Pranav Satheesh

pranavsatheesh17@gmail.com • pranav-satheesh.github.io • Indian Institute of Technology Madras, India

Reserach Interests

Gravitational Wave Astronomy and Astrophysics, Post-Newtonian theory and Numerical Relativity, Cosmology using Gravitational waves

Education

Indian Institute of Technology Madras, Chennai, India 2017 - 2022 (expected)
BS-MS Dual Degree Physics
CGPA: 9.19/10

Research Experience

Improving eccentric binary Black hole models by including spin effects Jul 2021 - *Present*
Mentored by Dr. Chandra Kant Mishra, IIT Madras and Dr. Prayush Kumar, ICTS

- This work is part of my final year thesis. I'm working on improving a non-spinning eccentric black hole waveform model (ENIGMA) by including effects of Black Hole spins in the waveform.

Constructing ready-to-use frequency domain waveform model for eccentric binary black holes including non-quadrupole modes
Mentored by Dr. Chandra Kant Mishra, IIT Madras Aug 2019 - August 2021

- I worked on producing an efficient, ready-to-use frequency domain waveform model for eccentric binary black holes. The waveform also accounts for periastron effects
- The waveform is produced by applying *Stationary Phase approximation* on time domain waveforms that includes non-quadrupole modes.

Studying primordial gravitational waves from inflation and reheating phase
Mentored by Prof. L. Sriramkumar , IIT Madras Aug 2021 - Present

- I'm studying the evolution of primordial gravitational waves during the inflationary era data and the reheating phase of the universe.

Polarimetric method for predicting gravitational wave polarization of LISA verification binaries
Mentored by Prof. Prasenjit Saha, University of Zurich Summer 2020

- I worked on developing a method utilizing Polarimetry to measure the orientation and inclination of the binary system (HP Lib). Such binaries are sure candidates for the Laser Interferometer Space Antenna (LISA) mission.
- My work was presented at the 237th American Astronomical Society meeting.

Signal detection and parameter estimation using LIGO O1 and O2 data
Mentored by Prof. Rajesh Nayak , IISER Kolkata Summer 2019

- The project involved learning the basics of gravitational waves data analysis and parameter estimation using LIGO's publicly available data from O1 and O2 run.

Publications

- (In preperation) **Pranav Satheesh**,Chandra Kant Mishra
  Ready-to-use eccentric frequency domain templates with non quadrapole modes
- (In preperation) Tamal RoyChowdhury, Abhishek Chattaraj, **Pranav Satheesh**, Chandra Kant Mishra
  Eccentric time domain and frequency domain Inspiral-Merger-Ringdown hybrid waveforms

Conferences

- Tamal RoyChowdhury, Abhishek Chattaraj, **Pranav Satheesh**, Chandra Kant Mishra, **14th Amaldi 2021, 19-23 July (online)**, *Elements of modelling binary black holes in eccentric orbits through inspiral, merger and ringdown stages*
- Tamal RoyChowdhury, Abhishek Chattaraj, **Pranav Satheesh**, Chandra Kant Mishra, **8th KAGRA International Workshop, 2021**, *Modelling Frequency Domain Inspiral-merger-ringdown Wave-forms for Eccentric Binary Black Hole Mergers*

- **Pranav Satheesh**, Prasenjit Saha, Hans Martin Schmid , **237th American Astronomical Society meet, 2021**, *A spectropolarimetric method for predicting the gravitational wave polarization of LISA verification binaries*
- **Pranav Satheesh**, **RAS Career Poster Exhibition, 2020**, *Frequency Domain Gravitational Waveform Modelling for Eccentric Black Hole Binaries*

Scholarships and Awards

- Selected for **ThinkSwiss Research Scholarship** by Swissnex, India — 2020
- Recepient of the INSPIRE-DST Scholarship for Higher Education — 2017 - *Present*

Professional Memberships

- *Member*, **LIGO Scientific Collaboration** — 2021-*Present*
- *Undergraduate Member*, **American Astronomical Society** — 2020-*2021*

Schools and Workshops

- Participant, **North American Einstein Toolkit School 2021**, July 2021 (Online)
- Participant, **ICTS Summer School on Gravitational Wave Astronomy**, ICTS, Bengaluru, India, July 2021 (Online)
- Tutor, **Code Astro 2021**, June 2021 (Online)
- Participant, **IPTA Student Workshop**, June 2021 (Online)
- Participant, ICERM, Brown University (online)
- Participant, Bilby workshop, ICTS
- Participant, **Physics of the Early Universe**, ICTS, Bengaluru, India, September 2020 (Online)
- Participant, **ICTS Summer School on Gravitational Wave Astronomy**, ICTS, Bengaluru, India, May-June 2020 (Online)
- Participant, **Code Astro 2020**, June 2020 (Online)

Relevant Coursework

General Relativity and Cosmology, Advanced General Relativity, Classical Field Theory, Advanced Particle Physics, High Energy Physics, Computational Physics, Advanced Statistical Physics, Quantum Mechanics, Classical Mechanics

Technical Skills

Programming Languages - Python, C, C++
Softwares - Mathematica, SAO DS9
Tools/Frameworks - LaTeX, Git

Outreach

Talks

- Tutor, *Relativity and Gravitation*, Horizon-IITM Summer School, July 2021
- Tutor, *Black holes and Gravitational Waves*, Horizon-IITM Summer School, July 2021
- Tutor, *Analysis of Globular Clusters Using Colour-Magnitude Diagrams*, Shaastra IITM, Jan 2020
- *Surfing the Gravitational Waves*, Astro week-Horizon IITM, 2019

Service

- Head, Horizon: The Physics and Astronomy Club of IIT Madras — 2019-2020