

Aditya R. Khuller

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Education

Arizona State University

B.S.E., Aerospace Engineering

Aug. 2015 – May 2019

- **Thesis:** Investigating the Distribution of Frosts in Relation to Present-Day Gully Activity on Mars. Advisors: Phil Christensen, Tanya Harrison & Serina Diniega.

M.S., Geological Sciences

Aug. 2019 – May 2021

- **Thesis:** Characteristics of the Basal Interface of the Martian South Polar Layered Deposits. Advisor: Jeff Plaut.

Ph.D., Geological Sciences

Aug. 2019 – Feb. 2023

- **Dissertation:** The Dynamics & Evolution of Martian Ices: Implications for Present-Day Liquid Water. Advisors: Phil Christensen, Gary Clow, Steve Warren & Steve Ruff.

Work Experience

University of Washington Applied Physics Laboratory

Senior Research Scientist

November 2024 – present

- Developing improved, validated model of H₂O ice melt and sublimation to assess whether shallow subsurface liquid water is forming on Mars under present-day conditions (**Khuller**, Jordan, Clow, Christensen, Warren, *in prep.*).

NASA Jet Propulsion Laboratory

Postdoctoral Researcher

March 2023 – Oct. 2024

- Simulated the radiative heating effects of dust within the water vapor-dominated coma (cloud of gases) observed by the European Space Agency's Rosetta mission around Comet 67P/Churyumov–Gerasimenko (**Khuller**, von Allmen, Hofstadter, *in prep.*).

Arizona State University

Graduate Student Researcher

Aug. 2019 – March 2023

- Developed improved, validated model for calculating temperature, humidity, and turbulent fluxes of volatiles in the atmospheric surface layer of planets such as Earth, Mars, and Titan (**Khuller** & Clow, 2024, *JGR*)
- Developed the first radiative transfer model for dusty martian snow and glacier ice validated against in-situ measurements, which shows that the H₂O ice excavated at the Phoenix landing site is dusty snow (**Khuller**, Christensen & Warren, 2021, *JGR*).
- Presented the first direct evidence that the mid-latitude “pasted-on” terrain on Mars is composed of shallow, buried dusty H₂O ice, with the lowest latitude detection of exposed subsurface H₂O ice on Mars at 33°S (**Khuller** & Christensen, 2021, *JGR*).
- Developed novel methodology to search for CO₂ frosts within entire THEMIS infrared dataset and found that about half of all gullies overlap with CO₂ frost detections. I also used the TES water vapor retrievals to assess the formation and distribution of H₂O frosts on Mars (**Khuller**, Christensen, Harrison, Diniega, 2021, *JGR*).
- Conceived a global search for mapping exposed subsurface H₂O ice within martian gullies and quantitatively assessing their approximate dust content and ice grain size

using HiRISE images. To do so, I trained two undergraduates and one middle-school student on how to use JMARS, HiVIEW, ArcGIS & Matlab (Braunisch, **Khuller**, Christensen, *in prep.*).

- Analyzed thermal emission spectra of materials within the enigmatic, dusty Medusae Fossae Formation (MFF) using TES data to search for dust-free ‘windows’.

NASA Jet Propulsion Laboratory

Graduate Student Researcher

May 2020 – March 2023

- Discovered widespread radar signals similar to those proposed to be caused by a subglacial lake throughout the martian south polar layered deposits using MARSIS (**Khuller** & Plaut, 2021, *GRL*).

Graduate Student Researcher

June 2019 – Aug. 2019

- Characterized the composition and thermophysical properties of martian aeolian dunes using multispectral data (THEMIS, CRISM and TES) and proposed three scenarios for the formation and origin of martian sands with Dr. Serina Diniega.

Undergraduate Student Researcher

May 2018 – Aug. 2018

- Mapped martian polygonal ridge networks thought to represent fossilized remnants of ancient groundwater near the Perseverance rover landing site with the help of Zooniverse citizen scientists using CTX across an area of 2.8×10^7 km² and analyzed their thermophysical properties using THEMIS (**Khuller**, Kerber et al., 2021, *Icarus*)
- Assisted with rover field testing and lunar materials/instrument research for a NASA Discovery mission (Moon Diver) proposal.
- Continued to help run a 3-D FORTRAN weather model for simulating aeolian erosion in Antarctica with Dr. Laura Kerber.

