

JPL POSTDOCTORAL FELLOW

NASA Jet Propulsion Laboratory, 4800 Oak Grove Dr, Pasadena, CA, 91109 □+1 (626) 429-8532 | ■al.emran@jpl.nasa.gov | A https://www.jpl.nasa.gov/site/research/alemran/

Research Summary _____

I am a planetary scientist specializing in the characterization of the surface and subsurface of terrestrial planets, small bodies, and the icy moons of gas giants in the Solar System. I am currently a postdoctoral fellow at NASA JPL, working on understanding the surfaces of Mars, Mercury, and icy bodies using orbital spacecraft observations. I employ an interdisciplinary approach that integrates remote sensing, spectroscopy, photometry, physical modeling, data science, machine learning, and laboratory experiments to investigate surface processes, geology, and compositions on planetary bodies. My research seeks to understand the dynamic interactions between planetary surfaces, atmospheres, and interiors, and how these interactions influence the habitability of planetary bodies.

Education _____

| University of Arkansas | Fayetteville, AR 72701 |
|--|--------------------------------------|
| PhD in Space and Planetary Sciences | August, 2019 - December, 2022 |
| Thesis: Deciphering Surfaces of Trans-Neptunian and Kuiper Belt Objects using Radiative S and Laboratory Experiments Advisor: Vincent F. Chevrier | Scattering Models, Machine Learning, |
| Auburn University | Auburn, AL 36849 |
| MS in Geography [Planetary Geoscience] | August, 2017 - August, 2019 |
| Thesis: Surficial Investigations of Hargraves Crater and Siloe Patera, MarsAdvisor: Luke J. Marzen and David T. King Jr. | |
| University of Dhaka | Dhaka, Bangladesh |
| MS in Physical Geography and Environment | May, 2012 - Nov, 2014 |
| Thesis: Spatio-temporal Changes in Hydro-morphology of Sandwip Island, Bangladesh Advisor: Md. Abdur Rob | |
| University of Dhaka | Dhaka, Bangladesh |
| BS in Geography and Environment | April, 2008 - April, 2012 |
| Minors in Geology Honors thesis: Morphological Investigation of Mono River, Bangladesh | |

Professional Experience _____

| 2023 - | JPL Postdoc Fellow, NASA Jet Propulsion Laboratory, California Institute of Technology |
|-------------|--|
| 2021 - 2022 | Graduate Assistant, Data Science Program, University of Arkansas |
| 2021 | Graduate Assistant, Center for Space and Planetary Sciences, University of Arkansas |
| 2020 | Graduate Assistant, Department of Physics, University of Arkansas |
| 2019 - 2020 | Graduate Assistant, Center for Space and Planetary Sciences, University of Arkansas |
| 2017 - 2019 | Graduate Assistant, Department of Geosciences, Auburn University |
| 2015 - 2017 | Research Assistant, Department of Architecture, BRAC University |
| 2014 - 2015 | Graduate Assistant, Department of Geography and Environment, University of Dhaka |

Awards, Fellowships, & Grants _

2023 Asteroid (28646) Alemran, International Astronomical Union (IAU)

| 2022 | Outer Planets Assessment Group (OPAG) Participant Stipend, Lunar and Planetary Institute, Houston, Texas | \$ 1,000 |
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| 2022 | GPSC Travel Fellowship, University of Arkansas | \$ 1,000 |
| 2022 | GSIE Travel Fellowship, University of Arkansas | \$ 5,00 |
| 2021 | GPSC Travel Fellowship, University of Arkansas | \$ 1,000 |
| 2020 | GPSC Travel Fellowship, University of Arkansas | \$ 1,000 |
| 2020 | GSIE Travel Fellowship, University of Arkansas | \$ 5,00 |
| 2019 | LPI Career Development Award, Lunar and Planetary Institute, Houston, Texas | \$ 1,000 |
| 2019 | Collage of Science and Mathematics Travel Fellowship, Auburn University | \$ 1,000 |
| 2019 | Graduate School Travel Fellowship, Auburn University | \$ 800 |
| 2018 | Collage of Science and Mathematics Travel Fellowship, Auburn University | \$ 1,000 |
| 2018 | Geoscience and GSC Travel Fellowship, Auburn University | \$ 1,000 |
| 2018 | Bangladesh-Sweden Trust Fund Fellowship, Economic Relations Division, Ministry of | ć 700 |
| | Finance, Government of the People's Republic of Bangladesh | \$ 700 |
| 2013 | Merit Scholarship, Bangladesh University Grant Commission (UGC) | \$ 200 |

