

Gaurav Waratkar

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After completing my Bachelor's degree in Mechanical Engineering from IIT Bombay, I am working under Prof. Varun Bhalerao at the Department of Physics at IIT Bombay. I am a part of the team building Daksha, an X-ray telescope which will serve as an all-sky monitor for gamma-ray bursts beating the sensitivity of the state of the art. I am interested primarily in astronomical instrumentation & building reduction pipelines for bulk data analysis.

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.

Education

- **Indian Institute of Technology Bombay** **Mumbai, MH**
Bachelor's in Technology in Mechanical Engineering *2015 - 2019*
- **Taywade Junior College of Arts, Commerce & Science** **Nagpur, MH**
Intermediate/+2 *2015*
- **R.S. Mundle English School** **Nagpur, MH**
Matriculation *2013*

Publications

14. Michael W. Coughlin, . . . , **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, [arXiv:1907.12645](#) (Oct 2019). **Cited: 7**
13. **G. Waratkar** et al. "LIGO/Virgo S190425z: GROWTH-India observations of the Swift/UVOT transient.", GRB Coordinates Network [24304](#) (Apr. 2019).
12. **G. Waratkar** et al. "LIGO/Virgo S190426c: GROWTH India follow-up.", GRB Coordinates Network [24316](#) (Apr. 2019).
11. Robert Stein, . . . , **G. Waratkar**, . . . et al. "LIGO/Virgo S190901ap: Additional candidates from the Zwicky Transient Facility.", GRB Coordinates Network [25656](#) (Sept. 2019).
10. Robert Stein, . . . , **G. Waratkar**, . . . et al. "LIGO/Virgo S190901ap: Additional observations from the Zwicky Transient Facility.", GRB Coordinates Network [25634](#) (Sept. 2019).

9. Harsh Kumar, . . . , **G. Waratkar**, . . . et al. "LIGO/Virgo S190901ap: GROWTH-India follow-up of ZTF19abvionh.", GRB Coordinates Network [25632](#) (Sept. 2019).
8. Erik Kool, . . . , **G. Waratkar**, . . . et al. "LIGO/Virgo S190901ap: Candidates from the Zwicky Transient Facility.", GRB Coordinates Network [25616](#) (Sept. 2019).
7. Shreya Anand, . . . , **G. Waratkar**, . . . et al. "LIGO/Virgo S190425z: Additional Candidates from the Zwicky Transient Facility.", GRB Coordinates Network [24311](#) (Apr. 2019).
6. V. Bhalerao, . . . , **G. Waratkar**, . . . et al. "LIGO/Virgo S190425z - GROWTH-India follow-up of two ZTF candidates.", GRB Coordinates Network [24201](#) (Apr. 2019).
5. Viraj Karambelkar, . . . , **G. Waratkar**, . . . et al. "Photometric follow-up of blazar TXS 1515-273 with GROWTH-India". The Astronomer's Telegram [12570](#) (Mar. 2019).
4. Viraj Karambelkar, . . . , **G. Waratkar**, . . . et al. "Photometric follow-up of AT2019ahd (AT-LAS19car) with GROWTH-India". The Astronomer's Telegram [12476](#) (Feb. 2019).
3. H. Kumar, . . . , **G. Waratkar**, . . . et al. "GRB190211: GROWTH-India detection of optical afterglow.", GRB Coordinates Network [23896](#) (Feb. 2019).
2. H. Kumar, . . . , **G. Waratkar**, . . . et al. "GRB190202: GROWTH-India detection of optical afterglow.", GRB Coordinates Network [23874](#) (Feb. 2019).
1. H. Kumar, . . . , **G. Waratkar**, . . . et al. "GRB190114C: GRowth-India detection of optical afterglow.", GRB Coordinates Network [23733](#) (Jan. 2019).

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

Talks, Conferences and Schools

- **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*

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

Position of Responsibility

- **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