Jesse Tarnas

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Education:

Brown University

PhD Student, Department of Earth, Environmental, and Planetary Sciences
Advisor: Prof. Jack Mustard
Committee Members: Prof. Ralph Milliken & Prof. Stephen Parman
Anticipate PhD completion in 2021
MA Planetary Geoscience '18
Awards: Brown University Graduate Travel Grant (2), Brown University Doctoral Research Travel Grant, SSERVI Grant for 2017 Sudbury Field Camp, Mars Student Travel Grant for 4th Landing Site Workshop for the Mars 2020 Rover Mission, RI Space Grant Travel Grant,
Workshops: JPL Planetary Science Summer Seminar 2019, NASA Volcanology Workshop 2019, Sudbury Field Camp 2017

Wesleyan University

BA Physics '16
BA Astronomy '16 (Honors)
Minor in Planetary Science
Awards: CT Space Grant Undergraduate Directed Campus Scholarship, Howards Hughes Research Fellowship, THINK STEM Scholarship, William James & Dorothy Bading Lanquist Scholarship, CT Space Grant Travel Award.
Thesis: *Transit, Secondary Eclipse, and Phase Curve Analysis to Characterize Kepler Exoplanets.*

Research Experience:

Graduate Researcher, Jack Mustard Group, Brown University, Fall 2016 – Present
- Modeling radiolytic H_2 production, transportation, and dissolution on Mars during the Noachian.
- Serpentine Fe-oxidation state characterization using VNIR reflectance spectroscopy.
- Development of novel data analysis methods for hyperspectral datasets.
- Characterization of hydrothermally-associated minerals in CRISM data with novel analysis methods.

Research Associate, Friedemann Freund Group, NASA Ames Space Academy, NASA Ames Research Center, Summer 2015
- Conducting experiments relevant to earthquake forecasting research.
- Measuring peroxy defect content of different rock types using Seebeck Effect.
- Modeling radio/microwave propagation through different rock substrates using MATLAB.
- Working to develop radar sounding smallsat system with the rest of NASA Ames Space Academy group.
- Assisting in development of Global Earthquake Forecasting Network by GeoCosmo Science Center.

Research Assistant, Seth Redfield Group, Wesleyan University, Spring 2012-Spring 2016
- Applying Python transit, secondary eclipse, and phase curve model to Kepler & K2 data to characterize of transiting and nontransiting exoplanets.
- Searching for transits of exoplanets orbiting white dwarf stars using the 24" Perkin Telescope.
- Reducing data using customized IDL and IRAF routines.
- Constructing variable input model of a white dwarf exoplanet transit using IDL.
- Constructing model of exoplanet atmosphere Rayleigh scattering using Python.
- Conducted research during summer 2013 through Howard Hughes Research Fellowship.
- Operated WIYN 3.5m telescope at Kitt Peak with Professor Redfield

Research Assistant, James Greenwood Group, Wesleyan University, Spring 2013-Summer 2014
- Synthesized lunar glass using Deltech furnace.
- Analyzing samples with scanning electron microscope and ion microprobe.
- Developing experimental design for testing chondrule formation theory.
- Creating anaerobic furnace environment.

Research Assistant, Reinhold Blümel Group, Wesleyan University, Fall 2012-Summer 2013

- Generated data from numerical simulations of ions in a Paul trap.

Publications:

- **Tarnas, J. D.**; Mustard, J. F.; Lin, H.; Goudge, T. A.; Amador, E. S.; Bramble, M. S.; Kremer, C. H.; Zhang, X.; Itoh, Y.; Parente, M. Orbital identification of hydrated silica in Jezero crater, Mars, *GRL* 46 https://doi.org/10.1029/2019GL085584 (2019).
- **Tarnas, J. D.**; Mustard, J. F.; Sherwood Lollar, B.; Bramble, M. S.; Cannon, K. M.; Palumbo, A. M.; Plesa, A.-C. Radiolytic H_2 production on Noachian Mars: Implications for habitability and atmospheric warming, *EPSL* 502: 133-145 (2018).
- **Tarnas, J. D**.; Nam, Y. S.; Blümel, R. Universal heating curve of damped Coulomb plasmas in a Paul trap. *Physical Review A* 88, 041401(R) (2013).
- Palumbo, A. M.; Deutsch, A. N.; Bramble, M. S.; **Tarnas, J. D**.; …, Scientific Exploration of Mare Imbrium with OrbitBeyond, Inc.: Characterizing the Regional Volcanic History of the Moon, *New Space* 7: 3 (2019).
- V. Stamenković, L. W. Beegle, K. Zacny,…, **J. D. Tarnas**, …, The next frontier for planetary and human exploration, *Nature Astronomy* 3: 116-120 (2019).