Publications

Published

Mercury

Emran, A. and K. Stack. 2025. Understanding Compositional Evolution of Hollows at Dominici Crater, Mercury. *Icarus*, doi:10.1016/j.icarus.2025.116576

Mars

- **Emran, A.**, Marzen, L.J., King, D.T., Chevrier, V.F., 2020. Thermophysical and Compositional Analyses of Dunes at Hargraves Crater, Mars. *Planet. Sci. J.* 2(6):218.
- **Emran, A.**, Marzen, L.J., King, D.T., 2020. Semiautomated Identification and Characterization of Dunes at Hargraves Crater, Mars. *Earth and Space Science* 7, e2019EA000935.
- **Emran, A**., J.D. Tarnas, and K. M. Stack. 2025. Global Distribution of Serpentine on Mars. *Geophysical Research Letters* 51, e2024GL110630

Pluto

- **Emran, A.**, Dalle Ore, C. M., Cruikshank, D. P., and Cook, J. C., 2023. Surface Composition of Pluto's Kiladze Area and Relationship to Cryovolcanism. *Icarus* 404.
- **Emran, A.**, Dalle Ore, C. M., Ahrens, C. J., Khan, K., Chevrier, V.F., and Cruikshank, D. P., 2023. Pluto's Surface Mapping using Unsupervised Learning from Near-Infrared Observations of LEISA/Ralph. *Planet. Sci. J.* 4(1):15.
- **Emran, A.**, Cruikshank, D. P., Ahrens, C. J., Moore, J. M., White, O. L., 2025. Kiladze Caldera: A possible Cryovolcano on Pluto. *Planet. Sci. J.*, doi:10.3847/PSJ/adb1e1

TNOs and KBOs

- **Emran, A.**, Chevrier, V.F., 2023. Discrepancy in Grain Size Estimation of H₂O ice in the Outer Solar System. *Res. in Astronomy and Astrophysics*. DOI 10.1088/1674-4527/acb9db.
- **Emran, A.**, and Chevrier, V.F., 2022. Uncertainty in Grain Size Estimation of Volatiles on Trans-Neptunian Objects and Kuiper Belt Objects. *The Astronomical Journal*. 163, 196.

Earth

- **Emran, A.**, Roy S., et al., 2018. Assessing topographic controls on vegetation characteristics in CHT from remotely sensed data. *Rem. Sens. App.: Soc.and Env.* 11, 198–208.
- **Emran, A.**, Rob M.A., Kabir M.H., 2017. Coastline change and erosion-accretion evolution of Sandwip Island, Bangladesh. *Int. Jr. of Applied Geospatial Res.*. 8(2):3.
- **Emran, A.**, Rob M.A., Kabir M.H, Islam M.N., 2016. Modeling spatio-temporal shoreline and areal dynamics of coastal island using geospatial technique. *Mod. Earth Sys. and Env.* 2(4).

UNDER REVIEW

A. Khuller and **Emran, A**. 2025. Quantitative Evaluation of the delta-Eddington, Hapke, and Shkuratov Models for Predicting the Albedo and Inferring the Grain Radius of Ice. [*Icarus*]

In Prep

- **Emran, A**., Sun, V. Z., J. Tarnas, and K. Stack. 2025. A Global Survey of Diagenetic and Low-Grade Metamorphic Minerals in Craters on Mars. [Intended for *Journal of Geophysical Research Planets*]
- **Emran, A**. et al. 2025. Europa's Composition as Evidenced by Spectral Analysis of Galileo NIMS Data. [Intended for *Astro-physical Journal Letters*]
- **Emran, A.**, Chevrier, V.F., 2025. The Outer Solar System Astrophysics Lab: A New Experimental Facility for Spectral and Thermal Investigations of Ices at Cryogenic Temperatures [Intended for *Journal of Astronomical Instrumentation*]
- **Emran, A.**, Dalle Ore, C. M. Mastrapa R. et al., 2025. Mapping Organic Components at the Saturn's Rings and Satellites using Unsupervised Machine Learning. [Intended for *Planet. Sci. J.*]
- Sciamma-O'Brien, E., Cook, J.c., **Emran, A.** et al., 2025. Investigating the Origins of Pluto's Surface Dark Materials Through Integrated Laboratory, Modeling, and Observational. [Intended for *Planet. Sci. J.*]

