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
Long Term Observations 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 broadly redefine our understanding of ionospheres on hydrogen-dominated worlds.
- Assisted on, independently ran, and proposed for observations on Keck/NIRSPEC (2022 - 2026) and IRTF/iSHELL (2023 - 2026).

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

A Global View of Jupiter's Upper Atmosphere Through H_3^+ — ApJL, Feb 2026
Kate Roberts et al. 10.3847/2041-8213/ae3c9b

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

Short-Term Variability of Jupiter's Satellite Footprints as Spotted by JWST GRL, In Review

K.L. Knowles et al., incl **K. Roberts**

JWST Discovers the Vertical Structure of Uranus' Ionosphere GRL, Accepted

P.I. Tiranti et al., incl **K. Roberts**

Photochemistry in Jupiter's ionosphere: insights from simultaneous H_3^+ and electron density observations during Juno perijove 54 PSJ, Jan 2025

L. Moore et al., incl **K. Roberts** 10.3847/PSJ/ae2f49

Unraveling Jupiter's Enigmatic Ionosphere: Evidence of Magnetically-Controlled Wind-Driven Dynamics GRL, Dec 2025

O. Agiwal et al., incl **K. Roberts** 10.1029/2025GL119171334

Pole-to-Pole Vertical Ionospheric Profiles at Jupiter from JWST JGRA, Aug 2025

P.I. Tiranti et al., incl **K. Roberts** 10.1029/2025JA034066

Magnetic Silhouettes in Jupiter's Non-Auroral Ionosphere JGRA, May 2025

K.L. Knowles et al., incl **K. Roberts** 10.1029/2025JA033868

Sub-auroral Heating at Jupiter Following a Solar Wind Compression GRL, Apr 2025

J. O'Donoghue et al., incl **K. Roberts** 10.1029/2024GL113751

Experience

US Research Software Sustainability Institute, Summer School Attendee Aug 2025

- Received training in software engineering best practices for scientists.
- Learned about the materials, process, and mindset of open science.

Boston University, Graduate Teaching Fellow Sep 2022 - May 2023

- AS100 "Cosmic Controversies," *Prof Michael Mendillo, Spring 2023*
- AS101 "Solar System," *Prof Paul Withers, Fall 2022*

Kalamazoo College, Teacher's Assistant Jan 2020 - Mar 2022

- PHYS150 "Introduction to Mechanics," *Winter 2020, 2021, 2022*
- PHYS152 "Introduction to Electricity and Magnetism," *Spring 2020, 2021*
- PHYS220 "Introduction to Quantum, Relativity, and Nuclear Physics," *Fall 2020, 2021*
- PHYS370 "Electronics and Electromagnetism," *Winter 2021, 2022*

Kalamazoo College, Math & Physics Center Consultant Sep 2019 - Mar 2022

- Created an environment which encourages creativity, communication, and collaboration between students, professors, and consultants.
- 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.

Funding

Future Investigators in NASA: Earth, Space Science, and Technology 2023-2026

Why are the Giant Planets so Hot? Determining the Dominant Heat Sources in Jupiter's Upper Atmosphere

DPS Student Travel Grant Fall 2025

For 2025 joint meeting of the Division of Planetary Sciences and Europlanet Science Congress.

AGU Student Travel Grant Fall 2024

For 2024 American Geophysical Union Conference.

Hartmann Student Travel Grant Fall 2023

For 2023 joint meeting of the Division of Planetary Sciences and Europlanet Science Congress.

Massachusetts Space Grant Summer 2023

Why are the Giant Planets so Hot? Determining the Dominant Heat Sources in Jupiter's Upper Atmosphere

Massachusetts Space Grant Summer 2022

Chasing Shadows in Jupiter's Ionosphere

Observing Programs

IRTF Program #994, PI 2025B

Observing Short-Term Variability in Jupiter's Upper Atmosphere, 12 hours.

JWST Program #8147, Co-I Cycle 4, 2025

Chasing the Great Red Spot: Exploring Coupling Between Jupiter's Atmospheric Layers, 15.60 hours.

IRTF Program #054, PI 2025A

'In the Hot Seat': Jupiter's Equatorial Upper Atmosphere, 18 hours.

Keck Program PID 130 2024A N174, Co-I 2024A - 2025B

Joint Keck-Juno observations of Jupiter, its moons and its magnetosphere, 14.25 nights.

JWST Program #5308, Co-I Cycle 3, 2024

Hunting for the source of Saturn's atmospherically driven aurora, 11.64 hours.

Talks & Posters

Invited Talk, Kalamazoo College Society of Physics Students Feb 2026

Jupiter's Upper Atmosphere & My Path in Science.

Contributed Talk, Boston Area Planetary Science Meeting Jan 2026

A Global View of Jupiter's Upper Atmosphere.

Contributed Talk, ISSI International Team 23-592 Sep 2025

Short-term Variability in Jupiter's Upper Atmosphere.

Contributed Talk, Division of Planetary Sciences & Europlanet Science Congress Sep 2025

Jupiter's Stable Upper Atmosphere: Mapping Long-term Temperature Trends and Ionospheric Density Structures.

Contributed Talk, Boston Area Planetary Science Meeting May 2025

Spatiotemporal Variations of Temperature in Jupiter's Upper Atmosphere.

Poster, American Geophysical Union Annual Meeting Dec 2024

High-Resolution Maps of Magnetically Organized Temperature and Density Structures in Jupiter's Upper Atmosphere.

Poster, Conference on Magnetospheres of the Outer Planets Jul 2024

Jupiter's Upper Atmosphere: Observations of Temporal Variations in Temperature. (page 99, Poster A06)

Contributed Talk, ISSI International Team 23-592 Feb 2024

Lat-Long Variations in Temperature & Density via Keck Observations in Jupiter's Upper Atmosphere.

Poster, Division of Planetary Sciences & Europlanet Science Congress Oct 2023

Mapping Temporal and Spatial Temperature Variations in Jupiter's Upper Atmosphere.

Contributed Talk, Kalamazoo College Math-Physics-Computer Science SIP Fest Apr 2022

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

Contributed Talk, Caltech Student-Faculty Programs Seminar Day Apr 2022

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

Poster, 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

Boston University, Inclusive Astronomy: Astro365 2022, 2023, & 2024 Nov

- Volunteered at open science nights for local, underserved high school students.
- Ran science demos on plasmas, spectroscopy, and telescopes with thoughtful explanations.

Boston University, Astronomy Graduate Student Department Representative Jul 2023 - Jul 2024

- Worked as liason between graduate students and faculty.
- Gathered and communicated ideas of the the collective graduate student body.
- Assisted in planning department events: prospective student visits, faculty candidate visits during faculty searches.

Honors & Awards

- 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 ΣΠΣ, 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)*
- 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

Russell Mapaye, Undergraduate Student, Boston University 2022 - 2024
Now a PhD Student at Aberystwyth University

Nico McMahon, Undergraduate Student, Boston University 2022 - 2024
Now a PhD Student at Rochester Institute of Technology

Jay LoMonaco, Undergraduate Student, Boston University 2022 - 2024

Jonah Beurkens, Undergraduate Student, Kalamazoo College 2021 - 2022
2022 REU Student at University of Florida

Matthew Nelson, Undergraduate Student, Kalamazoo College 2021 - 2022
Now a PhD Student at University of Illinois Urbana-Champaign

Claire Kvande, Undergraduate Student, Kalamazoo College 2020 - 2022
Now a PhD Student at University of Washington