMRPhenomX and BHPTNRSurrogate waveform models.
∗ Demonstrated the significant effects of higher harmonics for IMRI systems and need to develop aligned and precessing spin waveform surrogates.

Summer Internship **May'23 - July'23**
Guide: Dr. Karan Jani *Vanderbilt University, USA*

∗ The current gravitational wave signals from CBCs observed by LIGO-Virgo are not well localised. The upcoming LIGO-India (Aundh) and LIGO-Livingston pair provide the longest baseline amongst all pairs of current and in-construction GW detectors, and the inclusion of LIGO-India in the detector network can significantly improve the localisation of sources by using detector triangulation. The network expansion can improve the sky-localisation area from 100 sq. deg. to 1 sq. deg. and break the degeneracy between distance-inclination.

* To demonstrate this, we systematically injected GW190521-like systems (at Advanced LIGO and Advanced Virgo design sensitivity) into the HLV and HLVI detector network and recovered the parameters (Bayesian PE) using phenomenological and surrogate GW waveforms (IMRPhenomXPHM and NRSur7dq4).
* Completed PyCBC tutorials and familiarized with using PyCBC Inference and Bilby for parameter estimation.

Summer Trainee (CCS lectures) **May'22 - August'22**

Guides: Dr. Yashwant Gupta, Dr. Ruta Kale, Dr. Yogesh Wadadekar *NCRA-TIFR, Pune, IN*

* An overview of multi-wavelength astronomy, mechanism of radio telescopes and GMRT.
* Qualitative descriptions of neutron stars, pulsars, AGNs.
* Learned to work with FITS files and about mean and median stacking with some optimising techniques like the Binapprox algorithm
* An exposure of equatorial/Galactic coordinates
* An exposure of Astronomy Catalogues. Worked with AT20G BSS catalogue and SuperCOSMOS all-sky catalogue to learn about cross-matching
* Learned about optimisation and used NumPy optimisation, Sorting optimisation and Binary search optimisation.
* Learned about k-d trees optimisation using Astropy

Technical Skills

Programming languages and packages: Python, Bash, LaTeX, MATLAB, PyCBC, GWCOSMO, ICAROGW, GADGET-4

Professional softwares: Git, Excel, PowerPoint, Word, VEGAS Pro

Operating systems: Linux, macOS, Windows

Experienced with HTCondor and running jobs on large computing clusters.

Online Courses

Machine Learning for Physics and Astronomy

CCA Flatiron Institute

* Course conducted by Dr. Viviana Acquaviva which provided a foundation in methods of Machine Learning, focussing on its application to real research problems, from exploratory data analysis to hypothesis testing and diagnostics.
* A rigorous exposure to neighbors and trees supervised models, evaluation and diagnostics in supervised classification, optimization, regression, ensemble methods, clustering and dimensional reduction, and an introduction to neural networks.

Data-driven Astronomy

The University of Sydney, Australia

* Course conducted by Dr. Tara Murphy and Dr. Simon Murphy, focussing on working with large datasets, implementing algorithms, and learning from data using ML tools. I will be learning to work with files from exoplanet surveys, pulsar detections, galaxy clusters, etc., using Python and SQL.

Computational Thinking using Python

Massachusetts Institute of Technology, USA

* A two-course program for 4-months conducted by Dr. Eric Grimson and Dr. John V. Guttag focussing on computational thinking and providing elementary training in Python. Explored some simple algorithms, data structures, plotting with the pylab package and statistical thinking.

Winter Break Intensive Program

QubitXQubit

* A four-day program conducted by Dr. Akshay Agarwal providing an introduction to Quantum Information Science (QIS)

Workshops

Gravitational Wave Open Data Workshop **April'24**

`gwosc.org` and *IUCAA* *Pune, IN*

* Conducted by the GWOSC with a study-hub at IUCAA, Pune. Open Data Workshop is the 7th in a series of workshops that began in 2018. Completed the challenge quiz and got certified.