Conference Abstract

* presenting author; * mentored undergraduate

- **Emran, A.**, Cruikshank, D. P., Ahrens, C. J., Moore, J. M., White, O. L., 2025. Pluto's Kiladze as a possible Cryovolcano. *Progress in Understanding the Pluto System: 10 Years after Flyby*, APL/JHU, Abstract No. 7004.
- **Emran, A**., Sun, V. Z., J. Tarnas, and K. Stack. 2025. A Survey of Diagenetic and Low-Grade Metamorphic Minerals in Craters on Mars. *LPSC 2025*, Houston, Abstract No. 2818.
- Voigt*, J. R. C, Sun, V. Z., **Emran, A**. Viviano, C. E., Schroeder, J., Stack, K. M. 2024. Global Distribution of Hydrated Silica: Revealing Local and Regional Water Availability throughout Mars' History. *AGU 2024*, Washington, D.C.
- **Emran, A**. J. Tarnas, and K. Stack. 2024. Global Significance of Serpentine on Mars. *Tenth International Conference on Mars 2024*, Caltech, Abstract No. 3085.
- Voigt*, J. R. C, Sun, V. Z., **Emran, A**. Viviano, C. E., Schroeder, J., Stack, K. M. 2024. Global Distribution of Hydrated Silica on Mars . *Tenth International Conference on Mars 2024*, Caltech, Abstract No. 3181.
- **Emran, A**. A. Flatland⁺, J. Tarnas, and K. Stack. 2024. Where and How Does Serpentine Form on Mars?. *LPSC 2024*, Houston, Abstract No. 1224.

- **Emran, A**. and K. Stack. 2024. Compositional Evolution of Hollows at Dominici Crater on Mercury. *LPSC 2024*, Houston, Abstract No. 1216.
- Suda*, M., **Emran, A**., and V. Chevrier. 2024. A New Facility to Measure Thermal Properties of Ultravolatile Ices (N2, CH4, and CO) in the Outer Solar System. *LPSC 2024*, Houston, Abstract No. 2631.
- **Emran, A**. A. Flatland⁺, J. Tarnas, and K. Stack. 2023. Global Distribution of Serpentine on Mars using Machine Learning Techniques. *AGU 2023*, San Francisco, CA.
- Sciamma-O'Brien^{*}, E., Bertrand, T., Brubach, J.B., Cook, J., Cruikshank, D.P., Dalle Ore, C., Drant, T., Dubois, D., **Emran, A.**, Gautier, T., Grundy, W.M., Homyk, A.J., Homyk, A., Mastrapa, R.M.E., Perrin, Z., Rannou, P., Ricketts, C.L., Roush, T.L., Salama, F., Vettier, L., Wooden, D.H., 2023. New Optical Constants of Titan and Pluto Aerosol Analogs from the Visible to the Infrared and Their Use to Analyze Cassini and New Horizons Observations. AAS DPS meeting, 55, 220.01.
- **Emran, A**. C. M. Dalle Ore, R. Mastrapa, T. Bertrand, J. C. Cook, D. P. Cruikshank, W. Grundy, T. L. Roush, F. Salama, D. H. Wooden, and E. SciammaO'Brien. 2023. Investigations of The Origins of Pluto's Surface Dark Materials: Compositional Mapping of Cthulhu Macula and Sputnik Planitia. *54th LPSC*, Houston, Abstract No. 2918.
- J. C. Cook^{*}, T. Bertrand, D. P. Cruikshank, C. M. Dalle Ore, **A. Emran**, W. M. Grundy, R. Mastrapa, T. L. Roush, F. Salama, D. H. Wooden, E. Sciamma-O'Brien. 2023. Investigations of the Origins of Pluto's Surface Dark Materials: Spectral Modeling. *54th LPSC*, Houston, Abstract No. 2816.
- J. C. Cook*, and **A. Emran**. 2023. Using New Horizons Observations of Pluto As A Bootstrap to Derive Composition Maps of Triton. *54rth LPSC*, Houston, Abstract No. 2902.
- Sciamma-O'Brien*, E., Roser, J., Boersma, C., Boydstun, K., Vorobets, M., Perez-Rojo, S., Stone, N., Sciamma, J., Wetsch, A., Bertrand, T., Cook, J.C., Cruikshank, D. P., Dalle Ore, C. M., Drant, T., Dubois, D., including **Emran, A.** et al., 2023. On the New Optical Constants Database (OCdb) and its Importance for the Interpretation of Observational Data. Laboratory Astrophysics Division (LAD) meeting, Albuquerque, June 4-8.
- **Emran, A**. and Chevrier VF . 2022. Single Scattering Albedo Induced Uncertainty in Grain Size Estimation of Surface Volatile on TNOs and KBOs. *53rd LPSC*, Houston, Abstract No. 1092.
- **Emran, A**, Chevrier VF, and Ahrens C . 2021. A New Methane Spectral Index from NASA's New Horizons Ralph/MVIC Instrument. *5th Planetary Data and PSIDA*, Abstract No. 7007.
- **Emran, A**, Chevrier VF, and Ahrens C . 2020. CH4 Snowline in the Mountains of Pluto during NASA's New Horizons Flyby. *51st LPSC*, Houston, Abstract No. 1616.
- **Emran, A**, Marzen LJ, and King Jr. DT . 2019. Automated Object-Based Identification of Dunes at Hargraves Crater, Mars. *50th LPSC*, Houston, Abstract No. 1157.
- **Emran, A**, Marzen LJ, and King Jr. DT . 2018. Thermophysical characterization of Jezero crater and NE Syrtis, Mars. *49th LPSC*, Houston, Abstract No. 1874.
- **Emran, A**, DT King Jr. and LJ Marzen . 2018. Surficial Geology of Siloe Patera at Arabia Terra, Mars. *AGU Fall Meeting 2018*, Washington, D.C., Abstract No. 437616.
- **Emran, A**, DT King Jr., LJ Marzen, CW Coker, and SP Wright . 2018. Remote Sensing Characterization of Siloe Patera, Mars. *PGM*, U of Tennessee, Knox., Abstract No. 7017.

