

# Kate Roberts

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## Education

**Boston University**, Ph.D. in Astronomy Sep 2022 – ~May 2027  
**Boston University**, M.A. in Astronomy Sep 2022 – Nov 2024  
Advisor: Prof. Luke Moore

**Kalamazoo College**, B.A. in Physics and Studio Art, minor in Applied Mathematics Sep 2018 – Mar 2022  
Graduated *summa cum laude* with highest award of *honors* in physics.  
Thesis: *The Surface Composition of Anomalous Asteroids as a Window into the Early Solar System*.  
Advisors: Prof. Katherine de Kleer (Caltech), Prof. Arthur Cole (Kalamazoo College), Received *honors*.

## Research Experience

**Graduate Research Fellow**, Boston University, Boston, MA May 2023 - Present

### The Climate of Jupiter's Upper Atmosphere

- Reduced and analyzed IR spectra of Jupiter's upper atmosphere from Keck/NIRSPEC
- Derived global, upper atmospheric temperatures and ion densities to redefine our understanding of ionospheres on hydrogen-dominated worlds.
- Assisted on, independently ran, and proposed for observations on Keck NIRSPEC (2022 - 2025) and IRTF iSHELL (2023 - 2025).

**Research Support Assistant**, California Institute of Technology, Remote Mar 2022 - Jun 2022

### The Surface Composition of Anomalous Asteroids Continued

- Reduced and analyzed IR spectra of M- and L-type asteroids from Keck/NIRSPEC.
- Detected first 4.5-micron (iron) spectral feature on the surface of M-type, Psyche (unofficial).

**SURF Student Researcher**, California Institute of Technology, Pasadena, CA Jun 2021 - Aug 2021

### The Surface Composition of Anomalous Asteroids as a Window into the Early Solar System

- Collaborated with Prof. Katherine de Kleer to complete a relevant research proposal for the program application.
- Reduced and analyzed IR spectra of asteroids Psyche and Eunomia from Keck/NIRSPEC.
- Determined the extent of silica compounds on the surface of the asteroid, and established significant composition variability over asteroid surfaces.
- Research completed and manuscript written as a Senior Individual Project (SIP, Senior Thesis) in partial fulfillment for the degree of Bachelor of Arts from Kalamazoo College.

**REU Student Researcher**, Michigan State University, Remote May 2020 - Jul 2020

### Machine learning for improved resolution and fast predictions in an O-PPAC

- Enrolled in two-week machine learning crash course through MSU.
- Applied gained knowledge from Prof. Michelle Kuchera (Davidson College) to write and edit neural network code which learned on simulated data to infer the locations of rare particles.
- Detector being tested with code for faster and more accurate beam tuning within the particle accelerator at the Facility of Rare Isotope Beams (FRIB).

## Publications

**The Climate of Jupiter's Upper Atmosphere** Submitted  
Kate Roberts et al.

**Spatiotemporal Variations of Temperature in Jupiter's Upper Atmosphere** Apr 2025  
Kate Roberts et al. 10.3847/PSJ/adc09b

<b>Unraveling Jupiter's Enigmatic Ionosphere: Evidence of Magnetically-Controlled Wind-Driven Dynamics</b> O. Agiwal et al., incl K. Roberts	Submitted
<b>JWST Reveals the Vertical Structure of Uranus' Ionosphere</b> P.I. Tiranti et al., incl K. Roberts	Submitted
<b>Short-Term Variability of Jupiter's Satellite Footprints with JWST</b> K.L. Knowles et al., incl K. Roberts	Submitted
<b>Pole-to-Pole Vertical Ionospheric Profiles at Jupiter from JWST</b> P.I. Tiranti et al., incl K. Roberts 10.1029/2025JA034066	Aug 2025
<b>Magnetic Silhouettes in Jupiter's Non-Auroral Ionosphere</b> K.L. Knowles et al., incl K. Roberts 10.1029/2025JA033868	May 2025
<b>Sub-auroral Heating at Jupiter Following a Solar Wind Compression</b> J. O'Donoghue et al., incl K. Roberts 10.1029/2024GL113751	Apr 2025

