Gaurav Waratkar

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I am interested primarily in Astronomical Instrumentation and Multi-Wavelength follow-up of high-energy transients like Gamma-Ray Bursts (GRBs), Fast Radio Bursts (FRBs) & Gravitational Wave (GW) sources.

Education

- **Indian Institute of Technology Bombay** — **Mumbai, MH**
  Graduate Student at STAR Lab, Department of Physics — *2020 - Present*
  Guide: Prof. Varun Bhalerao
  Topic: Daksha Instrumentation (New proposed X-ray Space Telescope), EM Follow-up of Fast Transients using CZTI payload onboard AstroSat and understanding noise characteristics of CZTI.
- **Indian Institute of Technology Bombay** — **Mumbai, MH**
  Bachelor's in Technology, Mechanical Engineering Department — *2015 - 2019*

Talks, Conferences and Schools

- **Conference on 5 years of AstroSat**
  Poster presentation: Searching for Transients using AstroSat CZTI — *Jan 2021*
- **GROWTH Annual Conference 2018**
  Poster presentation: Satellite visibility orbital simulator — *December 2018*
- **GROWTH Winter school 2018**
  Tutor, module testing & organizing the winter school — *December 2018*
- **Krittika – The Astronomy Club of IITB**
  Talk: Basics of Pulsars & their detection in radio data — *October 2018*

Publications

3. Sharma, Y., . . . , **G. Waratkar**, . . . et al. "The Search for Fast Transients with CZTI", Journal of Astrophysics and Astronomy, arXiv:2011.07067 (Jan 2020).
2. Kasliwal, Mansi M., . . . , **G. Waratkar**, . . . et al. " Kilonova Luminosity Function Constraints Based on Zwicky Transient Facility Searches for 13 Neutron Star Merger Triggers during O3", The Astrophysical Journal, 10.3847/1538-4357/abc335 (Dec 2020). **Cited: 17**
1. Coughlin, Michael W., . . . , **G. Waratkar**, . . . et al. "GROWTH on GW190425: Searching thousands of square degrees to identify an optical or infrared counterpart to a binary neutron star merger with the Zwicky Transient Facility and Palomar Gattini IR", The Astrophysical Journal, 10.3847/2041-8213/ab4ad8 (Oct 2019). **Cited: 41**

Non-Refereed.....

Checkout on ADS

Experience

- **Department of Physics, IIT Bombay** — **Mumbai, MH**
  Project Research Assistant — *May 2019 - Present*
  Advisors: Prof. Varun Bhalerao, Prof. Salil Kulkarni, Prof. Deepak Marla, Prof. PJ Guruprasad, Prof. Rakesh Mote
  - Contributing towards Daksha, a twin X-ray telescope proposed to ISRO, aimed as an all-sky monitor for GRBs

and EMGW follow-up, with order of magnitude higher sensitivity than current missions.
- Performing orbital heating tests, modal analysis and static structural simulations with NX Nastran and Ansys (incorporating integration and mission costs) to ensure satellite robustness and consistency with mission goals
- Mentored 12 undergraduate students on multiple projects related to the mission over the past 5 months

- **National Centre for Radio Astrophysics** **Pune, MH**
  Visiting Students Research Program *May 2018 - Present*
  Advisor: Prof. Yashwant Gupta, Director, NCRA-TIFR
  - Working on a blind pulsar search pipeline on an ongoing pilot survey using uGMRT, where we have potentially discovered few new pulsars - Gupta et al. (in prep) to report the same in future.
  - Led in the refining of a radio contamination source by processing raw data at the start of the pipeline.
  - Accrued 30 hours of first-hand observation experience with regular observations in the 34th cycle of GMRT.
  - Improved the pipeline by adding relevant end parameters for easier pipeline debugging & pulsar detection.

Research and Technical Projects

- **EMGW Follow-up using GROWTH-India Telescope**
  Advisor: Prof. Varun Bhalerao, Physics Department, IIT Bombay *Jan 2019 - Present*
  - Reduced the weight of GROWTH-India telescope assembly to bring it under design specifications of the motor
  - Optically followed the 2 'visible' BNS mergers S190425z & S190426c in O3a run of LIGO-VIRGO network
  - Published several GCNs & ATels reporting the follow-up of interesting transients through GIT
  - Tutored over 20 students in remote observations through GIT for PH426 - Astrophysics course projects
  - Was fully responsible for over 10 nights, helping out in others whenever needed by the current core team

