Alexander Mark Kling

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Education

Ph.D. Earth, Atmospheric, and Planetary Science **2020 – Present**
Concentration: Planetary Science
Purdue University, West Lafayette, IN

B.S. Geology *magna cum laude* **2016 – 2020**
Stony Brook University, Stony Brook, NY

Research Interests

I am interested in the study of planetary materials and linking this to modelling and spacecraft data to understand the formation and evolution of planetary body surfaces. Currently, I am working to understand the processes by which solar wind volatiles such as hydrogen, water, helium, and neon water may form and be stored on the lunar surface in association with space weathering. I tackle these problems using a combination of analytical and in situ experimental techniques such as transmission electron microscopy, electron energy loss spectroscopy, and atom probe tomography. This work is directly applicable to understanding volatile cycling on the lunar surface and other airless bodies and may inform future missions targeting lunar volatiles such as Lunar Trailblazer, the VIPER rover, and the Artemis program.

Research Experience

Graduate Research Assistant **Aug 2020 – Present**
Department of Earth, Atmospheric, and Planetary Sciences, Purdue University
Thesis Advisor: Dr. Michelle S. Thompson
Dissertation: Understanding the behavior of volatiles formed by space weathering on the Moon via analyses of returned samples and laboratory experiments

Undergraduate Research Assistant **May 2017 – May 2020**
Center for Planetary Exploration (CPEx), Stony Brook University
Mentors: Dr. Timothy D. Glotch and Dr. A. Deanne Rogers
Projects: Temperature dependence of visible to near-infrared spectral properties of minerals under simulated airless body conditions,
Development of VNIR and TIR spectral libraries relevant to Bennu in preparation for OSIRIS-REx,
Raman and micro-FTIR spectral mapping of shocked basalts

NSF REU Research Intern **June 2019 – Aug 2019**
Department of Astronomy and Planetary Science, Northern Arizona University
Mentors: Dr. Jean-Francois Smekens and Dr. Christopher S. Edwards
Project: Laboratory spectroscopy of terrestrial volcanic ash and potential applications to Martian remote sensing

NSF REU Research Intern **June 2018 – Aug 2018**
Department of Earth and Planetary Sciences, American Museum of Natural History
Mentor: Dr. Denton S. Ebel
Project: Modal abundances of EH3 chondrites using image analysis of x-ray maps

Undergraduate Research Assistant **Jan 2017 – May 2017**
Facility for Isotope Research & Student Training (FIRST), Stony Brook University
Mentors: Dr. Steven S. Jaret and Dr. E. Troy Rasbury
Project: Determining the ages and provenance of detrital zircons in SBU campus loess using U-Pb dating

Publications

Kling, A. M., Greer, J., Thompson, M. S., Heck, P. R., Isheim, D., & Seidman, D. N. (2025). Nanoscale reservoirs store solar wind-derived water on the lunar surface. *Earth and Planetary Science Letters*, 651, 119178. https://doi.org/10.1016/j.epsl.2024.119178
**Selected for the 2025 Pellas-Ryder award for outstanding student paper in planetary sciences.*

Breitenfeld, L. B., Rogers, A. D., Glotch, T. D., Hamilton, V. E., Christensen, P. R., Lauretta, D. S., Gemma, M., Howard, K. T., Ebel, D. S., Kim, G., **Kling, A. M.**, Nekvasil, H., Lindsley, D. H., DiFrancesco, N. J. (2021). Machine learning mid-infrared spectral models for modal mineralogy predictions of CI/CM chondrite asteroids and Bennu. *Journal of Geophysical Research: Planets*, 126, e2021JE007035. https://doi.org/10.1029/2021JE007035

Glotch, T. D., Edwards, C. S., Yesiltas, M., Shirley, K. A., McDougall, D. S., **Kling, A. M.**, et al. (2018). MGS-TES spectra suggest a basaltic component in the regolith of Phobos. *Journal of Geophysical Research: Planets*, 123, 2467-2484. https://doi.org/10.1029/2018JE005647