Undergraduate Student Researcher

May 2017 – Aug. 2017

- Mapped inverted fluvial features, meso-yardangs and analyzed crater depth-diameter ratios using ArcGIS and Matlab to infer material properties in the Medusae Fossae Formation on Mars.
- Helped set up a 3-D FORTRAN weather model for simulating aeolian erosion in Antarctica with Dr. Laura Kerber.

Sun Devil Satellite Laboratory at ASU

Chief Systems Engineer

June 2016 – May 2019

- Led a team in collaboration with NASA’s Jet Propulsion Lab to develop a Multi-Axis Pulsed Plasma Thruster for small satellites. (**Khuller** et al., 2018, *AIAA JPC*)
- Helped design and construct a high vacuum chamber system and high power (~1000 V, 10 kA) supply for thruster operational testing using SolidWorks, LTspice, machining and soldering.

Mars Space Flight Facility at ASU

Barrett Honors Undergraduate Researcher

Apr. 2016 – Aug. 2019

- Developed a micro-scale thermal model that incorporates radiative transfer and conduction to investigate the depths of frost formation within granular martian regolith. (**Khuller** et al., *in prep.*)

- Developed a meso-scale thermal model for calculating the temperatures of sloped and flat locations on Mars (validated against the planetary thermal model KRC) with Dr. Phil Christensen.
- Analyzed the VNIR spectra of ices on Mars using CRISM and ENVI.

Materials Science Laboratory at ASU

Undergraduate Researcher

Mar. 2016 – Mar. 2018

- Led a team developing biocompatible piezoelectrics for prosthetic power generation.
- Conducted lab experiments developing solutions for thin film manufacturing.

Phoenix CubeSat

Mission Operation & Electrical Power Engineer

Nov. 2015 – July 2018

- Conducted orbital power and communications analysis using STK and assisted with designing telemetry interface for a NASA-funded CubeSat mission currently orbiting Earth.

NASA Mission Experience

Europa Clipper

E-THEMIS Testing

Instrument Operator (2022)

Lucy

L'TES Testing

Instrument Operator (2020)

Mars Odyssey

THEMIS Science Team Member

Data Analysis (2016–present)

Professional Associations & Service

- Member of 23-person NASA Mars Concurrent Exploration Science Analysis Group (MCE-SAG) to provide recommendations to the Mars Exploration Program for scientific investigations within the next decade in parallel with the Mars Sample Return effort (2022-2023)
- Journal Reviewer for Nature Geoscience, Nature Communications Earth & Environment, JGR: Planets, Icarus, Planetary & Space Science, IEEE (2021-present)
- Proposal Reviewer for NASA Science Mission Directorate Panels
- Member of ASU Graduate Student Advisory Panel, Professional Development & Engagement (2021)
- Social Chair, Caltech Postdoctoral Association (2023-2024)
- Session Chair, 10th International Conference on Mars (2024)
- Session Chair, COSPAR (2021)
- ASU Global Guide (2016-2019; to help new international students assimilate)
- Barrett Community Assistant (2016) & Barrett Bridges Program Mentor (2016-2018)

Publications

Published & Under Review

1. **Khuller, A.R.**, Warren, S.G., Christensen, P.R., Clow, G.D. (2024). [Potential for Photosynthesis on Mars within Snow and Ice](#). *Nature Communications Earth & Environment*. (Editor's highlight).

