Neil Ghugare

Education

The Ohio State University **08-2022 – Present**

BS in Physics, BS in Astronomy and Astrophysics *Columbus, Ohio*

- German and Math Minors. University Honors program.
- Involved in campus clubs including the Society of Physics Students, Astronomical Society, and AI Club.

Goethe-Institut Dresden **05-2024 – 06-2024**

Course Participation Certificate *Dresden, Germany*

- Completed Goethe I75 German course at CEFR B2 level during a summer study abroad program, engaging in cultural immersion and language practice with native speakers in several German cities.

Experience

The Ohio State University **01-2023 – Present**

Undergraduate Research Assistant *Columbus, Ohio*

- Currently conducting theoretical astrophysics research with Dr. Todd Thompson, Dr. Prasanna, and Dr. Coleman on neutron star formation and magnetar winds using high-performance computing and Athena++.
- Contributed to experimental condensed matter physics research under Dr. ChunNing Lau, focusing on AI/ML identification of Graphene layers through unsupervised clustering algorithms and neural networks.

The Ohio State University **08-2025 – Present**

Student Mentor *Columbus, Ohio*

- Student mentor, part of the Momentum program to facilitate success in the intermediate mechanics course sequence.
- Provided one-on-one support to mentees through bi-weekly meetings, study tables, and more.

The Ohio State University **09-2023 – 09-2024**

Student Assistant - Grader *Columbus, Ohio*

- Assisted professors by grading homework and assignments, including creating answer keys for proof-based math courses.

Certifications

Goethe Zertifikat B2 **06-2024**

- Successfully demonstrated reading, listening, speaking, and writing abilities at the CEFR B2 level for German.

Wolfram Language & Mathematica Level 1 Certification **04-2023**

- Demonstrated proficiency in using the Wolfram Mathematica software, including the use of notebooks.
- Demonstrated proficiency in using the Wolfram Language, including data analysis, visualization, the neural net framework, and more.

OpenEDG PCEP Certified Entry-Level Python Programmer **07-2022**

- Demonstrated proficiency in entry-level python programming skills and basic OOP principles.

Projects

Magnetar Wind Simulations in Athena++ **Ongoing**

- Ran 2D & 3D isothermal and Qian-Woosley EOS Parker wind simulations utilizing HPC resources and the MHD code-base Athena++.
- Generated profile plots and animations of the simulation results. Generalized the code to work for different simulation cases and to work seamlessly in the command line.
- Implemented numerical techniques, such as Newton-Raphson inversion, interpolation, and simple numerical integration.
- Project supported by the OSU Undergraduate Research Apprenticeship Program 2025.

ISS Docking Port Locator and Distance Regressor AI **02-2025**

- Created a multi-headed network (MHN) built on top of MobileNetV3Small architecture with three heads to regress the xy-coordinates and the distance to the ISS docking port on an image.
- Designed a 3D visualization displaying the SpaceX Dragon capsule's flight path to the ISS using the regressed data.
- Awarded 3rd place in Ohio State AI Club's HackAI 2025, out of 26 teams.

Graphene Layer Identification AI **07-2023**

- Employed unsupervised clustering algorithms like DBSCAN and GMM along with image pre-processing to identify layers of graphene on an Si/SiO_2 substrate using RGB color channels.
- Created a CNN Tensorflow model to identify if a graphene sample was present on the given image.
- Project supported by the OSU Physics Summer Research Program 2023 and presented in a poster session.

Hemoglobin Binding Cooperativity **04-2023**

- Used MATLAB to compare models (Non-Cooperative/Pauling/Adair) of oxygen binding to hemoglobin.
- Created contour plots of to fit polynomial constants and ran Monte Carlo simulations for better models.
- Supported by the OSU Polaris program and presented findings in a poster session.

Technical Skills

Programming Languages: Python, Java, C++, MATLAB, and Mathematica. Familiar with C, FORTRAN, and more.
Frameworks & Libraries: TensorFlow, Scikit-Learn, CUDA, Jupyter, and Conda/PyPI/Venv.
Tools & Platforms: LaTeX, Git, Gradle/Maven, and HPC practices.
Language Skills: English (Native), German (CEFR Level B2), and understands Marathi.