Manuscripts in preparation:
Dyar, M. D., Lane, M. D., Glotch, T. D., Breitenfeld, L. B., Clark, R. N., Pearson, N., Sklute, E. C., McCanta, M. C., Hendrix, A., Weller, B., Schaller, M., **Kling, A.**, and McDougall, D. Spectroscopy of the Hamburg meteorite, Michigan H4 chondrite, *Meteoritics & Planetary Sciences*. *In revision.*

Kling, A. M. & Thompson, M. S. Solar wind neon storage in space weathered lunar regolith grains and implications for the behavior of neon in planetary materials. *Manuscript in preparation for submission to Geochimica et Cosmochimica Acta.*

First-Authored Conference Abstracts and Presentations

* = undergraduate advisee

Kling, A. M., Thompson, M. S., Prince, B. P., Rahman, Z., Sycko, K.*, Zega, T. J. (2025) Unraveling the complex relationship between progressive space weathering and the cycling of solar wind volatiles on the Moon. 87th Annual Meeting of the Meteoritical Society. Abstract 5260. *Invited Presentation.*

Kling, A. M., Sycko, K.*, Prince, B. P., Thompson, M. S., Rahman, Z., Chang, Y.-J., Zega, T. J. (2025) Using in situ heating in the transmission electron microscope to probe the retention of implanted solar wind gases in lunar samples. Microscopy and Microanalysis Meeting.

Kling, A. M., Sycko, K.*, Thompson, M. S., Rahman, Z., Chang, Y.-J., Zega, T. J. (2025) Retention of solar wind helium in space weathered lunar ilmenite during micrometeorite impacts: Implications from in situ TEM heating experiments. 56th Lunar and Planetary Science Conference. Abstract 2765.

Kling, A. M., Rahman, Z., Thompson, M. S., and Zega, T. J. (2024) Simulating lunar surface processes in the lab: Developing FIB procedures for in situ TEM heating experiments of space weathered lunar grains. 86th Annual Meeting of the Meteoritical Society. Abstract 6369.

Kling, A. M. & Thompson, M. S. (2024). Solar wind neon stored in space weathering signatures in

mature lunar soils. 55th Lunar and Planetary Science Conference. Abstract 1567.

Kling, A. M., Greer, J., Thompson, M.S., Heck, P. R., Isheim, D., Seidman, D. N. (2023). Solar Wind-Sourced Water Stored in Nanoscale Reservoirs in Lunar Soil Grains. 54th Lunar and Planetary Science Conference. Abstract 1710.

Kling, A. M., Greer, J., Thompson, M.S., Heck, P. R. (2022). Coordinated TEM and APT analyses to understand the distribution of solar wind-sourced hydrogen and water in space weathered lunar soils. 84th Annual Meeting of the Meteoritical Society. Abstract 6332.

Kling, A. M., Greer, J., Thompson, M.S., Heck, P. R. (2022). Identification of solar wind-sourced water in the space weathered rims of lunar soils. 53rd Lunar and Planetary Science Conference. Abstract 1504.

Kling, A. M., Benner, M. C.*, Thompson, M. S., Greer, J., Diaz, R. E., Heck, P. R. (2021). The Search for Water in Lunar Soils Through Coordinated Analysis of Space Weathering Characteristics in an Apollo 17 Sample. 83rd Annual Meeting of the Meteoritical Society. Abstract #6241.

Kling, A. M., Thompson, M.S., Greer, J., Heck, P. R. (2021). Coordinated Analysis of Space Weathering Characteristics in Lunar Samples to Understand Water Distribution on the Moon. Microscopy and Microanalysis Meeting.

Kling, A. M., Thompson, M. S., Greer, J., Heck, P. R. (2021). Coordinated Analysis of Space Weathering Characteristics in Lunar Samples to Understand Water Distribution on the Moon. Annual V. M. Goldschmidt Conference.