2. **Khuller, A.R.** (*under review*). Melting and Sublimation of H₂O Ice on Mars: Misconceptions about the Phase Diagram and Triple Point of H₂O.
3. **Khuller, A.R.**, Miner, K., Milton, J., Rolla, J. (*under review*). The Need for Collaborative Frameworks for Natural Disaster Management.
4. Rolla, J., Miner, K., **Khuller, A.R.**, Emberson, R., Fielding, E., An, K., Schultz, L. (*under review*). Satellite-Aided Disaster Response.
5. **Khuller, A.R.** and Clow, G.D., (2024). [Turbulent Fluxes and Evaporation/Sublimation Rates on Earth, Mars, Titan, and Exoplanets](#). *Journal of Geophysical Research: Planets* (Editor's highlight).
6. Landis M., Acharya, P.J., Alsaeed, N.R., Andres C., Becerra P., Calvin, W.M., Cangi, E.M., Cartwright, S.F.A.; Chaffin, M.S.; Diniega, S., Dundas, C. M., Hansen, C.J., Hayne, P.O., Herkenhoff, K.E., Kass, D.M., **Khuller, A.R.**, McKeown, L., Russell, P.S., Smith, I.B., Sutton, S.S., Widmer, J.M., Whitten, J.L., (2023). [Polar Science Results from Mars Reconnaissance Orbiter: Multiwavelength, multiyear insights](#). *Icarus*.
7. **Khuller, A.R.** and Christensen, P.R., (2021). [Evidence of Exposed Dusty Water Ice within Martian Gullies](#). *Journal of Geophysical Research: Planets* (Cover page).
8. **Khuller, A.R.** and Plaut, J.J. (2021). [Characteristics of the Basal Interface of the Martian South Polar Layered Deposits](#). *Geophysical Research Letters*.
9. **Khuller, A.R.**, Christensen, P.R., S.G. Warren, (2021). [Spectral Albedo of Dusty Martian H₂O Snow and Ice](#). *Journal of Geophysical Research: Planets*.
10. **Khuller, A.R.**, Christensen, P.R., Harrison, T.N., Diniega S., (2021). [The Distribution of Frosts on Mars: Links to Present-Day Gully Activity](#). *Journal of Geophysical Research: Planets*.
11. **Khuller, A.R.**, Kerber, L., Schwamb, M.E., Beer, S., Nogal, F., Perry, R., Hood, W., Aye, K.-M., Portyankina, G., Hansen, C.J., (2021). [Irregular Polygonal Ridge Networks in Arabia Terra, Nili Fossae and Nilosyrtis](#). *Icarus*.
12. **Khuller, A.R.**, Alavi, O., Mayer, J., Lanes, T., Needham, P., Rajagopalan, S.S., Curiel, A., Bonelli, D., Thompson, E., Miller, R., Grayson, M., Sandys, N., White, D.B., Mikellides, P.G., (2018). [Pulsed Plasma Thruster for Multi-Axis CubeSat Attitude Control Applications](#). *54th AIAA Joint Propulsion Conference and Exhibit*.

In Preparation

1. **Khuller, A.R.**, Jordan, R.E., Clow, G.D., Christensen, P.R., Warren, S.G. (in prep.). An Improved Model of Ice Melt and Sublimation on Mars: Implications for Present-Day Liquid Water.

2. **Khuller, A.R.**, Jordan, R.E., Warren, S.G., Clow, G.D., Christensen, P.R. (in prep.). Subsurface Melting in Snow and Ice.
3. **Khuller, A.R.**, von Allmen, P., Hofstadter, M. (in prep.). The Radiative Effects of Dust on Water Vapor in a Cometary Coma.
4. Braunisch, S., **Khuller, A.R.**, Christensen, P.R. (in prep.). Mapping Exposed Dusty Water Ice in Martian Gullies.
5. **Khuller, A.R.**, Christensen, P.R., Diniega S., Harrison, T.N., (in prep.). The Formation of Near-surface Frosts on Mars.