Conference Abstracts

- **Tarnas, J.D.**; Mustard, J.F.; Sherwood Lollar, B. Warr, O.; Cannon, K.M.; Palumbo, A.M., Plesa-A.C. Abiotic CH_4 flux from the Precambian Shield on Earth and during the Noachian Hesperian and Amazonian periods on Mars, *2019 AGU Fall Meeting* (2019).
- Mustard, J.F.; **Tarnas, J.D.**; Wu, X. Mineralogy, Water-rock Alteration and Geochemical Conditions in the Hawai'i Scientific Drilling Program Core: Implications for Understanding the 3-D architecture of Volcanic Subsurface, *2019 AGU Fall Meeting* (2019).
- Wu, X.; **Tarnas, J.D.**; Zhang, X.; Mustard, J.F. A Sparsity Divergence Constrained Factor Analysis and Target Transformation Method and Application to Hydrous Minerals Detection of Hyperspectral Imagery, *2019 AGU Fall Meeting* (2019).
- **Tarnas, J.D.**; Mustard, J.F.; Sherwood Lollar, B.; Warr, O.; Palumbo, A.M.; Plesa, A.-C. Deep groundwaters on Earth as analogs for modern martian habitats, *Mars Extant Life: What's Next?*, 5104 (2019).
- **Tarnas, J.D.**; Mustard, J.F.; Sherwood Lollar, B.; Cannon, K.M.; Palumbo, A.M.; Plesa, A.-C. Mars could have been warmed by eccentricity variations or a subsurface biosphere, *Ninth International Conference on Mars*, 6345 (2019)
- Parente, M.; Arvidson, R.; Itoh, Y.; Lin, H.; Mustard, J.F.; Saranathan, A.M.; Seelos, F.P.; **Tarnas, J.D.** Mineral detections over Jezero crater using advanced data processing techniques for CRISM data—the CRISM "Fandango", *Ninth International Conference on Mars*, 6382 (2019).
- Mustard, J.F.; Bramble; M.S., Kremer, C.H.; **Tarnas, J.D.**; Pascuzzo, A.; Head, J.W. A geologic record of the first billion years of Mars history at the Mars 2020 landing site, *Ninth International Conference on Mars*, 6404 (2019).
- **Tarnas, J.D.**; Mustard, J. F., Sherwood Lollar, B.; Cannon, K. M.; Palumbo, A. M., Plesa, A.-C.; Bramble, M.S. An insufficient methane budget for warming Noachian and Hesperian Mars, *LPSC XLV*, 2551 (2019).
- **Tarnas, J.D.**; Mustard, J.F.; Sherwood Lollar, B.; Cannon, K.M.; Palumbo, A.M.; Plesa, A.-C. Is Abiotic Methane Production Sufficient for Warming Noachian and Hesperian Mars?, *2019 Astrobiology Science Conference*, (2019)
- **Tarnas, J.D.**; Mustard, J.F.; Lin, H.; Goudge, T.A.; Amador, E.S.; Bramble, M.S.; Zhang, X. Hydrated silica in the Jezero deltas, *LPSC XLV*, 2029 (2019).
- Mustard, J.F.; **Tarnas, J.D.**; Parente, M. Laboratory Testing of the Factor Analysis-Target Transformation Method for Mineral Detection at Low Abundance from Visible-Infrared Hyperspectral Data, *LPSC XLV*, 3008 (2019).
- Pascuzzo, A.C.; **Tarnas, J.D.**; Mustard, J.F.; Lin, H. VNIR Characterization of the Martian North Polar Ice Cap 2): Constraining the Surface Compositions, *LPSC XLV*, 3063.
- Parente M., Arvidson, R.E., Itoh, Y., Lin, H., Mustard, J.F., Saranathan, A.M., Seelos, F.P., **Tarnas, J.D.** Convergence on Mineral Detections over Gale Crater, NE Syrtis and Jezero Crater using Advanced Data Processing Techniques for CRISM Hyperspectral Imaging Data, *LPSC XLV*, 3112 (2019).
- Tokle, L.; Palumbo, A.; Deutsch… **Tarnas, J.**; … Vatsal, V. Scientific Exploration of Mare Imbrium with OrbitBeyond Inc.: Characterizing the Regional Volcanic History of the Moon, *LPSC XLV*, 2484 (2019).
- Lin, H.; Zhang, X.; Wu, X.; **Tarnas, J.D**.; Mustard, J.F. Target Transformation Constrained Sparse

Unmixing (TTCSU) Algorithm for Retrieving Hydrous Minerals on Mars: Application to Southwest Melas Chasma, *International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences*, 42: 1003-1008 (2018).