Kling, A. M. and Ebel, D. S. (2019). Modal abundances of EH3 chondrites using image analysis of X-ray maps. 50th Lunar and Planetary Science Conference. Abstract 1698.

Kling, A. M., Shirley, K. A., Glotch, T. D. (2018). Temperature dependence of visible to near-infrared spectral properties of minerals under simulated airless body conditions. NASA Exploration Science Forum.

Kling A., Jaret S., Rasbury E. T. (2017). U-Pb Ages for Zircons from SBU Campus Loess. 24th Conference on "Geology of Long Island and Metropolitan New York."

Kling A., Cobo C., Gil L., Tang S. (2015). The Effect of Road Salt on Soil pH. 22nd Conference on "Geology of Long Island and Metropolitan New York."

Co-Authored Conference Presentations

* = undergraduate advisee

St.Pierre, J. G. A., Thompson, M. S., **Kling, A. M.**, Hibbitts, K. A., Cahill, K. R. S. (2025) Preparing for the analysis of volatiles in frozen samples to be returned by the Artemis missions. 87th Annual Meeting of the Meteoritical Society. Abstract 5264.

St.Pierre, J. G. A., Thompson, M. S., **Kling, A. M.**, Hibbitts, K. A., Cahill, K. R. S. (2025) Preparing for the analysis of volatiles in frozen samples to be returned by the Artemis missions. 56th Lunar and Planetary Science Conference. Abstract 2606.

Hibbits, C. A., Ahrens, C., Asenath-Smith, E., **Kling, A.**, Shearer, C., Thompson, M., Wilbur, Z., Barnes, J. (2024). Findings from the LEAG ExMAG Specific Action Team on Cold-Conditioned and Volatile Artemis Samples. NASA Exploration Science Forum.

Sycko, K.*, **Kling, A.** & Thompson, M. (2023). Characterizing the effects of space weathering on the

surface of lunar grains using scanning electron microscopy. Purdue University Spring Undergraduate Research Conference.

Sycko, K*. & **Kling, A.** (2022). Characterizing the effects of space weathering on lunar grains using scanning electron microscopy. Purdue University Fall Undergraduate Research Expo.

Greer, J., **Kling, A. M.**, Isheim, D., Seidman, D. N., Thompson, M. S., Heck, P. R. (2022). Nanoscale analyses of space weathered mature lunar soil 79221. 84th Annual Meeting of the Meteoritical Society. Abstract 6303.

Greer, J., **Kling, A. M.**, Isheim, D., Seidman, D. N., Thompson, M. S., Heck, P. R. (2022). Nanoscale analyses of vesicles in space-weathered lunar soil silicates and ilmenite. 53rd Lunar and Planetary Science Conference. Abstract 1508.

Breitenfeld, L. B., **Kling**, **A.**, Kim, G., Rogers, A. D., Glotch, T. D., Hamilton, V. E., Christensen, P. R., Lauretta, D. S., and the OSIRIS-REx Team (2019). VNIR and TIR spectra of fine-grained minerals under ambient and simulated asteroid environment conditions with applications to OSIRIS-REx. 50th Lunar and Planetary Science Conference. Abstract 1866.

Rogers, D., Glotch, T., McDougall, D., **Kling, A.**, Hamilton, V., Lauretta, D. (2018). Determining Modal Mineralogy of Fine-Particulate Surfaces on Bennu Using Partial Least Squares (PLS) Analyses of OSIRIS-rex OTES and OVIRS Spectra. 15th Annual Meeting Asia and Oceania Geosciences Society.

