YUGESH BHOGE

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Research Experience

(Manuscript in preparation)*

- **Population-based kilonovae distinction from BNS and NSBH mergers *** *Apr 2025 - Present*
  In collaboration with Dr Ish Gupta, Prof Rahul Kashyap and Dr Mukul Bhattacharya IIT Bombay
  - Implemented modified **Arnett-Chatzoupoulos-Villar's (ACV)** lightcurve model to distinguish between various populations of BHNS and BNS mergers using **multi-band photometry**, effectively breaking the degeneracy between the merger types solely based on EM observations

- **Bayesian formalism for distinguishing kilonova from NSBH and BNS mergers** *Jul 2024 - Present*
  Guided by Prof Rahul Kashyap IIT Bombay
  - Developing a combined inference model, integrating **(Bilby + different waveform models)** Bayesian Inference for GW analysis and kilonova **ACV LC** modelling for EM inference to distinguish between NSBH and BNS merger.
  - Performing parameter estimation upon intrinsic CBC parameters solely from lightcurve involves converting lightcurve properties, such as ejecta mass and velocity, into individual component masses and tidal deformability. This will help in **determining CBC parameters solely based on EM observation**, and also enable breaking the degeneracy between the merger types.

- **Constraining Equation of State of neutron star using neutron star-black hole mergers *** *Feb 2024 - Aug 2025*
  In collaboration with Mr Vasudev Dubey, Prof Rahul Kashyap and Dr Ish Gupta IIT Bombay
  - Built a Bayesian inference pipeline based on `Bilby` with **IMRPhenomNSBH** and **IMRPhenomNRTidalV2** waveform models to recover tidal deformability from simulated NSBH merger signals, achieving accurate retrieval of chirp mass, mass ratio and effective tidal deformability ($\tilde{\Lambda}$) . Demonstrated the **asymmetric nature of NSBH systems yields cleaner tidal signatures than BNS mergers**, enabling tighter constraints on competing neutron-star equations of state and informing 3-generation detector forecasts

- **Rayleigh-Taylor Instability in Stellar Interiors [ ]** *Jan 2025 - Apr 2025*
  Guided by Prof Rahul Kashyap IIT Bombay
  - Derived a **general MHD dispersion relation** for the Rayleigh Taylor instability with stability map plots in stellar interiors, predicted critical/fastest growing wavelengths and confirmed the theory with **2D finite volume simulations**.
  - Our results confirm the **stabilising influence of magnetic fields**, especially for **shorter wavelengths**, and highlight conditions under which RTI is suppressed.

- **Design and Fabrication of Suspension System for All-Terrain Vehicle** *Mar 2019 - Apr 2020*
  Guided by Prof Sunil Dambare Pune University
  - Designed, analysed, fabricated and tested the suspension system for an Off-road racing vehicle with the use of different software like CATIA V5 and Solidworks 2018 for design purposes, Lotus Shark and Adams for multi-body dynamics simulation and Hypermesh and Ansys R16 for analysis purposes. Minimised the camber gain on wheels to **0.0098deg per mm of wheel travel**, also maintained the ride frequency to **1 - 1.8 Hz (front) and 1.1 - 2.0Hz (rear)** to ensure comparatively better ride quality. Simulated and verified the results using multi-body dynamics software Lotus Shark, and through experiments using rigs and the error was found to be within **1.6%**

- **Study of Aerospike Engine and its Performance Comparison with Conventional Bell-Cone type Nozzle in Single Stage To Orbit Flight** *Mar 2019 – Nov 2019*
  Guided by Prof Sunil Dambare Pune University
  - Demonstrated the effectiveness of the aerospike nozzle over conventional bell cone type nozzle (both modelled and tested in computational environment using CAD and CFD) by comparing their properties like **PMF**, which is decreased by **7.00%**, and **thrust coefficient**, which is increased by **26.66%**. This can make single stage to orbit possible also reducing amount of fuel needed and hence can increase payload capacity.