Presentations & Abstracts

1. **Khuller, A.R.**, Jordan, R.E., Warren, S.G., Clow, G.D., Christensen, P.R. (2024). SNTHERM24: An Improved Snow, Firn, and Glacier Ice Evolution Model for Earth and Mars. NASA Community Snow Meeting, #001.
2. **Khuller, A.R.**, von Allmen, P., Hofstadter, M. (2024). The Radiative Effects of Dust on Water Vapor in a Cometary Coma. AGU, Fall Meet., #1704046.
3. **Khuller A.R.**, Clow G.D., Christensen P.R., Warren S.G., Jordan R.E. (2024). [Advances in Modeling the Energy Balance of H₂O Ice on Mars: Implications for Present-Day Liquid Water](#). 10th Mars Conf, #3023.
4. Plaut, J.J. and **Khuller, A.R.**, (2024). [Mapping and Characterizing the South Polar Dorsa Argentea Formation Using the MARSIS 3D Volume](#). 8th Mars Polar Conf, #6010.
5. Rangarajan, V.G., Tornabene, L.L., Conway, S.J., **Khuller, A.R.**, Braunisch, S.R. (2024). [Spectral Assessments of Gully-Associated Light-Toned Materials on Mars: Insights from HiRISE Observations](#). 10th Mars Conf, #3224.
6. **Khuller A.R.**, Clow G.D., Christensen P.R., Warren S.G., Jordan R.E. (2024). [Advances in Modeling the Energy Balance of H₂O Ice on Mars: Implications for Present-Day Liquid Water](#). 55th Lunar Plan. Sci. Conf., LPI, Houston, #1328.
7. Braunisch S.R., **Khuller A.R.**, Christensen P.R. (2024). [Mapping Exposed Water Ice Within Mid-Latitude Martian Gullies](#). 55th Lunar Plan. Sci. Conf., LPI, Houston, #2421.
8. **Khuller, A.R.** and Clow, G.D. (2022). [An Improved Model for H₂O Ice Sublimation on Mars: Implications for Martian Ice Stability and Evolution](#). AGU, Fall Meet., P25C-06.
9. **Khuller, A.R.** and Clow, G.D., (2022). [An Improved Model of Water Ice Sublimation on Mars: Validation at the Phoenix Landing Site](#). 7th Int. Workshop on Mars Atmosphere.
10. **Khuller, A.R.** and Clow, G.D., (2022). [Modeling the Sublimation of H₂O Ice on Mars: Validation at the Phoenix Landing Site](#). 53rd Lunar Plan. Sci. Conf., LPI, Houston, #1597.
11. Orlando, E.J., Blaske, C.H., **Khuller, A.R.**, Christensen, P.R., (2022). [Mapping Exposed Dusty Water Ice in Martian Gullies](#). 53rd Lunar Plan. Sci. Conf., LPI, Houston, #2504.

12. **Khuller, A.R.** and Christensen, P.R., (2021). [Evidence of Water-rich Snow Deposits within Martian Gullies](#). 43rd COSPAR, #43, 395.
13. Plaut, J.J. and **Khuller, A.R.**, (2021). [The Basal Interface of Mars' South Polar Layered Deposits](#). AGU, Fall Meet., P32D-06.
14. Orlando, E.J., Blaske, C.H., **Khuller, A.R.**, Christensen, P.R., (2021). [Mapping Exposed Dusty Water Ice in Northern Martian Gullies](#). AGU, Fall Meet., EP55A-1104.
15. Glogau, L. and **Khuller, A.R.**, (2020). [The Effect of Surface Thermophysics on Temperatures at Europa](#). 51st Lunar Plan. Sci. Conf., LPI, Houston, #2465.
16. Tovar, M.A. and **Khuller, A.R.**, (2020). [The Variation of Martian Dust Devil Lifetime with Surface Temperature and Pressure](#). 51st Lunar Plan. Sci. Conf., LPI, Houston, #2239.
17. **Khuller, A.R.** and Diniega, S., (2020). [The Mineralogy and Thermophysical Properties of Dunes on Mars: Implications for the Age and Origin of Martian Sand](#). 6th Int. Planetary Dunes Workshop, #3051.
18. **Khuller, A.R.** and Christensen, P.R., (2019). [Evidence of Water-rich Snow Deposits within Martian Gullies](#). 50th Lunar Plan. Sci. Conf., LPI, Houston, #3060.
19. **Khuller, A.R.**, Christensen, P.R., Harrison, T.N., Diniega S., (2019). [Investigating the Distribution of Frosts in Relation to Present-Day Gully Activity on Mars](#). 50th Lunar Plan. Sci. Conf., LPI, Houston, #3045.
20. **Khuller, A.R.**, Kerber, L., Schwamb, M.E., Beer, S., Nogal, F., Perry, R., Hood, W., Aye, K.-M., Portyankina, G., Hansen, C.J., (2018). [Polygonal Ridge Networks in Arabia Terra, Nili Fossae and Nilosyrtris: Potential Implications for Mars 2020 Landing Site Selection](#). AGU, Fall Meet., P43A-06.
21. Stacey, K., **Khuller, A.R.**, Kerber, L., (2018). [The Medusae Fossae Formation in SW Elysium Planitia, Mars as a Record of Recurring Hydrogeologic Activity](#). 49th Lunar Plan. Sci. Conf., LPI, Houston, #2815.
22. **Khuller, A.R.** and Kerber, L., (2017). [Mapping Variability in the Medusae Fossae Formation: Yardang Morphologies, Fluvial Reworking, and Crater Depth to Diameter Ratios](#). AGU, Fall Meet., EP53B-1713.