- **Transient visibility from a satellite simulator**
  Advisor: Prof. Varun Bhalerao, Physics Department, IIT Bombay *July 2017 - April 2018*
  - Developed a Monte-Carlo based python simulator which generates all sky visibility data for a given satellite
  - Incorporated any satellite any configuration feature for detection of a random Gravitational Wave trigger
  - Designed a new algorithm for editing satellite TLEs based on user inputs using packages like PyEphem
  - Addressed the effects of SAA, earth occultation, detector sensitivity on satellite visibility in the simulator

- **Simulations on Core vs Cusp density problem of Dark Matter**
  Advisor: Prof. D Narasimha, Department of Astronomy and Astrophysics, TIFR *Summers 2017*
  - Replicated the Navarro–Frenk–White (NFW) profile of dark matter halos on the platform GADGET2
  - Investigated the influence of softening parameter on halo density profile on single component only Dark matter
  - Optimized the performance of all simulations based on DAA-TIFR high performance cluster (HPC)

- **IIT Bombay Racing (Powertrain Subsystem)**
  Junior Design Engineer, Mechanical Department, IIT Bombay *Sept 2016 - April 2017*
  - Researched on the plausibility of use of Titanium, was responsible for procurement of 4-way bypass valves, tripod joints, mechanical differential & wind tunnel tests of radiator, statistical tests of cooling system
  - A planetary gearbox with 4 planets was chosen for the new car considering structural robustness, performance, costs & integration with Gearbox, Cooling System & Electronic Differential by FEA simulations in ANSYS
  - Developed 3-D CAD models in SolidWorks for parts of gearbox such as casings, gears, bearings, driveshaft

Scholastic Achievements

- Secured an **AP grade** in Machine Design course for exceptional performance | Given to 2 out of 160 students
- Qualified **IUCAA**'s PhD entrance exam INAT's written test by being in **Top 38** out of over 800 candidates
- Secured a **National Rank of 89** in JEST, Physics PhD entrance exam organised by TIFR, Mumbai
- Secured a **99.75 percentile** in JEE Mains 2015 in over 1.3 million students
- Qualified for the prestigious **Indian National Astronomy Olympiad** for being in **top 300 in the country**

- Awarded the National Talent Search (NTS) Scholarship given by NCERT Delhi, **Government of India**
- Awarded **'Best Outgoing Student'** from 122 students for being best overall performer over 10 years

Relevant Courses

- Physics: Astrophysics, Thermal & Statistical Physics, Classical Mechanics, Basics of Electricity & Magnetism, Quantum Physics and Application
- Math: High Performance Scientific Computing, Data Analysis & Interpretation, Introduction to Numerical Analysis, Linear Algebra, Differential Equations, Calculus
- Mechanical: Machine Design, Computational Fluid Dynamics & Heat Transfer, Fluid Mechanics, Microprocessors & Automatic Control, Applied Thermodynamics, Computer Aided Simulation of Machines

Outreach

- **Krittika – The Astronomy Club of IIT Bombay**
  Manager and Convener *2016 - 2018*
  - Received two 6" equatorial Telescopes worth over INR 80,000 as a token of appreciation from HBCSE
  - Conducted first ever outreach session for school students from slums around the institute & from Kashmir
  - Doubled the club's social media reach in 2 years helped by highly successful trips to MAST & IRO, Mt. Abu
  - Planned a budget of over 0.4 million INR for club activities including lectures, documentary screenings, night sky observations, telescope handling workshops, quizzes & field trips to GMRT & Nehru Planetarium, Mumbai.

Relevant Course Projects

- Constraints on WDM by Lyman-α Forest, Astrophysics *Prof. Vikram Rentala, Physics Department*
- Dark Matter Simulations on GADGET2, Astrophysics *Prof. Vikram Rentala, Physics Department*

Skills

- Languages: Python(intermediate), C++(intermediate)
- Softwares: PRESTO, NX, SolidWorks, AutoCAD, Ansys (Fluent, Structural), GADGET2, Arduino

Extracurricular Activities

- Awarded 'Best Cadet' in National Cadet Corps (NCC) - Air Wing among 400 cadets
- Represented Hostel 7 in Volleyball in General Championships 2015, secured 2nd Place among 14 hostels
- Attended Five-day nurturance program for NTS awardees conducted by NCERT-Delhi, IUCAA
- Participated in multiple Kho-Kho and Roller-Skating Tournaments, intra-hostel Football League
- Secured Rank 1 in multiple talent exams, quizzes in city | Secured a top 20 State rank for consecutive years