Gaurav Waratkar

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About Me

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 and building reduction pipelines for bulk data analysis.

Education

- **Indian Institute of Technology (IIT) Bombay** — *2015-2019*
  Bachelor's in Technology in Mechanical Engineering, CPI: 6.79/10 — *Mumbai, MH*
- Taywade Junior College of Arts, Commerce & Science — *2015*
  Intermediate/+2: 88.46 % — *Nagpur, MH*
- R.S. Mundle English School — *2013*
  Matriculation: 94.00 % — *Nagpur, MH*

Publications

- 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*". In: arXiv e-prints, arXiv:1907.12645 (July 2019).
- **G. Waratkar** et al. "*LIGO/Virgo S190425z: GROWTH-India observations of the Swift/UVOT transient.*" In: GRB Coordinates Network 24304 (Apr. 2019).
- **G. Waratkar** et al. "*LIGO/Virgo S190426c: GROWTH India follow-up.*" In: GRB Coordinates Network 24316 (Apr. 2019).
- Robert Stein, …, **G. Waratkar**, … et al. "*LIGO/Virgo S190901ap: Additional candidates from the Zwicky Transient Facility*." In: GRB Coordinates Network 25656 (Sept. 2019).
- Robert Stein, …, **G. Waratkar**, … et al. "*LIGO/Virgo S190901ap: Additional observations from the Zwicky Transient Facility.*" In: GRB Coordinates Network 25634 (Sept. 2019).
- Harsh Kumar, …, **G. Waratkar**, … et al. "*LIGO/Virgo S190901ap: GROWTH-India follow-up of ZTF19abvionh.*" In: GRB Coordinates Network 25632 (Sept. 2019).
- Erik Kool, …, **G. Waratkar**, … et al. "*LIGO/Virgo S190901ap: Candidates from the Zwicky Transient Facility.*" In: GRB Coordinates Network 25616 (Sept. 2019).
- V. Bhalerao, …, **G. Waratkar**, … et al. "*LIGO/Virgo S190425z - GROWTH-India follow-up of two ZTF candidates.*" In: GRB Coordinates Network 24201 (Apr. 2019).
- Viraj Karambelkar, …, **G. Waratkar**, … et al. "*Photometric follow-up of blazar TXS 1515-273 with GROWTH-India*". In: The Astronomer's Telegram 12570 (Mar. 2019).
- Viraj Karambelkar, …, **G. Waratkar**, … et al. "*Photometric follow-up of AT2019ahd (AT-LAS19car) with GROWTH-India*". In: The Astronomer's Telegram 12476 (Feb. 2019).
- H. Kumar, …, **G. Waratkar**, … et al. "*GRB190211: GROWTH-India detection of optical afterglow.*" In: GRB Coordinates Network 23896 (Feb. 2019).
- H. Kumar, …, **G. Waratkar**, … et al. "*GRB190202: GROWTH-India detection of optical afterglow.*" In: GRB Coordinates Network 23874 (Feb. 2019).
- H. Kumar, …, **G. Waratkar**, … et al. "*GRB190114C: GRowth-India detection of optical afterglow.*" In: GRB Coordinates Network 23733 (Jan. 2019).

Experience

Department of Physics, IIT Bombay *July 2019 - Present*

Project Research Assistant *Mumbai, MH*

Advisor: Prof. Varun Bhalerao, Prof. Salil Kulkarni, Prof. Deepak Marla, Prof. PJ Guruprasad, Prof. Rakesh Mote (IITB)

- 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

National Centre for Radio Astrophysics *May 2018 - Present*

Visiting Students Research Program *Pune, MH*

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 possible radio contamination source by pre-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-product parameters for a better pipeline debugging & pulsar detection.

Research and Technical Projects

EMGW Follow-up using GROWTH-India Telescope *(Jan 2019 – Present)*

Advisor: Prof. Varun Bhalerao, Assistant Professor, Department of Physics, IIT Bombay *Mumbai, MH*

- Reduced the weight of GROWTH-India telescope assembly to bring it under design specifications of telescope motor
- Optically followed the 2 'visible' BNS mergers S190425z & S190426c in O3 run of LIGO-VIRGO network
- Published several GCNs & ATels reporting the follow-up of interesting transients through GIT
- Contributed in the automation of remote observations from IIT Bombay
- Tutored over 20 students in remote observations through GIT for PH426 - Astrophysics course projects

Transient visibility from a satellite simulator *(July 2017 – April 2018)*

Advisor: Prof. Varun Bhalerao, Assistant Professor, Physics Department *Mumbai, MH*

- 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

Core vs Cusp Dark matter density problem simulations *(Summers 2017)*

Advisor: Prof. D Narasimha, Department of Astronomy and Astrophysics, TIFR *Mumbai, MH*

- 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) *(Sep 2016- April 2017)*

Junior Design Engineer, Mechanical Department, IIT Bombay *Mumbai, MH*

- 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 Design & Electronic Differential by carrying out 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 just 2 out of 160 students
- 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** in the National Standard Examination in Astronomy conducted by HBCSE, Mumbai
- Awarded the **National Talent Search (NTS) Scholarship** given by NCERT Delhi, Government of India
- Secured an **All India Rank 18** in NMTC conducted by Association of Mathematics Teachers of India
- Awarded '**Best Outgoing Student'** from 122 students for being best overall performer over 10 years

Talks, Conferences & Schools

- GROWTH Annual Conference 2018 *December 2018*
  Poster presentation: Satellite visibility orbital simulator
- GROWTH Winter school 2018 *December 2018*
  Tutor, Module testing & organizing the winter school
- Talk: Basics of Pulsars & their detection in radio data, *Krittika – The Astronomy Club of IITB* *October 2018*

Relevant Courses

- Physics: Astrophysics, Thermal & Statistical Physics, Classical Mechanics, Basics of Electricity & Magnetism, Quantum Physics and Application, 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 *2016-2018*

Manager & Convener

- 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

Technical Skills

- Languages: Python(intermediate), C++(intermediate),
- Softwares: GADGET2, PRESTO, GPTool, NX, SolidWorks, AutoCAD, Ansys (Fluent, Structural), Photoshop CS6, Arduino

Extracurricular Activities

- Awarded 'Best Cadet' in NCC Air Wing among 400 cadets | Awarded A grade in 'A certificate' exam
- 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