Proposals

- PI, NASA Solar System Workings (2024): “Modeling the Evolution of H₂O Ice on Mars: Implications for Present-Day Liquid Water” (**selected**: \$688K)
- Science PI, NASA Postdoctoral Program (NPP-2022): Minor weakness, withdrawn after accepting JPL postdoc offer.
- Science PI, Future Investigators in NASA Earth and Space Science and Technology (FINESST-2022): Received no weaknesses on proposal, not funded.

- NASA Discovery Program: Assisted with Science Traceability Matrix preparation for Moon Diver mission.

Teaching

- Graduate Teaching Assistant, ASU: Earth, Solar System and Universe Lab (2019); Remote Sensing (2021); ASU/NASA SpaceWorks I & III (2021)
- Teaching Assistant, Planetary Science, Elon Musk's Astra Nova School (2021– Present)
- Volunteer Teacher, Skype A Scientist (Grades 3-12 across the U.S.) (2021– Present)

Skills

- *Programming:* Matlab, FORTRAN, Linux, C++, Python, DaVinci.
- *Software:* ArcGIS, ENVI, SolidWorks (CAD), STK (Orbital Analysis & Design), JMars, LTspice, MS Project.
- *Miscellaneous:* Machine Shop (Mill & Lathe) Training, Soldering, High Vacuum System Design & Operation, Woodworking.
- *Languages:* French (intermediate), Hindi (intermediate), Spanish (beginner).
- *Other:* Guitarist of a progressive/metal band, Soccer (club, high school & Sunday league), Film & Digital Photography, Improv, Chess (high school captain), Table Tennis, Service Dog Trainer.

Mentoring

- Sarah Braunisch (2022-present), PhD Committee Member; Mars ice mapping and VNIR spectral analysis
- Helena Brittain (2023), Mars snow metamorphism analysis
- Liz Orlando (2021-2022), Mars ice mapping and VNIR spectral analysis
- Claire Blaske (2021-2022), Mars ice mapping and VNIR spectral analysis
- Victoria Hiatt (2022), Mars ice mapping and VNIR spectral analysis
- Lior Glogau (2020), Europa thermal modeling
- Michael Tovar (2020), Mars dust devil analysis and thermal modeling
- Emma Brown (2021-2022), ASU Peer Mentoring

Field Work

- **“Holey Tour”, Arizona:** Analyzed volcanic, impact crater, karst and tectonic features.
- **Granite Wash, Arizona:** Collected samples for thermal infrared spectral analyses.
- **Barstow, California & Meadow, Utah:** Collected and analyzed basalt samples as lunar analogs for a NASA Discovery Mission proposal (Moon Diver).
- **Valles Caldera, New Mexico & Bonito, Arizona:** Collected and analyzed large-scale volcanic deposits as part of ASU Advanced Volcanology course.
- **Florence, Arizona:** Designed and launched a high-altitude meteorology balloon system as part of the ASU/JPL MacGyver Engineering course.
- **Juneau, Alaska:** Selected for Juneau Icefield Research Program (deferred due to recent elbow fracture and dislocation).

