Nicholas J. McClure

nic5153mcclure@gmail.com
ORCID: 0009-0000-9626-2192

Research Interests

- Time-domain astronomy and photometric variability in compact binary systems
- Accretion physics and outbursts in cataclysmic variables
- Applications of time-series analysis in large data sets
- Asteroseismology and stellar evolution

Education

Texas Tech University, Lubbock, TX
B.S. in Physics (Astrophysics concentration) Expected Dec 2025

University of Texas at Arlington, Arlington, TX
B.A. coursework in Music Composition May 2022

University of North Texas, Denton, TX
B.S. coursework in Psychology 2019–2020

Research Experience

Mysterious Modulations March 2024 – Present
Supervisor: Dr. Michael Fausnaugh

- Performed standard image reduction on ground-based CCD data using bias, dark, and flat-field frames to prepare images for photometric analysis.
- Developed Python scripts to perform detailed time-series analysis on TESS light curves, utilizing signal processing techniques such as polynomial detrending, Lomb-Scargle periodograms for frequency analysis, and phase-folding to verify periodic signals.
- Analyzed periodicities in cataclysmic variable systems to identify and characterize sources of stellar variability, including beat frequencies from blended sources.
- *Publication in progress.*

SkyQ May 2025 – Present
Supervisor: Dr. Michael Fausnaugh

- Developing a Python package to consolidate astronomical targets into a master table, calculate observability based on airmass and altitude, and rank targets to create streamlined observing plans.
- The goal of this project is to publish nightly observing plans to the Skyview website, increasing the accessibility of the observatory for undergraduate research.

Observing Experience

Preston Gott Skyview Observatory, Shallowater TX
Array of 12-inch Schmidt-Cassegrain telescopes

- **2025 Oct:** Time-series photometry to identify contaminating sources and confirm EB classification (∼18 hours, SDSS g', r')
- **2025 Jul:** Time-series photometry to identify contaminating sources (∼5 hours, SDSS g', r')
- **2024 Nov:** Time-series photometry to identify contaminating sources (∼5 hours, SDSS g', r')

Key Laboratory Projects

Intermediate Physics Laboratory, Spring 2025

- **Microwave Optics in Disordered Media:** Investigated the refractive properties of a plano-convex lens constructed from quartz sand using an 11 GHz Gunn oscillator. The project involved developing a physical model, performing intensive error analysis, and using a constrained linear fit of refraction angles to confirm Snell's Law and determine a refractive index consistent with Maxwell-Garnett predictions. Culminated in a formal research paper.
- **The Zeeman Effect:** Investigated the splitting of atomic spectral lines in a strong magnetic field. Measured the resulting polarization and wavelength shifts to perform a high-precision calculation of the electron's charge-to-mass ratio (e/m).
- **Gravitational Constant Measurement:** Performed a high-precision measurement of the gravitational constant (G) by analyzing the period of a torsional harmonic oscillator using a laser monitoring system to detect minute angular displacements.
- **Solar Cell Characterization:** Characterized the efficiency of a photovoltaic solar cell by measuring its current-voltage (I-V) curve under varying illumination conditions to determine key performance metrics, including fill factor and maximum power output.

Presentations

- *Mysterious Modulations: TESS Insights into the Dwarf Nova AT2019muu* – TSAPS, Dallas, TX (Oct 2024); Sigma Pi Sigma Poster Symposium, Lubbock, TX (Nov 2024, Oct 2025); 245th AAS Meeting, National Harbor, MD (Jan 2025); Texas Tech Undergraduate Research Conference (Apr 2025)

Technical Skills

- **Technical:** Python (AstroPy, NumPy, SciPy, Matplotlib), LaTeX, Time-Series Analysis (Lomb-Scargle, Fourier methods), Signal Processing (detrending, phase-folding), CCD Photometry & Image Reduction, Data Modeling & Intensive Error Analysis, Telescope Operation
- **Communication:** Public speaking, curriculum development, STEM outreach and education

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Teaching & Outreach Experience

Lab/Learning Assistant, Texas Tech University Jan 2025 – Present

- Facilitated instruction for Solar System and Stellar Astronomy lab courses; guided observational exercises
- Assisted with on-site observational instruction using campus observatory equipment and instruction for Observational Astronomy (junior-level course)

Astronights Volunteer, TTU Physics & Astronomy Dept. 2025 – Present

- Volunteered for departmental public outreach events to teach the local community about astronomy.
- Operated a personal telescope rig to provide the public with live views of celestial objects.

STEM Educator, Science Spectrum, Lubbock, TX Dec 2022 – Mar 2023

- Delivered interactive astronomy/physics demos to public audiences
- Developed original curriculum and led eclipse-outreach events (attendance 800+)

Private Tutor, ClubZ! Tutoring Services Mar 2020 – Dec 2021

- Provided one-on-one tutoring in high school and undergraduate level mathematics and physics.
- Tailored instruction to individual student needs, resulting in significant grade improvements.

Academic Honors & Awards

- Menzel Undergraduate Research Scholarship, Texas Tech University (2025)
- Dean's List, Texas Tech University (2025)
- Lab Assistant of the Week, Texas Tech University (2025)
- Bucy Undergraduate Scholarship in Physics (2024)

Relevant Coursework

- **Astronomy:** Observational Astronomy, Solar System Astronomy, Astrophysics I–II, Radio Astronomy, Radiative Processes in Astrophysics
- **Physics:** Physics I–IV, Mechanics, E&M I–II, Quantum Mechanics, Computational Physics, Optics, Modern Physics Lab, Intermediate Lab, Error Analysis
- **Mathematics:** Calculus I–III, Differential Equations I–II, Linear Algebra

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Professional Affiliations

- American Astronomical Society – Member/Presenter – 2024–Present
- American Physical Society – Member/Presenter – 2024–Present
- Society of Physics Students (SPS), Member – 2023–Present
- College of Arts & Sciences Undergraduate Research Academy (CASURA), Member – 2024–Present