VARUN CHATURMUTHA

Graduate Research & Teaching Assistant
Physics and Astronomy Department, Georgia State University
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EDUCATION

- **Doctor of Philosophy in Astronomy** — Dec 2024 (expected)
  Georgia State University, Atlanta, GA, USA — *4.16/4*
  Advisors: Dr. Stuart M. Jefferies, Dr. Piet Martens, Dr. Bernhard Fleck
  Dissertation: Seismology of the Solar Atmosphere
- **Master of Science in Physics** — Dec 2022
  Georgia State University, Atlanta, USA — *4.15/4*
- **Master of Science in Astronomy** — Sep 2019
  University of Padova, Italy (Erasmus Mundus - AstroMundus Joint Degree) — *Grade A*
  Advisor: Dr. Giovanni Carraro
  Dissertation: Binarity as a possible explanation of the dual horizontal branch in NGC 6792
- **Bachelor of Technology in Engineering Physics** — May 2017
  Indian Institute of Technology, Guwahati — *7.52/10*
  Advisor: Dr. Santabrata Das
  Thesis: Transonic Properties of Accretion Flows Around Black Holes

EMPLOYMENT HISTORY

- **Georgia State University**, Atlanta, GSU — 2021-24
  Graduate Research/Teaching Assistant
- **NASA Goddard Space Flight Center** — 2020-21
  Data Analyst for The Helioviewer Project: Service Usage Analysis and Process Improvement Task
- **Remote Sensing for Space Sciences group**, GSU, Atlanta, USA — 2019-20
  Research Assistant in Solar Physics

RESEARCH EXPERIENCE

- **Acoustic Waves as a Probe of the Dynamics of the Solar Atmosphere** — 2021-2023
  Advisor: Dr. Stuart M. Jefferies, Dr. Bernhard Fleck
  Developed a novel, physically motivated wave propagation model of the solar atmosphere; demonstrated strong evidence for wave reflection in the solar atmosphere using MOTH II and SDO/HMI data; found a method to probe height of the plasma $\beta = 1$ surface in varying magnetic field regions using travel time of acoustic waves.
- **Probing the Atmosphere of the Sun-as-a-Star using Seismic Waves** — 2022-now
  Advisor: Dr. Stuart M. Jefferies, Dr. Bernhard Fleck, Dr. Piet Martens
  Formulated a proof of concept for extending analysis of acosutic waves in the solar atmosphere using sun-as-a-star data to probe the atmospheres of distant stars.
- **Horizontal Flows in the Solar Atmosphere** — 2021-now
  Advisor: Dr. Stuart M. Jefferies, Dr. Bernhard Fleck, Dr. Piet Martens
  Implementing multi-height Doppler data, MOTH, SDO/HMI, SOHO/MDI, and Hinode/SOT, toward detection of atmospheric gravity waves and measurement of horizontal flows in the solar atmosphere

- **The Helioviewer Project** 2020-21
  Advisor: Dr. Jack Ireland
  Developed live interactive usage statistics of the Helioviewer project services and data sources using Bokeh (Python) visualization tools
  (eg. live coverage map of SDO/HMI: api.helioviewer.org/statistics/bokeh/SDO_coverage.html).

- **Search for Solar g-modes** 2019-now
  Advisor: Dr. Stuart M. Jefferies
  Investigated detection of solar gravity modes using oscillations in the magnetically active regions of the Sun over a 60 day baseline. Concluded lack of statistical confidence in the g-mode detection with this technique. Currently working on a different approach: utilizing 12 years of sun-as-a-star Doppler data from GOLF and HMI to increase frequency resolution in the g-mode frequency regime ($\sim 10 - 100\,\mu$Hz) and enhance signal via cross-correlation techniques.

- **Binarity as a Possible Explanation for the Dual Horizontal Branch in NGC 6791** 2019
  Advisor: Dr. Giovanni Carraro
  Established the role of binarity and mass loss in the formation of extreme horizontal branch EHB stars.

- **Transonic Properties of Accretion Flows around Black Holes** 2017
  Advisor: Dr. Santabrata Das
  Explored Rankine-Hugoniot shock formations in accretion disk models; compared equivalence of relativistic and isothermal plasma gas in different black hole accretion models.

