Pranav Satheesh

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Department of Physics, University of Florida

Reserach Interests

Supermassive black hole (SMBH) dynamics, Gravitational Waves, Formation of SMBHs and Galaxy evolution, AGNs

Education

University of Florida 2022 - Present
Ph.D. in Physics

Indian Institute of Technology Madras 2017 - 2022
BS-MS Dual Degree in Physics
Thesis: Modelling subdominant harmonic modes of eccentric binary black hole waveforms

Employment

Research Assistant 2023 - Present
University of Florida
Mentored by Prof. Laura Blecha

Fellowships and Awards

- UF astrophysics Fellowship
- Graduate fellowship for first-year graduate students from UF Physics 2022 - 2023
- 62nd Institute day award for academic performance in Physics from IIT Madras 2021
- Selected among top 8 students in India for ThinkSwiss Research Scholarship 2020
- Recepient of the INSPIRE-DST Scholarship for Higher Education 2017 - *Present*

Talks and Posters

- (Talk) Midwest Relativity meeting, University of Chicago
- **Pranav Satheesh**, Shashank Gandhi, Chandra Kant Mishra, **6th IIT Madras physics in-house symposium, April 2022**, *Parameter Estimation of Eccentric Binaries using a Frequency Domain Inspiral Waveform*
- **Pranav Satheesh**, Shashank Gandhi, Chandra Kant Mishra, **LIGO-Virgo-KAGRA collaboration meeting, March 2022**, *Fisher analysis of eccentric binaries with higher mode frequency domain inspirals*
- (Contributed poster)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*
- (Poster) **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*
- (Poster) **Pranav Satheesh**, **RAS Career Poster Exhibition, 2020**, *Frequency Domain Gravitational Waveform Modelling for Eccentric Black Hole Binaries*

Research Experience

Studying merger outcomes of triple massive black holes systems Feb 2022 - *Present*
Advisor: Dr. Laura Blecha

Studying the outcomes of triple massive black hole systems in cosmological simulations. We can get an interacting triple system in certain cases of galaxy mergers. My work involves characterizing these triples in cosmological simulation and studying their merger outcomes and merger rate.

Modelling higher-order modes from eccentric Binary Black Hole mergers Jul 2021 - Jul 2022
Advisors: Dr. Prayush Kumar, ICTS-TIFR and Dr. Chandra Kant Mishra, IIT Madras

Worked on 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)

Professional Memberships

- *Associate Member*, **NanoGrav Collaboration** 2023-Present
- *Graduate Member*, **American Astronomical Society** 2023-Present
- *Graduate Member*, **American Physical Society** 2022-2023
- *Member*, **LIGO Scientific Collaboration** 2021 - 2022
- *Undergraduate Member*, **American Astronomical Society** 2020-2021

Teaching Experience

- Teaching Assistant Code/Astro workshop 2023
- Teaching Assistant UF first year labs
- Teaching Assistant, **Complex Networks (ID5080)** Aug 2021 - *Present*
  Graduate level course at IIT Madras
- Teaching Assistant, **Code Astro 2021** June 2021
  Virtual Software Engineering Workshop for Astronomy supported by the Heising-Simons Foundation.

Other workshops and meetings

- NanoGrav meeting online
- GW summer school 2022
- **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
- **Physics of the Early Universe**, ICTS (Online) Sep 2020
- **ICTS Summer School on Gravitational Wave Astrophysics** May 2020

Technical Skills

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

Outreach

Author Astrobites

Organizer Physics Graduate Committe, UF

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

Science-communication pieces

- *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

Public Talks

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