

K. Marshall Seaton, Ph.D.

NASA Postdoctoral Program Fellow

Jet Propulsion Laboratory, 4800 Oak Grove Dr., Pasadena, CA 91109

Cell: (423) 741-1901 • Office: (818) 354-1504 • Email: Seaton@gatech.edu

Summary

Marshall is experienced in a wide range of analytical techniques ranging from porosity measurements to mass spectrometry. He has developed multiple separation methods for the analysis of amino acids in complex hypersaline brine samples using capillary electrophoresis with laser-induced fluorescence, including chiral separations, using benchtop systems. As a part of his NPP appointment at JPL, he is currently studying the ionization and molecular degradation of species entrained in ice grains after hypervelocity impacts using the Hypervelocity Ice Grain System (HIGS), which will inform future hypervelocity exospheric and plume sampling operations at Europa and other icy moons.

Education

Ph.D., Analytical Chemistry • Georgia Institute of Technology • 2022

M.S., Chemistry • East Tennessee State University • 2017

B.S., Chemistry • East Tennessee State University • 2014

Professional Experience

NASA Postdoctoral Program (NPP) Fellow

2023-present

Advisor: Dr. Bryana Henderson. Research focuses on studying the products (both impact-induced ionization and molecular degradation) resulting from hypervelocity impacts of salt- and organic-bearing ice grains in preparation for the Europa Clipper's interrogation of Europa's exosphere and plumes using the Surface Dust Analyzer (SUDA) instrument.

Science Lead, NASA Planetary Science Summer School Program

2021

Facilitated the formulation and implementation of key science objectives for a multi-flyby mission concept to Enceladus. Responsibilities included establishing measurement requirements, overseeing instrument selection, managing the mission's science traceability matrix (STM), and coordinating mission science-related efforts across an 18-person team of early-career scientists and engineers.

Future Investigator in NASA Earth and Space Science and Technology (FINESST)

2019-2022

Examined biomarker survivability in Enceladus plume capture conditions using laser-induced projectile impact testing (LIPIT) and developed novel analytical methods to quantify amino acids in extraterrestrial brine analogues using capillary electrophoresis with laser-induced fluorescence (CE-LIF).

Jet Propulsion Laboratory Summer Internship

2018

Developed novel quantitative extraction and analysis methods for agarose gels containing organic biomarkers using liquid chromatography with mass spectrometry (LC-MS) and assisted in the development of novel LC-MS methods for the chiral separation of amino acids using supercritical CO₂ extraction on a benchtop system.

Recent Awards

NASA Astrobiology Early Career Collaboration Award for work developing hypervelocity sampling strategies • 2018

1st Place, Appalachian Student Research Forum for outstanding oral presentation • 2017

Distinguished Graduate Student Award for excellence in teaching • 2016

K. Marshall Seaton III

Cell: (423) 741-1901 • Office: (404) 894-4050 • Email: seaton@gatech.edu

Invited Talks

1. **K M Seaton**, S A Stevens, B Henderson, I Kanik, T Orlando, A M Stockton. (2020) *A tale of Two Moons: Science and Technology Development to Inform future In Situ Icy Moon Sampling Strategies*. East Tennessee State University, Johnson City, TN.