Honors and Awards

New American University Scholarship (2015 – 19), Barrett Community Scholarship (2016 – 19), Bidstrup Research Funding (2016, 2017), FURI Research Funding (2016), KEEN Research Funding (2017), FURI Travel Grant (2017, 2018), USG Travel Grant (2017, 2018), W. L. Gore Research Funding (2017), R. Greeley Planetary Geology Scholarship (2018), G.E.M. Scholarship (2018), COSPAR Australia Travel Award (2021), Nininger Travel Award (2022), IPSL Early Career Scientist Award (2022), ASU Outstanding Graduate Research Award (2022), ASU Graduate Research Support Program (2023), NASA Small Bodies Assessment Group Travel Grant (2023), and the NASA Community Snow Meeting travel award (2024).

Press

Online Articles

- [“Could Life Exist Below Mars Ice? NASA Study Proposes Possibilities”](#) NASA, Oct 17, 2024.
- [“Alien life could lurk on Mars beneath protective ice, study suggests”](#) Space.com, Oct 17, 2024.
- [“ASU graduate lands dream job at NASA's Jet Propulsion Lab”](#) ASU News, May 3, 2023.
- [“Otherworldly weather forecasts could help future Mars explorers reach this vital resource”](#) CNN, Aug 30, 2021.
- [“A new clue emerges of what may lie beneath the Martian south pole”](#) CNN, Aug 20, 2021.
- [“Mars Snow is Dusty, Can Potentially Melt, Finds New Study”](#) The Weather Channel, Aug 25, 2021.
- [“How ASU Fell into NASA's Orbit”](#) ASU State Press, Jan 28, 2022.
- [“More Mysterious Buried Splotches on Mars Might Not Be Liquid Water”](#) Sky & Telescope, July 5, 2021.
- [“Mars may have dozens of lakes beneath its south pole”](#) Space.com, June 28, 2021.
- [“ASU student digs into Mars dunes as JPL intern”](#) ASU News, Mar 30, 2020.
- [“Citizen scientists help map ridge networks on Mars”](#) ASU News, April 5, 2022.
- [“JPL Interns Are Working from Home While 'Going the Distance' for Space Exploration”](#) JPL/NASA, July 23, 2020.
- [“Study Looks More Closely at Mars' Underground Water Signals”](#) NASA, June 24, 2021.
- [“Melting dusty ice may have carved Martian gullies”](#) ASU News, Feb 10, 2021.
- [“Sun Devil Satellite Lab Tests its Ignition Method with Electrifying Results”](#) ASU State Press, Feb 22, 2017.

Video Interviews

- [“Searching for life beneath the ice on Mars”](#) Fox 13 Seattle, October 24, 2024.
- [“Creators & Makers: Sun Devil Satellite Lab”](#) ASU Now, April 22, 2019.

Audio Interviews

- [“Pulsed Plasma Thrusters, with Adi Khuller, Omar Alavi & Joe Mayer”](#) The Art of Space Engineering, Dec 29, 2021.
- [“A Conversation on Running Student-Led Projects, with Adi Khuller, Omar Alavi & Joe Mayer”](#) The Art of Space Engineering, Dec 29, 2021.

Invited Talks

- [JPL Mars Forum](#) **Jet Propulsion Laboratory**, June 28, 2019.
- [JPL Mars Forum](#) **Jet Propulsion Laboratory**, Nov 17, 2023.
- [Earth & Space Sciences Colloquium](#) **University of Washington**, Jan 18, 2024.
- [Geological Sciences Seminar](#) **California State University**, Feb 29, 2024.
- [Caltech L\(a\)unch](#) **Caltech**, March 1, 2024.
- [JPL Postdoc Seminar](#) **Jet Propulsion Laboratory**, May 9, 2024.
- [Crater Café](#) **Purdue University**, July 17, 2024.