

# ALEX ROSS

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## EDUCATION

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### University of Washington

Seattle, WA

- *Bachelor of Science* in Physics & Astronomy with Interdisciplinary Honors Graduation June 2027
- *Minors* in Aeronautics & Astronautics and Applied Mathematics
- *Courses*: Classical Mechanics, Mathematical Physics, Thermal Physics, Analog Electronics, Extragalactic Astronomy, Quantum Mechanics, Engineering Statics, Particles and Symmetries, Astronomical Data Analysis

## EXPERIENCE

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### NASA Goddard Space Flight Center *Gravitational Astrophysics Intern, Greenbelt, MD*

Jun 2025 - Present

- Engineering a modular data analysis pipeline using **Python** to process real-time signals from the upcoming **LISA** space-based gravitational wave observatory.
- Developed and integrated software components including time series generation, dynamic spectrograms for transient signal detection, adaptive whitening filters, and Q-transform-based anomaly detection.
- Applied advanced signal processing and spectral estimation (Welch PSD) to enable low-latency characterization of weak signals in high-noise environments.
- Optimized system performance for deployment in mission-critical environments requiring **autonomous detection**, rapid data interpretation, and **event-driven response**.

### Institute for Nuclear Theory *Neutron Star Research Intern, Seattle, WA*

Mar 2025 - Present

- Performing advanced theoretical thermodynamics and linear algebra computations to model dense nuclear matter behavior and improve the accuracy of neutron star structure predictions.
- Analyzing thermal properties of ultra-dense matter to refine neutron star cooling models and constrain neutrino emission rates.
- Investigating phase transitions in nuclear matter at extreme densities and temperatures, incorporating quantum statistical mechanics approaches.
- Developing computational models utilizing machine learning in order to simulate and constrain the neutron star equation of state, producing a model capable of simulating neutron star structure **5 times faster than traditional TOV solvers**.

### UW Astronomy Department, JWST LEGGOS *Gravitational Lensing Researcher*

Nov 2024 - Present

- Researching high-redshift strongly lensed galaxies using Bayesian spectral energy distribution fitting tools, JWST photometry and spectroscopy, and **Python** to understand early universe star formation and galactic dynamics.
- Gathering data via remote observation using the Apache Point Observatory, processing and interpreting this data to determine age, stellar mass, size, star formation rate, dust content, and metallicity of cosmic noon galaxies.
- Writing a novel Python software pipeline using machine learning to automatically map and identify star forming clumps in strongly lensed galaxies, creating pseudo-SEDs from broadband photometry, reducing processing time by 60%.
- Working on a first-authorship paper detailing the software pipeline, with submission planned for mid-2026.

### Husky Satellite Lab *Lead Propulsion Engineer, Seattle, WA*

Sep 2024 - Present

- Engineering a **hot-gas CubeSat propulsion** system. Designed and prototyped a **resistojet system** that increases thrust by **50%** over previous system iterations utilizing **Onshape**, **NX** and **Ansys**, achieving target  $\Delta V$  values.
- Completed **thermodynamics research** on propellants, determining R-134a to be the ideal compound to maximize thrust for complex maneuvers around the moon while minimizing power requirements and mass.
- Performed trade studies and thermodynamic simulations in **Ansys** to determine the ideal Resistojet materials to prevent heat fatigue and electrical component damage.

- Simulated low-gravity fluid dynamics in **Ansys** in order to design a multi-stage propellant management system.
- Performed cis-lunar **orbital simulations** in **MATLAB** and **GMAT**, applying vector calculus and orbital mechanics to reduce system **wet mass requirement by 15%** and **total impulse demand by 10%**.

#### **Husky Robotics Team** *Instrumentation Research Lead, Seattle, WA*

June 2024 - Present

- Constructing a Mars rover, leading the instrumentation team for soil and atmospheric analysis. Spearheading the research and development for **data processing** methods, in-situ spectroscopy, geochemical analysis, and manufacturing.
- **Ensured integration** between instrumentation, electronics, and structures through itemized reports of power and weight requirements for each component, resulting in efficient testing and **20%** more weight to allocate to a stronger chassis.
- Conducted research on **Raman spectroscopy**, using **Ansys** to develop a cooling method utilizing TECs that **reduces thermal noise by 30%** and offers a **higher signal-to-noise ratio**, resulting in clean spectra and simpler data analysis.
- Designed and led experiments for geochemical analysis, Raman spectroscopy, and fluorimetry, allowing the team to determine the target molecule that will be most indicative of biological life, reducing our identification time by **75%**.
- Engineered and machined custom components including aluminum optics cages, spectrometer baseplates, and fasteners using **3-axis milling**, lathe, drill press, and 3D printing, saving **\$3,500+** and ensuring precision fit for mission requirements.

#### **AWARDS**

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- 2024-2025: Annual Dean's List, Seattle, WA
- 12/2024: Triangle Fraternity Brother of the Quarter, Seattle, WA
- 06/2023: Quincy Jones Jazz Musicianship award, Spokane, WA

#### **VOLUNTEER EXPERIENCE**

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##### **Triangle Fraternity** *Philanthropy Committee Chair*

May 2024 - Present

- Organized and executed fundraising events to raise money for STEM mental health awareness, LA wildfire victims, and blood cancer research.
- Orchestrated blood and plasma donation drives.

##### **Sloan Digital Sky Survey-V Local Volume Mapper** *Remote Observer*

Oct 2024 - Present

- Remote observer for the Local Volume Mapper, an integral-field spectroscopic survey that has the goal of mapping the interstellar gas emissions of the Milky Way, and the Large and Small Magellanic clouds.
- Remotely operate and service cryogenic tanks, monitoring pressure levels and fill rate to ensure the spectrograph system is properly cooled, reducing thermal noise and further optimizing data collection and resolution.

#### **SKILLS AND AFFILIATIONS**

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**Programming:** Python, MATLAB, C, Fortran, Julia

**Hardware:** Circuit theory, PCB design, Arduino, CNC Machining, 3D Printing (SLM, DMLS), Mills, Lathes

**CAD & Simulation:** Siemens NX, Onshape, Solidworks, Aerospace Toolbox, Ansys Workbench, Simscale, LaTeX, GMAT

**Mathematics/Physics:** Advanced linear algebra, vector and complex calculus, mathematical modeling and simulation, thermodynamics, fluid mechanics, elementary statistical mechanics, quantum mechanics, electromagnetism, classical mechanics

#### **AFFILIATIONS**

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**Affiliated Organizations:** NASA PWEE Academy participant, Society of Physics Students, Triangle Fraternity, Astronomy Undergraduate Engineering Group, American Physical Society, American Astronomical Society