Awards and Honors

Graduate:

M&M Student Scholar Award, Microanalysis Society (*$1,500*) **2025**

The Barringer Crater Company Travel Award, Barringer Crater Company (*$950*) **2025**

Pellas-Ryder Award for outstanding student paper in planetary sciences, Meteoritical Society and Planetary Geology Division of the Geological Society of America (*$1,500*) **2025**

Graduate Student Conference Support, Department of Earth, Atmospheric, and Planetary Sciences, Purdue University (2x, *$400 each*) **2024**

H. Jay Melosh Planetary Conference Support, Department of Earth, Atmospheric, and Planetary Sciences, Purdue University (*$2,000*) **2024**

College of Science Graduate Student Travel Award, College of Science, Purdue University (*$500*) **2024**

Future Investigators in NASA Earth and Space Science and Technology (FINESST) Fellowship, NASA *($150,000 over three years)* **2023-2026**

NASA Indiana Space Grant Doctoral Fellowship, Indiana Space Grant Consortium, *($12,000)* **2023**

LPI Career Development Award, Lunar and Planetary Institute *($1,000)* **2023**

College of Science Graduate Student International Travel Grant, College of Science, Purdue University *($800)* **2022**

Joseph Goldstein Scholar Award, Microanalysis Society *($1,000)* **2022**

Meteoritical Society Meeting Travel Grant, O. Richard Norton Fund *($1,500)* **2022**

Darrell Leap Hydrology Graduate Research Award, Department of Earth, Atmospheric, and Planetary Sciences, Purdue University *($500)* **2022**

College of Science Graduate Student International Travel Grant, **2022**

College of Science, Purdue University *($800)*

1-Min Research Madness Blitz Student Winner, Department of Earth, Atmospheric, and Planetary Sciences, Purdue University **2021**

NASA US Students Award, Universities Space Research Association *($1,150)* **2021**

Goldschmidt Conference Grant, Geochemical Society *($150)* **2021**

Undergraduate:

Oliver Schaeffer Award, Department of Geosciences, Stony Brook University **2020**

Provost's Award for Academic Excellence, Stony Brook University *($100)* **2020**

AIPG National Undergraduate Scholarship, American Institute of Professional Geologists *($1,000)* **2020**

Barry Goldwater Scholar, Barry Goldwater Scholarship and Excellence in Education Foundation *($7,500)* **2019**

USRA Distinguished Undergraduate, Honorable Mention, Universities Space Research Association **2019**

Angelo Tagliacozzo Memorial Geological Scholarship, American Institute of Professional Geologists, Northeast Section *($2,000)* **2019**

October 2018 Researcher of the Month, Undergraduate Research Experience and Creative Arts (URECA), Stony Brook University **2018**

Presidential Scholarship, Stony Brook University *($4,500 annually)* **2016 – 2020**

Dean's List, College of Arts and Sciences, Stony Brook University (8 semesters) **2016 – 2020**

Invited Talks

"Nanoscale reservoirs store solar wind-derived water on the lunar surface." **Feb 2025**
Friends of Lunar Volatiles SSERVI Focus Group, virtual.

"Nanoscale storage of solar wind volatiles and their retention on the lunar surface." **Sept 2024**
SSERVI CASA Moon Planetary Sample Science Seminar Series, virtual.

"From the grain scale to the global scale: How space weathering influences the behavior of water on the lunar surface." **May 2023**
NASA Lunar Trailblazer science team meeting, virtual.

Mentorship and Training

Undergraduate Students Advised:

Kaitlyn Sycko '24 Geology & Geophysics and Planetary Sciences, Purdue University (now a TEM/Geological Analyst at Asbestos TEM Laboratories) Fa 2022 – Sp 2024

Kasidi Lowry '25 Planetary Sciences, Purdue University Summer 2022

Daniel Garcia '25 Planetary Sciences, Purdue University Summer 2022

Vincent Soldano '23 Geology, University of Nevada, Reno via the Geosciences Education & Mentorship Support (GEMS) program (now a GIS specialist at Desert Research Institute) Fa 2021 – Sp 2022

Victor Garcia '24 Planetary Sciences, Purdue University Fall 2021

Maizey Benner '21 Planetary Sciences and Physics, Purdue University Spring 2021

(now a PhD student at the University of Arizona)

Training on Hitachi TM4000 Benchtop Scanning Electron Microscope:

Twelve undergraduates, four graduate students, and two professors

Teaching Experience

Guest Instructor for Scanning Electron Microscopy Lab **Fall 2022, 2023, Spring 2025**
EAPS 243: Earth Materials I (Mineralogy)
Department of Earth, Atmospheric, and Planetary Sciences, Purdue University

Undergraduate Teaching Assistant **Fall 2019**
GEO 347/547: Remote Sensing
Department of Geosciences, Stony Brook University

Selected Proposals

NASA Facility for Astromaterials Research (NFAR) Proposal, ARES/NASA JSC
Developing procedures for in situ FIB liftout and transfer of space weathered lunar grains for in situ TEM heating experiments
PI: Alexander Kling

Professional Service

Executive Secretary on NASA review panel

Student Panel Member, LEAG-ExMAG Specific Action Team, Cold-Conditioned and Volatile Artemis Samples Sub-Panel — 2023-2024

Manuscript Reviewer: *Nature Astronomy, JGR: Planets, Earth and Planetary Science Letters, GSA Bulletin, Nature Communications* — 2023 – Present

Session Chair, 85th Annual Meeting of the Meteoritical Society — 2022

Session Moderator, 53rd Lunar and Planetary Science Conference — 2022

Dwornik Award Judge, Lunar and Planetary Science Conference — 2022

University Service

Panelist, Future Mentor's Program, John Martinson Honors College, Purdue University — Fall 2024

Graduate Committee, Department of Earth, Atmospheric, and Planetary Sciences, Purdue University — Fall 2021 – Spring 2024

Professional Development Committee, EAPS Graduate Student Association, Purdue University — Fall 2021 – Spring 2024

Graduate Curriculum and Academic Policy committee, College of Science, Purdue University — Fall 2021 – Spring 2024

Panelist, "Ask a Scholar: Goldwater Scholars' Advice for Current Applicants," National and International Scholarships Office, Purdue University — Fall 2020, 2021

Academic Career and Success Committee, Tabler Quad, Stony Brook University — Aug 2018 – May 2019

Guest Speaker, SSO 102: The Undergraduate Researcher, Stony Brook University — 2019

Student representative for the Department of Geosciences at the Major/Minor Networking Event, Stony Brook University — 2019

Professional Development Workshops and Courses

Preparing Future Faculty course through the Purdue Graduate School	Fall 2023
Arizona State University Winter School on High Resolution Electron Microscopy	January 2023
Future Mentor's Program, John Martinson Honors College, Purdue University	Fall 2022
Gatan EELS and EFTEM Analysis School	May 2022
Science Communication course through the Alan Alda Center for Communicating Science at Stony Brook University	Fall 2018

Outreach

Lil LEAPS Planetary Science Outreach Series with the Lafayette Boys and Girls Club	Dec 2021 – May 2022
Elementary school campus visit science activities, Purdue University	May 2022
Earth Day event in partnership with Imagination Station, Department of Earth Atmospheric, and Planetary Sciences, Purdue University	May 2022
Passport Day, Department of Earth Atmospheric, and Planetary Sciences, Purdue University	February 2022
Homecoming booth outreach activities, Department of Earth Atmospheric, and Planetary Sciences, Purdue University	October 2021
AstroFest, Stony Brook Astronomy Club	April 2017, 2018, 2019
Solar observing and tabling at Stony Brook University Earth Stock event for Earth Day, Stony Brook Astronomy Club	April 2018, 2019
Mercury transit public telescope observing, Stony Brook Astronomy Club	November 2019
All About Astronomy event in collaboration with oSTEM at Stony Brook University, Stony Brook Astronomy Club	October 2019
International Observe the Moon Night event, Stony Brook Astronomy Club	October 2019
Department of Geosciences Booth at CommUniversity Day, Stony Brook University	September 2019
SSERVI RISE2 table at NASA STEM Day, Fenway Park	September 2019
Mid-Autumn Festival telescope observations of the Moon in collaboration with ChinaBlue, Stony Brook Astronomy Club	September 2018, 2019