INVITED/ GRADUATE STUDENT TALKS/ OTHER PRESENTATION

- Fall 2024. *Global Significance of Serpentine on Mars*. Presentation: Presented at NASA JPL's Postdoc Research Day.
- Fall 2023. *Global Distribution of Serpentine on Mars*. Presentation: Presented at NASA JPL's Postdoc Research Day.
- Fall 2023. Detection of Ammoniated Component at Pluto's Kiladze area Using Machine Learning and Radiative Transfer Model. Invited Talk: Presented at NASA JPL's Ice Seminar Series.
- Fall 2023. Global Distribution of Serpentine on Mars. Talk: Presented at NASA JPL's Postdoc Seminar Series.
- Spring 2023. *Surface Composition of Kiladze area and Relationship to Cryo-volcanism*. Invited talk: Presented at New Horizons Science Team Meeting.

Spring 2023. Leveraging Machine Learning and Radiative Transfer Model in Detecting Ammoniated Compound on Pluto and Relationship to Cryovolcanism. Invited talk: Presented at JPL's ICE Seminar.

- Summer 2022. *Mapping Pluto's Surface from New Horizons*. Invited talk: Presented at New Horizons Surface Composition Science Team Meeting.
- Spring 2018. *Geologic Origin of Siloe Patera, Mars*. Invited talk: Presented at Collage of Science and Mathematics Graduate Research Symposium, Auburn University.

Teaching Experience _____

| Fall 2022/ Fall 2021 | DASC 2113 - Principles and Techniques of Data Science, Teaching Assistant | University of Arkansas |
|-------------------------|---|---------------------------|
| Spring 2021 | DASC 3203 - Optimization Methods in Data Science, Teaching Assistant | University of Arkansas |
| Fall/ Spring 2020 | ASTR 2001L - Astronomy Lab (Survey of Universe), Teaching Assistant | University of Arkansas |
| Spring 2019 | GEOL 3060 - Lunar and Planetary Geology , Teaching Assistant | Auburn University |
| Fall 2018 | GEOG 6820 and 5820 - Remote Sensing, Teaching Assistant | Auburn University |
| Spring 2019 | GEOG 6830 and 5830 - GIS , Teaching Assistant | Auburn University |
| Spring/ Fall 2014 | GEOG 412 - Physical Geog. Lab , Teaching Assistant | University of Dhaka |

Skills and Expertise _____

PLANETS STUDIED/ WORKING ON:

Earth, Mars, Mercury, Pluto, Saturn System (Rings, Iapetus, Phoebe, Hyperion, Enceladus, and Rhea), Jupiter, Europa, Trans-Neptunian Objects, Kuiper Belt Objects, Exoplanet

Spacecraft Mission/ Instrument Data:

Earth: Landsat Series and SRTM Mars: Mars Global Surveyor (MOLA, TES), Mars Odyssey (THEMIS), Mars Reconnaissance Orbiter (HiRISE, CTX, CRISM) Mercury: MESSENGER – Mercury Dual Imaging System (MDIS) Pluto: New Horizons (MVIC, LORRI, LEISA) Saturn System: Cassini (VIMS) Jupiter: Galileo (SSI and NIMS) Exoplanet: Transiting Exoplanet Survey Satellite (TESS)

