Pranav Satheesh

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

RESERACH INTERESTS

Gravitational Wave Astronomy and Astrophysics, Formation and evolution of compact objects, Post-Newtonian theory and Numerical Relativity, Tests of General Relativity using Gravitational Waves.

EDUCATION

Indian Institute of Technology Madras, Chennai, India   2017 - 2022 (expected)
BS-MS Dual Degree Physics
CGPA: 9.19/10
Physics GPA: 9.44/10

RESEARCH EXPERIENCE

Modelling higher-order modes from eccentric Binary Black Hole mergers   Jul 2021 - Present
Advisors: Dr. Prayush Kumar, ICTS-TIFR and Dr. Chandra Kant Mishra, IIT Madras

Working on improving an Inspiral-Merger-Ringdown gravitational waveform model for binary black holes in eccentric orbits known as ENIGMA. My work involves extending the waveform from to include higher order modes that will play a crucial role in the search for eccentric binaries in future gravitational wave searches.

Ready-to-use frequency domain waveform model for eccentric binary black holes including non-quadrupole modes   Aug 2019 - Sep 2021
Advisor: Dr. Chandra Kant Mishra, IIT Madras

Developing a ready-to-use frequency domain waveform model for eccentric binary black holes that includes non-quadrupole terms and considers periastron effects. The waveform will be used to construcr an Inspiral-Merger-Ringdown waveform model in frequency domain.

Polarimetric method for predicting gravitational wave polarization of LISA verification binaries   May 2020 - Aug 2020
Advisor: Prof. Prasenjit Saha, University of Zurich

Developed 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.

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

Studying the evolution of primordial gravitational waves during the inflationary era data and the reheating phase of the universe.

Signal detection and parameter estimation using LIGO O1 and O2 data   May 2019 - Jul 2019
Advisor: Prof. Rajesh Nayak , IISER Kolkata

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) Tamal RoyChowdhury, Abhishek Chattaraj, **Pranav Satheesh**, Chandra Kant Mishra
  Eccentric time domain and frequency domain Inspiral-Merger-Ringdown hybrid waveforms

PRESENTATIONS AND POSTERS

- 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 among top 8 students in India for ThinkSwiss Research Scholarship	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*

TEACHING EXPERIENCE	• Teaching Assistant, **Complex Networks (ID5080)** *Graduate level course at IIT Madras*	Aug 2021 - *Present*
	• Teaching Assistant, **Code Astro 2021** *Virtual Software Engineering Workshop for Astronomy supported by the Heising-Simons Foundation.*	June 2021

SCHOOLS AND WORKSHOPS	• **LISC Continous Gravitational Wave Workshop** (Online)	Oct 2021
	• **Physics and Astrophysics at the Extreme (PAX-VII) Workshop** (Online)	Aug 2021
	• **ICTS Summer School on Gravitational Wave Astronomy** (Online)	Jul 2021
	• **IPTA Student Workshop** (Online)	June 2021
	• **Mathematical and Computational Approaches for solving source-free Einstein Field Equations** ICERM, Brown University (online)	Oct 2020
	• **Physics of the Early Universe**, ICTS (Online)	Sep 2020
	• **ICTS Summer School on Gravitational Wave Astrophysics**	May 2020

RELEVANT COURSEWORK

General Relativity and Cosmology, Advanced General Relativity, Methods of Computational Physics, Numerical Methods and Programming lab, Classical Field Theory, Advanced Particle Physics, High Energy Physics, Statistical Physics, Quantum Mechanics, Classical Mechanics, Mathematical Physics, Differential Equations

TECHNICAL SKILLS

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

OUTREACH

Service

- Head, **Horizon: The Physics and Astronomy Club of IIT Madras**   2019-2020
  I headed the student run physics and astronomy club at IIT Madras under the Center of Innovation (CFI). We engage the student community in the campus though various projects, lectures, workshops and compeetitive events.

Articles

- Undergraduate Research summary in Astrobites
  UR: A spectropolarimetric method for predicting the gravitational wave polarisation of LISA verification

Talks

- *Python for Astronomy*, An Youtube lecture series offered by me as part of Horizon   Jul 2020
- *Relativity and Gravitation*, Horizon-IITM Summer School   July 2021
- Tutor, *Analysis of Globular Clusters Using Colour-Magnitude Diagrams*, Shaastra IITM   Jan 2020