

**Research Interests**

Planetary science researcher with experience in scientific data analysis, numerical modeling, remote sensing, and scientific visualization.

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**Education**

**Massachusetts Institute of Technology**, Cambridge, MA

Candidate for Master's in Earth, Atmospheric, and Planetary Science

Expected Aug 2026

B.S., double major in Earth, Atmospheric, and Planetary Science and Physics, **GPA: 4.7/5.0**

May 2025

**Relevant Courses:** Geomorphology, Exploring Solar System Surfaces, Introduction to Geology, Computational Methods of Scientific Programming, Introduction to Computer Science Programming in Python, Introduction to Geophysics and Planetary Science, Physical Principles of Remote Sensing, Differential Equations

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**Research Experience**

**Graduate Researcher, MIT EAPS, Cambridge, MA**

Sept 2025 - Present

**PI: Prof. Julien de Wit**

- Extracted faint asteroid spectra from archival JWST observations by tracking moving signals across time ordered images and building a custom Python pipeline to study asteroids that appeared in data collected for other science targets
- Validated weak asteroid signals using image inspection, difference imaging, spectral extraction, and diagnostic plotting before scientific interpretation

**Research Student, Planetary Defense Group, Los Alamos National Laboratory (LANL)**

June 2025 - August 2025

**Mentors: Dr. Catherine Plesko and Dr. Mark Boslough**

- Analyzed meteoroid airburst ground damage footprint maps to quantify how entry angle, burst altitude, and entry velocity influence damage morphology
- Used Python to extract and clean damage boundary contours from reference maps, then applied Fourier-based fitting to compare predicted damage patterns across different impact scenarios
- Created a browser based Python GUI prototype (GitHub) that lets users tune inputs and instantly visualize predicted damage patterns to support rapid exploratory analysis

**Undergraduate Researcher, MIT EAPS, Cambridge, MA**

Sept 2024 - May 2025

**PI: Dr. Christopher N. Hill**

- Developed a Python-based heat transport model for icy moon oceans, analyzing how boundary conditions affect temperature structure and heat flow behavior
- Checked model behavior against analytic expectations, applied stability constraints, and produced diagnostic plots of temperature and heat flux profiles for interpretation

**Undergraduate Researcher, MIT EAPS, Cambridge, MA**

Feb 2024 - May 2024

**PI: Prof. Richard Teague**

- Analyzed multidimensional protoplanetary disk simulation data in Python to quantify how velocity and density structure evolved over time
- Validated the simulation by comparing derived velocity and density structure to observational plots, confirming consistency with observed disk behavior
- Developed matrix based diagnostics to separate intrinsic vortex rotation from projection effects, and validated velocity structure trends against published observational constraints

**Research Student, Space Remote Sensing and Data Science Group, LANL**

May 2023 - August 2023

**Mentor: Dr. Nina Lanza**

- Analyzed Perseverance SuperCam laser induced breakdown spectroscopy (LIBS) spectra and microphone data to study coating to bedrock transitions in Martian rocks
- Cleaned, processed, and compared LIBS peak-area trends with microphone amplitude data across laser shots to evaluate whether acoustic signals could help identify material transitions

**Undergraduate Researcher, MIT EAPS, Cambridge, MA**

Jan 2022 - August 2022

**PI: Prof. John Marshall**

- Analyzed icy moon ocean current simulation outputs in Python across 12 simulation cases to quantify how rotation and ocean depth impact particle transport and transit time statistics
- Generated transit time probability distributions and comparative diagnostic plots across 12 simulation cases in Python and MATLAB, identifying Rossby number scaling regimes and producing reproducible figures to compare model behavior across varied ocean parameters

**Graduate Mentor: Xiaohui Zhu. Faculty Advisor: Prof. Cédric G. Fichot**

- Modeled photobleaching of chromophoric dissolved organic matter (CDOM) in Python by fitting and comparing linear, quadratic, and polynomial regression models to quantify decay trends

**Publications**

- Wölfer, L., ..., **Nath, A.**, et al. (2025). ExoALMA XVII: Characterizing the Gas Dynamics Around Dust Asymmetries. *Astrophysical Journal Letters*, 984, L22. doi:10.3847/2041-8213/adc42c
- Zhang, Y., ..., **Nath, A.**, et al. (2025). Long Transit Time from the Seafloor to the Ice Shell on Enceladus. *Monthly Notices of the Royal Astronomical Society*, 541(2), 859–871. doi:10.1093/mnras/staf1008

**Manuscripts in Preparation**

- Nath, A., et al. (est. 2026). Serendipitous Spectral Characterization of Asteroids with Archival JWST Data. Manuscript in preparation.

**Teaching Experience****Teaching Assistant, Planetary Atmospheres, MIT EAPS**

Feb 2026 - Present

**Instructor: Prof. Raymond Pierrehumbert**

- Grade assignments and provide detailed feedback

**Residential Facilitator, Interphase Edge (MIT)**

June 2024 - August 2024

**Instructor: Mohamed Abdelhafez, Lecturer in Physics**

- Led twice-weekly review and problem-solving sections, held office hours, and graded problem sets for an introductory classical mechanics course, supporting students during guided practice

**Problem Set Reviewer, MIT Experimental Group**

August 2023 - Sept 2023

**Supervisors: Jonathan Bloom and Paola Rebusco**

- Reviewed ES.S601 problem sets for an introductory Python course focused on numerical modeling and physics applications, providing detailed feedback on clarity, difficulty, and accessibility.

**Teaching Assistant, Classical Mechanics I, MIT Experimental Group**

Sept 2022 - Dec 2022

**Instructors: Analia Barrantes and Paola Rebusco**

- Assisted students with problem sets on topics such as energy, momentum, and rotational mechanics by giving them hints when they got stuck, explaining them essential concepts, and identifying errors in their calculations.
- Graded two problem sets from all 30 students in class.

**Projects****Cinematic Stellar Evolution Visualization, Independent Project**

May 2025 - Present

*From Clouds to Us: The Story of Star Birth and Fusion*

- Created a planetarium-style science visualization in Houdini about star birth, fusion, and the origin of the elements
- Built data-informed star visuals using magnitude, color, and spatial placement to connect visual design with physical meaning
- Designed the visual pacing and narrative structure to explain astrophysics concepts for broad audiences

**Interactive Simulation Developer, MIT Experimental Study Group**

Feb 2023 - July 2023

- Designed and developed an interactive Python simulation to visualize magnetic fields, enabling users to explore electromagnetic principles through dynamic and intuitive visualizations

**Software Engineer, Independent project**

August 2019 - April 2021

**“ML-based Speech Recognition App for individuals with speech disorders”**

- Created an Android app using Python to recognize ten basic words spoken by individuals with speech disorders. Used Tensorflow for model training and predicted accuracy of the trained model.
- Earned First Prize at Massachusetts Science and Engineering Fair (MSEF), Second Prize at Massachusetts Junior Academy of Science (MJAS), Foundation Medicine Award, Naval Science Academy Award, U.S. Air Force Award.

**Technical Skills:****Programming:** Python, NumPy, SciPy, Matplotlib, Astropy, MATLAB, C, JavaScript**Computational Methods:** numerical modeling, simulation analysis, model validation, statistical analysis**Data & Remote Sensing:** FITS processing, JWST archival data analysis, image inspection, WCS transformations**Research Communication:** technical writing, documentation, scientific figures, presentations