## Experience

<b>US Research Software Sustainability Institute</b> , Summer School Attendee	Aug 2025
<ul style="list-style-type: none"> <li>Received training in software engineering best practices for scientists.</li> <li>Learned about the materials, process, and mindset of open science.</li> </ul>	
<b>Boston University</b> , Graduate Teaching Fellow	Sep 2022 - May 2023
<ul style="list-style-type: none"> <li>AS100 "Cosmic Controversies," <i>Prof Michael Mendillo, Spring 2023</i></li> <li>AS101 "Solar System," <i>Prof Paul Withers, Fall 2022</i></li> </ul>	
<b>Kalamazoo College</b> , Teacher's Assistant	Jan 2020 - Mar 2022
<ul style="list-style-type: none"> <li>PHYS150 "Introduction to Mechanics," <i>Winter 2020, 2021, 2022</i></li> <li>PHYS152 "Introduction to Electricity and Magnetism," <i>Spring 2020, 2021</i></li> <li>PHYS220 "Introduction to Quantum, Relativity, and Nuclear Physics," <i>Fall 2020, 2021</i></li> <li>PHYS370 "Electronics and Electromagnetism," <i>Winter 2021, 2022</i></li> </ul>	
<b>Kalamazoo College</b> , Math & Physics Center Consultant	Sep 2019 - Mar 2022
<ul style="list-style-type: none"> <li>Created an environment which encourages creativity, communication, and collaboration between students, professors, and consultants.</li> <li>Promoted in the 2021-2022 school year to lead consultants and enhance work ethic, productivity, and accessibility to students of all backgrounds while maintaining role as tutor.</li> </ul>	

## Funding

<b>Future Investigators in NASA: Earth, Space Science, and Technology</b> <i>Why are the Giant Planets so Hot? Determining the Dominant Heat Sources in Jupiter's Upper Atmosphere</i>	2023-2026
<b>DPS Student Travel Grant</b> <i>For 2025 joint meeting of the Division of Planetary Sciences and Europlanet Science Congress.</i>	Fall 2025
<b>AGU Student Travel Grant</b> <i>For 2024 American Geophysical Union Conference.</i>	Fall 2024
<b>Hartmann Student Travel Grant</b> <i>For 2023 joint meeting of the Division of Planetary Sciences and Europlanet Science Congress.</i>	Fall 2023
<b>Massachusetts Space Grant</b> <i>Why are the Giant Planets so Hot? Determining the Dominant Heat Sources in Jupiter's Upper Atmosphere</i>	Summer 2023
<b>Massachusetts Space Grant</b> <i>Chasing Shadows in Jupiter's Ionosphere</i>	Summer 2022

## Observing Programs

<b>IRTF Program #994, PI</b>	2025B
<i>Observing Short-Term Variability in Jupiter's Upper Atmosphere, 12 hours.</i>	
<b>JWST Program #8147, Co-I</b>	Cycle 4, 2025
<i>Chasing the Great Red Spot: Exploring Coupling Between Jupiter's Atmospheric Layers, 15.60 hours.</i>	
<b>IRTF Program #054, PI</b>	2025A
<i>'In the Hot Seat': Jupiter's Equatorial Upper Atmosphere, 18 hours.</i>	
<b>Keck Program PID 130 2024A N174, Co-I</b>	2024A - 2025B
<i>Joint Keck-Juno observations of Jupiter, its moons and its magnetosphere, 14.25 nights.</i>	
<b>JWST Program #5308, Co-I</b>	Cycle 3, 2024
<i>Hunting for the source of Saturn's atmospherically driven aurora, 11.64 hours.</i>	