- **Tarnas, J.D.**; Mustard, J. F., Sherwood Lollar, B.; Bramble, M.S.; Cannon, K. M.; Palumbo, A. M., Plesa, A.-C. H_2 and CH_4 Production, Storage, and Release over ~4.5 Gyr of Martian History: Implications for Atmospheric Warming, Habitability, and ISRU, *AGU*, 437871 (2018)
- **Tarnas, J. D.**; Mustard, J. F., Sherwood Lollar, B.; Bramble, M.S.; Cannon, K. M.; Palumbo, A. M., Plesa, A.-C. Production of H_2 on Mars Through Radiolysis and Implications for Habitability, *Goldschmidt 2018*, 2018004452.
- **Tarnas, J.D.**,;Mustard, J.F.; Sherwood Lollar, B.; Bramble M.S.; Cannon, K.M.; Palumbo, A.M.; Plesa, A.-C. Radiolytic H_2 Production, Transport, and Dissolution on Noachian Mars, *49th LPSC,* 2073 (2018).
- Lin, L.H.; **Tarnas, J.D.**; Mustard, J.F.; Zhang, X.; Wu, X. Dynamic Aperture Target Transformation (DATT): A Novel and Valuable Method for Mineral Detection on Mars, *49th LPSC*, 1835 (2018).
- Zhang, X.; Lin, H.; Mustard, J.F.; **Tarnas, J.D.** Hydrated silicates and carbonates mapping in candidate Mars 2020 rover landing sites with integration of Dynamic Aperture Target Transformation and Sparse Unmixing (IDATTSU), *49th LPSC*, 2088 (2018).
- **Tarnas, J.D.**; Lin, H.; Mustard, J.F.; Zhang, X. Characterization of serpentine and carbonate in Mars 2020 landing site candidates using Integrated Dynamic Aperture Target Transformation and Sparse Unmixing (IDATTSU), *49th LPSC*, 2236 (2018).
- **Tarnas, J. D.**; Mustard, J. F., Sherwood Lollar, B.; Bramble, M.S.; Cannon, K. M.; Palumbo, A. M. Radiolytic H_2 Production on Noachian Mars: Implications for Subsurface Habitability, *Fourth Conference on Early Mars*, 3039 (2017).
- **Tarnas, J. D.**; Mustard, J. F.; Sherwood Lollar, B.; Bramble, M. S. Radiolytic Hydrogen Production on Noachian Mars, *LPSC XLVIII*, 2030 (2017).
- **Tarnas, J. D.**; Mustard, J. F.; Sherwood Lollar, B.; Bramble, M. S. Radiolytic Hydrogen Production on Noachian Mars, *AbSciCon 2017*, 3381 (2017).
- Mustard, J. F.; **Tarnas, J. D.** Hydrogen production from the upper 15 km of martian crust via serpentinization: implications for habitability, *LPSC XLVIII*, 2384 (2017).
- **Tarnas, J.**, Redfield, S. Transit, Secondary Eclipse, and Phase Curve Modeling to Characterize Kepler Exoplanet Candidates. *AAS Meeting #227*, 138.14 (2016).
- Persaud, D.; Wu, T.; **Tarnas, J.**; Preudhomme, M.; Jurg, M.; Chalumeau, C.; Buckley, H.; Lombard-Poirot, N. HOMER: A smallsat ground penetrating radar sounding fleet to map planetary surfaces at high resolution, *LPSC XLVII*, 3051 (2016).
- Tregloan-Reed, J.; **Tarnas, J.**, Plante, Z.; Freund, F.; Determination of the amount of peroxy in granite rock using the Seebeck Effect. *AGU Fall Meeting*, 84075 (2015).
- Wu, T.; Persaud, D.; Preudhomme, M.; Jurg, M.; Smith, M.K.; Buckley, H.; **Tarnas, J.**; Chalumeau, C.; Poirot-Lombard, N.; Mann, B. Subsurface Feature Mapping of Mars using a High Resolution Ground Penetrating Radar System. *AGU Fall Meeting*, 76961 (2015).

Chaired Sessions:

Astrobiology I, LPSC 2018.