Projects

- **Blindspots in omnidirectional Interferometric Gravitational Waves detectors** *Oct 2024 - Dec 2024*
  Tools: PyCBC [ ]
  - Investigated the directional sensitivity and blind spots for gravitational wave detectors **(LIGO, Virgo and KAGRA)** using **PyCBC**, computed the antenna pattern functions and proposed mitigation strategies through multi-detector networks to improve detection sensitivity

- **Demonstration of chaos by period doubling route using Malkus waterwheel** *Aug 2024 - Oct 2024*
  Tools: Python, ImageJ [ ]
  - Built the Malkus waterwheel alongside its mathematical model based on **Lorenz system equation**, **limit cycle**, **pitchfork**, and **subcritical Hopf bifurcation** and demonstrated its chaotic behaviour under steady flow using **self written code** in **Python** and used **ImageJ** software for the image analysis and tracing purpose

- **Transforming Alphabets into Touch: A Braille Language Project** *Sep 2023 - Dec 2023*
  Tools: Arduino UNO, Arduino IDE, C++ [ ]
  - Fabricated a haptic feedback device that converts sentences and words from Braille language into mechanical movements that enable visually and hearing impaired people to understand. Mapped all **26** letters of Braille language into **6 segment display**, also included null characters as a significant time delay pause so that the person can distinguish between the words in a sentence that uses 6 segment haptic feedback display using 6 servo motor controlled using **Arduino UNO**

- **The Eco Coach** *May 2018 - Dec 2019*
  Design Project
  - Design project done for the Indian Railways to mitigate the problem of littering of plastic on railway tracks, built an integrated shredder and storage assembly for storing plastic waste inside the coach

Education

- **Indian Institute of Technology, Bombay** *Jul 2023 - May 2025*
  MSc Physics Mumbai, India
  - CPI: 7.54/10.00
- **Savitribai Phule Pune University** *Aug 2016 - Apr 2020*
  BTech Mechanical Engineering Pune, India
  - CGPA: 8.85/10.00

Workshops

- **GW - Detector Characterization Workshop** *Dec 2025*
  LISC IUCAA, Pune, India
  - Hands-on training including noise subtraction, glitch characterisation, spectral analysis, and machine learning applications in LIGO data analysis.

Honors and Awards

- **INSPIRE Scholarship** *May 2016*
  Department of Science & Technology, Government of India
  - Awarded to the top 1 % of the national Class 12 cohort for academic excellence

Professional Memberships

- **LIGO, LSC and LISC**, Membership ID: yugeshjivaram.bhoge@ligo.org *Feb 2025 - Present*

Skills

- **Computational Astrophysics:** Bilby, LALSuite, PyCBC, MOSFiT, NumPy, SciPy, Astropy
- **Simulation & Engineering:** Finite Volume Methods (FVM), CFD (Ansys Fluent), CAD (CATIA, SolidWorks), Arduino IDE, LTSpice, ImageJ
- **Mathematical & Statistical Tools:** MATHEMATICA, LaTeX, OriginLabs, MATLAB, Scilab
- **Programming & HPC:** Python, C++, Bash, HTML, HTCondor, Cuda, Cray

Position of Responsibility

- **Internship Coordinator** *Aug 2023 - May 2024*
  Training and Placement Cell, IIT Bombay [ ]
  - Streamlined internship processes for 1500+ students; collaborated with 300+ firms globally
  - Designed targeted plans for diverse student interests in core engineering, finance, and research

- **Team Captain** *Jan 2019 - Apr 2020*
  Genesis 16 Motorsports, DYPIEMR, SPPU [ ]
  - Managed a team of **25-30** people directly, and worked on building an **off-road racing vehicle**
  - Signed multiple **sponsorship deals** worth **Rs.50,000** with different industries for the project
  - Negotiated with the institute for the budget approval of **Rs 2,50,000**

Volunteer Experience

- **PE ROTA volunteer** *Aug 2025*
  LIGO Scientific Collaboration
  - Volunteered to launch 1 manual PE run for vanilla BBH event in PE ROTA shift
- **Scientific summary translator** *Jul 2025*
  LIGO Scientific Collaboration
  - Translated an exceptional event's (**GW231123**) science summary into regional languages (Marathi)
- **LIGO India Outreach Volunteer** *Dec 2024*
  LIGO INDIA
  - Volunteered at TechConnect (Techfest) with eight peers to raise awareness about gravitational waves and dispel misconceptions around the detectors as well as the detection by organising engaging educational activities, like the "Black Hole Ping Pong" game and an interactive "Stretch and Squash" selfie tool, to simplify complex concepts for diverse audiences

Certifications

- **International Centre for Theoretical Science, Bangalore:** Fascinating worlds of flows *Jul 2023*
- **Dassault's Systemes:** Certified SolidWorks Professional *Dec 2020*
- **Coursera & MathWorks:** Exploratory Data Analysis with MATLAB *Jul 2020*

Referee Details

1. **Prof Dr Rahul Kashyap**
   Designation: Assistant Professor
   Affiliation: Indian Institute of Technology, Bombay
   Email ID: rahulkashyap@iitb.ac.in
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2. **Dr Ish Mohan Gupta**
   Designation: Postdoctoral Fellow
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3. **Prof Dr Archana Pai**
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