TECHNIQUE/ METHODS:

Imaging Spectroscopy, Spacecraft Image Analysis, Multi-spectral and Hyperspectral Data, Physical Models, Visible/Near-/Mid-infrared Spectroscopy, Mineralogy, Thermophysical Properties, Radiative Transfer Models, Photometric Models, Hapke and Shkuratov Models, Icy Bodies, Cryogenic Experiments, Thermal Properties of Ices, Geomorphological/ Geologic Analysis, Remote Sensing, Mapping, GIS, Geospatial Datasets

Relevant Coursework:

Astrophysics, Astronautics, Astroinformatics, Astrobiology, Planetary Surfaces, Planetary Atmospheres, Atomic and Molecular Spectroscopy/ Spectrochemical Methods, Scientific Computation, Remote Sensing, Meteorology, Climatology, Lunar and Planetary Geology, Impact and Planetary Geology, Geomorphology I, Advanced Geomorphology, Mineralogy and Petrology, Remote Sensing of Planetary Surfaces, Fundamentals of Remote Sensing, Advanced GIS

Spring 2018. *Geologic Study Siloe Patera, Mars*. Presented at Collage of Science and Mathematics (COSAM) Research Symposium, Auburn University.

ASTRONOMY/ PLANETARY SOFTWARE: DS9, JMARS, ISISv3, Ames Stereo Pipeline (ASP)

GIS AND REMOTE SENSING: ENVI, ERDAS Imagine, eCognition, ArcGIS, QGIS, GDAL

BASIC PROGRAMMING: Python [expert], Matlab, R, Davinci, &TFX

MACHINE LEARNING/ DATA SCIENCE:

Algorithms: Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Whitens/Dnoise Image Cube, Savitzky Golay Filtering, Minimum Noise Fraction (MNF), t-distributed Stochastic Neighbor Embedding (t-SNE), Factor Analysis and Target Transformation (FATT), Hyperspectral Signal Identification by Minimum Error (HySime), Unsupervised Learning (K-means, Gaussian Mixture Models, Spectral Clustering, DBSCAN), Supervised Classification (Maximum Likelihood, Minimum Distance), Support Vector Machines (SVM), Random Forest Classifier *Bayesian Statistics:* Markov Chain Monte Carlo (MCMC)

MODULES: NumPy, Pandas, MatplotLib, SciPy, Astropy, SkLearn, ArcPy

OS/ BASIC SOFTWARE: Windows, MacOS, Linux, Microsoft Word, Excel, Powerpoint

LABORATORY SKILL: Cryogenic experimental design, Laboratory building

Outreach & Professional Development

Service and Outreach

| 2025 | Session Chair: LPSC, Lunar and Planetary Science Conference | Woodland, TX |
|-----------|---|---------------------------|
| 2019-2022 | Member: Space Hog, Astronomy and Planetary Science Outreach | University of Arkansas |
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Development

Workshop Participant: Outer Planets Assessment Group (OPAG), Sagan Exoplanet Summer Workshop 2021/2022

PEER REVIEW SERVICES

External reviewer : NASA's Planetary Data Archiving, Restoration, and Tools (PDART) Proposal **Internal reviewer :** JPL Proposal (Planetary Science R&A) **Journal Reviewer :** Earth and Space Science; Journal of Geophysical Research: Planets; Icarus

PROFESSIONAL MEMBERSHIPS

American Geophysical Union (AGU) Geological Society of America (GSA)

References _____

Katie S. Morgan

Research Scientist, NASA Jet Propulsion Laboratory 4800 Oak Grove Dr, Pasadena, CA, 91109 Email: kathryn.m.stack@jpl.nasa.gov ; Phone: 626-372-3784

Vincent F. Chevrier

Associate Professor, Space and Planetary Science University of Arkansas, Fayetteville, AR 72701 Email: vchevrie@uark.edu ; Phone: 479-283-0487

Dale P. Cruikshank

Dept. of Physics, University of Central Florida Orlando, FL 32816, USA Email:dpcruikshank@comcast.net ; Phone: 408-306-2800

Cristina M. Dalle Ore

Carl Sagan Center, SETI Institute Mountain View, CA, 94043, USA Email: cmdalleore@gmail.com ; Phone: 408-317-8507

Luke J. Marzen

Professor, Department of Geosciences Auburn University, Auburn, AL 36849 Email: marzelj@auburn.edu ; Phone: 334-663-1008

David T. King Jr.

Professor, Department of Geosciences Auburn University, Auburn, AL 36849 Email: kingdat@auburn.edu; Phone: 334-559-2451