INTERNSHIPS

- **University of Texas, Austin**, USA Summer 2018
  Mentors: Dr. Chris Sneden, Dr. Melike Afşar
  Topic: Chemical and Kinematic Analysis of M67

- **ISRO (Indian Space Research Organization) Satellite Center**, India Summer 2016
  Mentor: Dr. Anuj Nandi
  Topic: Quasi-Periodic Oscillations in Cataclysmic Variables

PUBLICATIONS

1. **Chaturmutha, V.**, Jefferies, S. M., & Fleck, B. (2024), (in preparation for ApJL), Probing the Atmosphere of the Sun-as-a-Star using Seismic Waves

2. **Chaturmutha, V.**, Fleck, B., & Jefferies, S. M. (2024). Wave Reflection in the Solar Atmosphere. The Astrophysical Journal, Volume 966, Issue 2, Id.200, 9 Pp., 966(2), 200. DOI: 10.3847/1538-4357/AD36C5

3. Shaver, S. R., Smith, A. R., Babu, S. S., Baruah, Y., Bauer, M., **Chaturmutha, V.** et al. (2024). Exploring Observational Heliophysics Across All Scales: Reflections and Insights From the 2023 NASA Heliophysics Summer School. Perspectives of Earth and Space Scientists, 5(1), DOI: 10.1029/2023CN000217

4. Bentz, M. C., Birch, M., Chapman, Z., **Chaturmutha, V.** et al. (2022). The Rotation Period and Variability Amplitude of 1664 Felix. Minor Planet Bulletin, 49(4), 254.

DATA PRODUCTS

- Usage Statistics of the Helioviewer Project Services
  api.helioviewer.org/statistics/bokeh/ Source Code: github.com/varunchaturmutha/hv_stats

AWARDS AND FUNDING — $56,000 total

- **Second Century Initiative** (2CI) University Doctoral Fellow — 2021-Present
  Georgia State University — $6,000
- **The Helioviewer Project, Usage Analysis (80NSSC20K1251)** — 2020-21
  NASA Goddard Space Flight Center — $33,427
  Role: Data Analyst; PI: Dr. Stuart M. Jefferies; Technical Officer: Dr. Jack Ireland
- Support for travel:
  - NASA Heliophysics Summer School 2023, Boulder, CO — $1,500
  - Space Weather Workshop 2023, Boulder, CO — $570
  - SHINE 2023, Stowe, VT — $1,500
  - Cool Stars 2024, San Diego, CA — $1,190
- **Scholarship** — 2018
  Erasmus Mundus AstroMundus Consortium — €11,000

ACHIEVEMENTS

- **NASA Heliophysics Summer School**, Boulder, CO — 2023
  One of only 26 participants selected globally
- **Three Minute Thesis (3MT)** Finalist — 2023
- **All India Rank 3256**, Indian Institute of Technology – Joint Entrance Examination — 2013
  99.7th percentile among 1.5 million candidates in India

TEACHING EXPERIENCE

- **ASTR 1000 Course** — Jan - May 2023
  Simulcast introductory astronomy course, assistant instructor for the online section in a hybrid format
- **ASTR 1010 Labs** — Jan 2021 - May 2024
  Introductory Solar System Astronomy Labs to non-science major undergraduate students. 2-3 labs per semester.
- **ASTR 1020 Labs** — Jan 2021 - May 2024
  Introductory Stellar & Galactic Astronomy Labs to non-science major undergraduate students. 2-3 labs per semester.

PROFESSIONAL PRESENTATIONS — * = upcoming

Invited Talks

- *Galaxies to Gluons, REU Lunch Talks, GSU — Jun 2024
  Probing the Atmosphere of the Sun-as-a-Star using Seismic Waves
- Galaxies to Gluons, REU Lunch Talks, GSU — Jun 2023
  Seismology of the Solar Atmosphere
- WaLSA Meeting, International Space Science Institute, Bern, Switzerland, — Apr 2022
  Phase Dispersion Relations
- Solar Lab Meeting, NASA Goddard Space Flight Center, Greenbelt, MD — Oct 2020
  Bokeh as a Data Visualization Tool