Technical Skills

Laboratory Techniques

- Transmission Electron Microscopy (TEM)
    - Analysis of geologic and planetary materials with associated techniques such as high-resolution TEM (HRTEM) imaging, electron diffraction, energy-dispersive X-ray spectroscopy (EDS), and electron energy loss spectroscopy (EELS)
    - Performing in situ heating TEM experiments on lunar samples and analog materials
- Electron Energy-Loss Spectroscopy (EELS)
    - Identification of light elements and volatile materials such as hydrogen, helium, water, and neon
    - Determination of iron oxidation state of nanoparticles

    - Development of multivariate statistical analysis pipeline for the analysis of EELS spectrum images using Python
- Focused Ion Beam Scanning Electron Microscopy (FIB-SEM)
    - Preparation of planetary and geological materials for TEM analyses
    - Preparation of samples and transfer of samples to microelectromechanical systems (MEMS) chips for in situ heating experiments
- Scanning Electron Microscopy (SEM)
    - Analysis of particulate samples and polished thin sections of planetary and geologic materials
- Visible to Near-Infrared (VNIR) Reflectance Spectroscopy
    - Analysis of powdered, whole rock, and pressed pellet samples of meteorites, volcanic ashes, and mineral mixtures
    - Analysis under ambient and simulated lunar/asteroid environment (SLE/SAE) conditions
- Thermal Infrared (TIR) Reflectance and Emission Spectroscopy
    - Analysis of powdered, whole rock, and pressed pellet samples of meteorites, volcanic ashes, and mineral mixtures
    - Analysis under ambient and simulated lunar/asteroid environment (SLE/SAE) conditions
- Small particle handling
    - Manipulation and sample preparation of single particles and powders for SEM, FIB, TEM, and spectroscopic analyses
- Ultramicrotomy
- Raman Spectroscopy
- Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS)

Programming Languages and Computer Experience

- Software: Digital Micrograph, The Stopping and Range of Ions in Matter (SRIM), Velox, INCA, Adobe Illustrator, ImageJ, ENVI, JMARS, Wolfram Mathematica, Microsoft Suite (Word, Excel, PowerPoint)
- Coding: Python (intermediate), Hyperspy python library (intermediate), MATLAB (intermediate), Davinci (beginner), Processing (intermediate), IDL (beginner)

Other Leadership Experience

President, Stony Brook University Astronomy Club — August 2019 – May 2020
Resident Assistant, Campus Residences, Stony Brook University — August 2018 – May 2020
Secretary, Stony Brook University Astronomy Club — August 2017 – May 2019
President, Wagner College Hall Council, Stony Brook University — August 2017 – May 2018

Professional Affiliations

Meteoritical Society
Microanalysis Society
Microscopy Society of America

Press

2025 Pellas-Ryder Award, Meteoritical Society, 5/8/2025

LPI Announces the Recipients of the 2023 Career Development Award, ***Lunar and Planetary Institute***, 2/24/2023

May 2020 Graduate Profile, ***SBU College of Arts and Sciences***, 5/20/20

Interviewed for the twelfth episode of the "Sprouting in STEM" podcast, a show about early career scientists, 11/24/2019

Three seawolves receive prestigious Goldwater Scholarships, ***SBU News***, 5/8/2019

SBU researchers make new discoveries about creation of Mars' moons, ***Stony Brook Statesman***, 10/30/2018

Alexander Kling '20 takes research from Earth to Mars, ***SBU News***, 10/3/2018

Martian moon may have come from impact on home planet, new study suggests, ***AGU***, 9/24/2018

References

Michelle Thompson, Associate Professor, Purdue University. mthompson@purdue.edu

Mike Sori, Associate Professor, Purdue University. msori@purdue.edu

Tom Zega, Professor, University of Arizona. tzega@lpl.arizona.edu

Tim Glotch, Professor, Stony Brook University. Timothy.glotch@stonybrook.edu