Workshop on Data Science in Astronomy **December'23**

IUCAA *Pune, IN*

* A three-day summit of talks and activities with Introductory and Advanced Lectures, exploration of real-world data science applications in astronomy and a hackathon.

Relevant Courses

The courses in blue are ongoing in the current semester.

- Cosmology
- Bayesian Inference
- Signal Processing
- Astronomy and Astrophysics
- Data Assimilation
- Deep Neural Networks
- Nuclear and Particle Physics
- Statistical Learning and Data Science
- Quantum Mechanics I and II
- Electrodynamics I
- Optics
- Electronics
- Numerical Computation
- Mathematical Methods for Physics
- Data Analysis
- Statistical Mechanics
- Classical Mechanics
- Introductory Quantum Physics
- Electromagnetism
- Real Analysis
- Group Theory
- Discrete structures
- Advanced Linear Algebra
- Physics Lab
- Multi-variable calculus
- The Solid Earth

Achievements

- Cleared the JEE-Advanced and JEE-Mains examinations.
- Undertook a B. Sc. course in Grade-12th and received the Certificate for *Outstanding Performance* in the same.
- Qualified for National Anveshika Experimental Skill Test Prelims 2020 (NANI) hosted by Shiksha Sopan, IIT Kanpur and the Indian Association of Physics Teachers
- Qualified for the National Talent Search Examination.
- Awarded with Sangeet Prabhakar degree (equivalent to the degree of Bachelor of Arts) by Prayag Sangeet Samiti in Hindustani Classical Sangeet in 2020

Short courses and lectures

- A 10-week course on Basic Quantum Mechanics, Dr. H. C. Verma, IIT Kanpur
- Colloquium on the Compact Muon Solenoid (CMS) - Dr. Seema Sharma, IISER Pune and Indian Physics Association
- Taming the Transient Sky - Dr. Varun Bhalerao, IIT Bombay
- Hues of Chaos, Chaos in Physics - Dr. M. S. Santhanam, IISER Pune
- Gravitation from Newton to Padmanabhan and Beyond - Dr. T. P. Singh, TIFR Mumbai
- Resonance Lecture Series - Indian Academy of Sciences (Bengaluru), IISER Thiruvananthapuram, IISER Mohali
- Gravitational Waves from Neutron star-black hole coalescences - LIGO, Virgo, Kagra
- Stay Home And Revise Physics (SHARP) - Dr. H. C. Verma, IIT Kanpur

Positions of Responsibility

Founder **April'21 - June'21**

India Defeats Corona *India*

- We formed a team, 'IndiaDefeatsCorona' when India suffered dire times from the second wave of CoViD. We arranged hospitals with Oxygen beds, ICU and ventilators, in the arrangement and transportation of oxygen cylinders to arrange prescribed medicines. We joined hands with the INITE Welfare Society to help people procure Oxygen Concentrator Machines free of cost for a service of fifteen days. We arranged blood and plasma donors in Gorakhpur, Lucknow, Hyderabad, Kolkata, Noida, Meerut, Bulandshahr, Agra, Delhi, Gurugram, Ghaziabad and Dehradun. With support from the associates of the Member of Parliament elected for the Gorakhpur constituency, we got help from the officials.

Public relations and arranger **April'21 - May'21**

Mithila Welfare Foundation *India*

- Worked to arrange blood/plasma donors in the Delhi region for the requests submitted to Mithila Welfare Foundation. It involved coordinating with patients' families to help them know the process of blood banks and help them find a suitable donor.

Volunteer Experience

Core member and Tutor **August'22 - April'22**

Mindspark, DISHA *IISER, Pune, IN*

- Mindspark, DISHA is an initiative by the students of IISER-Pune which imparts education to underprivileged students of Grade 8 by conducting classes every Saturday and Sunday. I work to design the structure of Mathematics lectures and also volunteer as a tutor.