Conference Oral Presentations

- 4th Annual One-minute Colloquium, Atlanta, GSU — Mar 2024
  The Dawn of the Seismic Probing of Stellar Atmospheres
- Inaugural Graduate Conference, Atlanta, GSU — Nov 2023
  The Dawn of the Seismic Probing of Stellar Atmospheres
- Starganza, 1st Meeting, Atlanta, GSU — Sep 2023
  The Dawn of the Seismic Probing of Stellar Atmospheres
- Solar Physics Division (SPD) 54th Meeting, Minneapolis, MN — Aug 2023
  Wave Reflection in the Solar Atmosphere
- 3rd Annual One-minute Colloquium, Atlanta, GSU — Mar 2023
  Can we predict Solar Flares using Acoustic Waves?
- Inaugural Graduate Conference, Atlanta, GSU — Nov 2022
  Acoustic Waves as a Diagnostic Tool of the Solar Atmosphere
- Georgia Regional Astronomer's Meeting (GRAM), Mercer University, GA — Nov 2022
  Acoustic Waves as a Diagnostic Tool of the Solar Atmosphere
- 2nd Annual One-minute Colloquium, Atlanta, GSU — Nov 2021
  Seismic Interferometry of the Solar Atmosphere

Conference Poster Presentations

- *SHINE, Juneau, AK — Aug 2024
  Wave Reflection in the Solar Atmosphere
- *Cool Stars 22, UC San Diego, CA — Jun 2024
  Probing the Atmosphere of the Sun-as-a-Star using Seismic Waves
- Space Weather Workshop, CU Boulder, CO — Apr 2023
  Flare Precursors in Acoustic Waves
- American Geophysical Union (AGU), Chicago, IL — Dec 2022
  Acoustic-Gravity Waves as a Probe of the Dynamics of the Solar Atmosphere

PUBLIC OUTREACH

Invited Talks:

- Tellus Science Museum, Cartersville, GA — May 2023
  Solar Flares and Their Impacts on Earth (YouTube)
- Charleston Planetarium, Facebook Live — Apr 2023
  Solar Flares and Their Impacts on Earth (FB Live)
- Bradley Observatory, Agnes Scott College, Atlanta, GA — Feb 2023
  Solar Flares and Their Impacts on Earth

Voluntary:

- STEM Night, Arcado Elementary School, Lilburn, GA — Mar 2024
- STEM Night, Mason Creek Elementary School, Winston, GA — Nov 2021
- Space Day, Georgia Institute of Technology, Atlanta, GA — Oct 2021
- Tuskegee Airmen Global Academy, Atlanta, GA — Sep-Oct 2021
- Organizer, GSU Science Olympiad Tournament — Feb 2020
- Village Education Program, Pragati Social Service, Techniche, Guwahati, India — Nov 2016

TECHNICAL SKILLS

Programming:	Python (proficient), SQL, IDL, Fortran, C++, C, Bash script, HTML
Softwares:	IRAF, DS9
Data Visualization:	Bokeh (Python)
Data Analysis:	Fourier analysis (proficient), Big data, Time series
Personal:	Excellent oral/written communication skills, strong problem-solving skills

LEADERSHIP AND SERVICE

- **Mentor**, Astronomy Peer Advising Leaders program (AstroPAL), GSU — 2022-now

  Mentoring junior graduate students about navigating difficult situations, maintaining work-life balance, regular check-ins, advisor-student relationsips, etc.

- **Webmaster**, Indian Network for Dynamical and Unified Solar Physicists (INDUS) — 2024-now

  Help maintaining and developing the INDUS Website

- **Student Representative**, DEI Taskforce, GSU — 2022-now

  Developed improvements for department climate; Initiatives we have completed include a GSU alumni career panel, advisor-student relationship survey, and guiding student bodies within the department.

- **Reviewer**, Student Technology Fee Proposals, GSU — 2022

  Assessed, ranked, and recommended proposals to benefit the university student community

- **Head**, Equinox Astronomy Club, IIT Guwahati, India — 2015-16

  Managed and organized astronomy events to engage on-campus population such as telescope sessions, astronomy quizzes, and general astronomy talks. Lead a team from IITG and secured third place in the Messier Marathon at the Inter-IIT Tech meet competition in IIT Kharagpur.

- **Organizer**, Astronomy competitions at Techniche (Technological Fest), IIT Guwahati — 2016

  As head of the astronomy club, I was tasked with creating astronomy-based competitions for the fest. Formulated "What If?"L a competition based on hypothetical physics/astronomy situations.

MEMBERSHIPS

- **Affiliate Member**, WaLSA (Waves in the Lower Solar Atmosphere) Team — 2021-now
- **Full Member**, American Astronomical Society — 2021-now
- **Member**, MENSA — 2008-now

REFERENCES

Stuart M. Jefferies, Ph.D.
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Email: sjefferies@gsu.edu
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