## Talks & Posters

<b>Contributed Talk</b> , ISSI International Team 23-592	Sep 2025
Short-term Variability in Jupiter's Upper Atmosphere.	
<b>Contributed Talk</b> , Division of Planetary Sciences & Europlanet Science Congress	Sep 2025
Jupiter's Stable Upper Atmosphere: Mapping Long-term Temperature Trends and Ionospheric Density Structures.	
<b>Contributed Talk</b> , Boston Area Planetary Science Meeting Congress	May 2025
Spatiotemporal Variations of Temperature in Jupiter's Upper Atmosphere.	
<b>Poster</b> , American Geophysical Union Annual Meeting	Dec 2024
High-Resolution Maps of Magnetically Organized Temperature and Density Structures in Jupiter's Upper Atmosphere.	
<b>Poster</b> , Magnetospheres of the Outer Planets Conference	Jul 2024
Jupiter's Upper Atmosphere: Observations of Temporal Variations in Temperature. (page 99, Poster A06)	
<b>Contributed Talk</b> , ISSI International Team 23-592	Feb 2024
Lat-Long Variations in Temperature & Density via Keck Observations in Jupiter's Upper Atmosphere.	
<b>Poster</b> , Division of Planetary Sciences & Europlanet Science Congress	Oct 2023
Mapping Temporal and Spatial Temperature Variations in Jupiter's Upper Atmosphere.	
<b>Contributed Talk</b> , Kalamazoo College Math-Physics-Computer Science SIP Fest	Apr 2022
The Surface Composition of Anomalous Asteroids as a Window into the Early Solar System.	
<b>Contributed Talk</b> , Caltech Student-Faculty Programs Seminar Day	Apr 2022
The Surface Composition of Anomalous Asteroids as a Window into the Early Solar System.	
<b>Poster</b> , Division of Nuclear Physics Conference	Oct 2020
Machine learning for improved resolution and fast predictions in a parallel-plate avalanche counter with optical readout (O-PPAC).	

## Service

<b>Boston University</b> , Inclusive Astronomy: Astro365	2022, 2023, & 2024 Nov
<ul style="list-style-type: none"><li>• Volunteered at open science nights for local, under-served high school students.</li><li>• Ran demos on plasmas, spectroscopy, and telescopes with thoughtful explanations and answers for young scientists-to-be.</li></ul>	
<b>Boston University</b> , Astronomy Graduate Student Department Representative	Jul 2023 - Jul 2024
<ul style="list-style-type: none"><li>• Worked as liason between graduate students and faculty.</li><li>• Gathered and communicated ideas of the the collective graduate student body.</li><li>• Assisted in planning department events: prospective student visits, faculty candidate visits during faculty</li></ul>	

searches.

## Honors & Awards

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- Recipient of the 2022 Kalamazoo College John Wesley Hornbeck Prize for Highest Achievement in Advanced Physics as a Senior Major
- Kalamazoo College Physics and 3/2 Engineering Department Student Advisor (2021-2022)
- President and Member of Kalamazoo College Chapter of Society of Physics Students (2021-2022) (Vice President: 2020-2021)
- Founder, President, and Member of Kalamazoo College Chapter of  $\Sigma\Pi\Sigma$ , the Physics and Astronomy Honors Society (2021-2022)
- Leading Senior Consultant of the Kalamazoo College Math and Physics Center (2021-2022)
- Society of Physics Students Notable Chapter (2020-2021, awarded Fall 2021)
- Recipient of the 2019 Kalamazoo College Cooper Prize for Outstanding Work in First Year Physics
- Recipient of the 2019 Kalamazoo College Brian Gougeon Prize for Outstanding Work in First Year Art

## Mentoring

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Russell Mapaye, Undergraduate Student, Boston University <i>Now a PhD Student at Aberystwyth University</i>	2022 - 2024
Nico McMahon, Undergraduate Student, Boston University <i>Now a PhD Student at Rochester Institute of Technology</i>	2022 - 2024
Jay LoMonaco, Undergraduate Student, Boston University	2022 - 2024
Jonah Beurkens, Undergraduate Student, Kalamazoo College <i>2022 REU Student at University of Florida</i>	2021 - 2022
Matthew Nelson, Undergraduate Student, Kalamazoo College <i>Now a PhD Student at University of Illinois Urbana-Champaign</i>	2021 - 2022
Claire Kvande, Undergraduate Student, Kalamazoo College <i>Now a PhD Student at University of Washington</i>	2020 - 2022