

Sev Graham

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EDUCATION

University of Arizona

May 2024

B.S. in Astronomy, Minors: Geosciences, Planetary Sciences, Physics

- Cumulative GPA 3.50; graduated cum laude.

SELECTED COURSEWORK

Astronomy & Planetary Science

Theoretical Astrophysics, Observational Astronomy, Planetary Astrobiology, Solar System Geology, Physics of the Solar System, Chemistry of the Solar System, Astronomy of Comets & Kuiper Belt Objects

Geoscience

Structural Geology, Petrology, Mineralogy, Geophysics, Earth Surface Processes, History of Earth's Climate

Physics

Computational Physics, Theoretical Mechanics, Quantum Theory, Electricity & Magnetism, Thermal Physics

Mathematics

Vector Calculus, Differential Equations, Statistics

PEER-REVIEWED PUBLICATIONS

Graham, S., & Volk, K. (2024). Uranus's Influence on Neptune's Exterior Mean-motion Resonances. *The Planetary Science Journal*, 5, 135. doi:10.3847/PSJ/ad4707

IN PREPARATION

Dual exoplanet system (in preparation). Contributing author: dynamical stability mapping, mean-motion resonance analysis, and transit-timing-variation modeling. Author list pending.

CONFERENCE PRESENTATIONS

Graham, S., & Volk, K. (2023). The destabilization of Neptune's distant mean-motion resonances by Uranus. AAS Division on Dynamical Astronomy Meeting #54, id. 203.01.

Graham, S., & Volk, K. (2022). The destabilization of some of Neptune's distant mean-motion resonances by Uranus. AAS Division for Planetary Sciences Meeting #54, id. 410.02.

Volk, K., Malhotra, R., & Graham, S. (2021). Mapping Neptune's resonances into the distant solar system. AAS Division on Dynamical Astronomy Meeting #52, id. 305.01.

RESEARCH EXPERIENCE

Undergraduate Researcher

Feb 2021 - May 2024

Lunar & Planetary Laboratory, University of Arizona

- Designed and ran N-body simulations (REBOUND; IAS15 and WHFAST) of the outer solar system and transneptunian objects to map Neptune's external mean-motion resonances.
- Traced the observed drop-off in resonance strength near 250 AU to Uranus-induced oscillations in Neptune's orbit rather than direct perturbation of the small bodies.
- Built a custom resonance-strength metric and Poincaré phase-space maps in Python to quantify transient resonance sticking in the scattering population.
- First-authored the results in *The Planetary Science Journal* (2024); connected predictions to forthcoming LSST/Rubin survey constraints.

Research Collaborator (Dynamics)

May 2026 - Present

Dual Exoplanet System (in progress)

- Providing dynamical analysis for a dual exoplanet system discovery paper: REBOUND stability mapping, resonance analysis, and TTV modeling.

Undergraduate Laboratory Worker

Mar 2022 - May 2024

Arizona Noble Gas Laboratory, University of Arizona

- Prepared whole-rock samples for Ar-Ar geochronology (crushing, sieving, acid treatment) and produced pure mineral separates via optical microscopy and density / magnetic separation.
- Packaged separates for neutron irradiation and loaded irradiated samples for noble-gas isotopic analysis.

Undergraduate Research Assistant

Jun 2022 - Aug 2022

Lunar & Planetary Laboratory, University of Arizona

- Contributed to SBDynT, a machine-learning package to classify the dynamical properties of small bodies expected from the LSST.
- Characterized centaur orbital dynamics, identifying resonant configurations with the giant planets and their stability timescales. These results were used to train the model.

PROFESSIONAL EXPERIENCE

Battery R&D Technician

Aug 2025 - Present

Ampcera, Tucson, AZ

- Developed the group's first viable dry-process graphite anode, carrying a delegated formulation through a self-designed calendaring process now in pouch-cell validation.
- Fabricate dry-process electrodes and run split-cell experiments characterizing new solid electrolyte powders (ionic conductivity, air-exposure resilience, operating temperature range); maintain controlled-atmosphere gloveboxes.

AWARDS & HONORS

Excellence in Undergraduate Research

May 2024

Department of Planetary Sciences, University of Arizona

Arizona NASA Space Grant Award

Aug 2022

OBSERVING EXPERIENCE

- Mount Lemmon Observatory: 12-inch, 24-inch, and 32-inch telescopes.
- Mount Bigelow: 61-inch Kuiper telescope.

TECHNICAL SKILLS

Programming

Python (NumPy, pandas, Matplotlib, SciPy, REBOUND, REBOUNDx)

Simulation

N-body integration (IAS15, WHFAST, MERCURIUS), resonance and stability analysis, Poincaré maps, TTV modeling, JPL Horizons

Laboratory

Controlled-atmosphere glovebox, electrochemical cell testing (split and pouch cells), Ar-Ar sample preparation, optical microscopy, SEM operation, rock saw operation, chemical handling, radiation safety

Electronics

Soldering, PC building, single-board computers

Computing

Linux command line, self-hosting (Docker), data analysis and scientific computing

Instrumentation

Consumer-grade telescope and drone operation

TECHNICAL PROJECTS

REBOUND Test-Particle Pipeline

- Parallelized N-body pipeline (MERCURIUS) in Python for solar-system and exoplanet stability studies; config-driven disk generation with collision and escape detection.

Self-Hosted Home Lab

- Multi-node Docker stack on Linux (server and NAS): personal cloud, media server, home automation, and a Raspberry Pi running BirdNET acoustic species monitoring.

TEACHING, MENTORING & SERVICE

Assistant Instructor

Jackrabbit Chinese Martial Arts, Tucson, AZ

- Regularly assist in instructing less experienced members in Taiji, Baguazhang, Xingyiquan, and Shuai Jiao concepts.
- Serve as club treasurer.

Citizen Science Contributor

BirdNET-Pi acoustic monitoring

- Built and maintain a Raspberry Pi acoustic monitoring station that automatically detects and uploads bird species identifications to a public database.

REFERENCES

Available upon request.