Publications

1. C I Pozarycki, **K M Seaton**, N Nuñez, A M Stockton. (2023) "Follow the Salt": Patterns of Biosignature Preservation and Evapoconcentration in Hypersaline Magnesium Brines. (*in preparation*)
2. **K M Seaton**, C I Pozarycki, N Nuñez, A M Stockton. (2022) Quantitative compositional analysis of amino acids in extraterrestrial brine analogues using capillary electrophoresis with laser-induced fluorescence. (*submitted*)
3. **K M Seaton**, S Gyalay, G Stucky de Quay, E R Burnett, C A Denton, B Doerr, K Ebadi, S Eckert, I T W Flynn, C I Honniball, S Hume, C L Kling, J C Marohnic, J Milton, C A Mondro, R G Nuno, C M Rooney, B E Strauss, A Nash, J Scully. (2022) Astrobiology eXploration at Enceladus (AXE): A New Frontiers mission concept study. (*In revision*)
4. **K M Seaton**, M L Cable, A M Stockton. (2022) Analytical chemistry throughout this solar system. *Annu. Rev. Anal. Chem.*, 15, 197-219. <https://doi.org/10.1146/annurev-anchem-061020-125416>
5. **K M Seaton**, M L Cable, A M Stockton. (2021) Analytical chemistry in astrobiology. *Anal. Chem.*, 93(15), 5981-5997, *invited Feature*. <https://doi.org/10.1021/acs.analchem.0c04271>
6. **K M Seaton**, A M Stockton, C O'Mahony. (2021) Capillary electrophoresis with laser-induced fluorescence detection for the diagnosis of phenylketonuria: A versatile wet or dry laboratory experiment in upper-level undergraduate analytical chemistry. *J. Chem. Educ.*, 98(6), 2097-2103. <https://doi.org/10.1021/acs.jchemed.0c01342>
7. I Little, **K M Seaton**, E. Alorkpa, A Vasiliev. (2017) Adsorption of cesium on bound porous materials containing embedded phosphotungstic acid. *Adsorption*, 23(6), 809-819. <https://doi.org/10.1007/s10450-017-9905-2>
8. **K M Seaton**, I Little, C Tate, R Mohseni, M Roginskaya, P Volodymyr, A Vasiliev. (2017) Adsorption of cesium on silica gel containing embedded phosphotungstic acid. *Microporous Mesoporous Mater.*, 244, 55-66. <https://doi.org/10.1016/j.micromeso.2017.02.025>
9. G Appiah-Kubi, **K M Seaton**, A Vasiliev. (2014) Functionalization of silica surface using Chan-Lam coupling. *Tetr. Lett.*, 55(16), 2722-2726. <https://doi.org/10.1016/j.tetlet.2014.03.050>
10. L Brown, **K M Seaton**, R Mohseni, A Vasiliev. Immobilization of heavy metals on pillared montmorillonite with a grafted chelate ligand. *J. Hazard. Mater.*, 261(15), 181-187. <https://doi.org/10.1016/j.jhazmat.2013.07.024>

Book Chapters

1. A M Stockton, M L Cable, C M Phillips-Lander, C Bennett, C Elbon, C Govinda Raj, R Guth-Metzler, M Pasek, C Pozarycki, **K M Seaton**, A Simpson, E Spiers. (2022) "The Fermi Paradox and Astrobiology" in L Johnson and K Roy (eds) *Interstellar Travel (Volume 1): Purpose and Motivations*, in press.

Selected Presentations

1. **K M Seaton**, E R Burnett, C A Denton, B Doerr, K Ebadi, S Eckert, I T W Flynn, S Gyalay, C I Honniball, S Hume, C L Kling, J C Marohnic, J Milton, C A Mondro, R G Nuno, C M Rooney, B E Strauss, G Stucky de Quay, A Nash, J Scully. (2022) *AXE: The Astrobiology eXploration at Enceladus New Frontiers Mission Concept*. Astrobiology Science Conference, Atlanta, GA.
2. **K M Seaton**, E R Burnett, C A Denton, B Doerr, K Ebadi, S Eckert, I T W Flynn, S Gyalay, C I Honniball, S Hume, C L Kling, J C Marohnic, J Milton, C A Mondro, R G Nuno, C M Rooney, B E Strauss, G Stucky de Quay, A Nash,

K. Marshall Seaton III

Cell: (423) 741-1901 • Office: (404) 894-4050 • Email: seaton@gatech.edu

J Scully. (2022) *Science objectives for a mission concept to Enceladus: The Astrobiology Exploration at Enceladus (AXE)*. 53rd Lunar and Planetary Science Conference, The Woodlands, TX.

3. **K M Seaton**, E R Burnett, C A Denton, B Doerr, K Ebadi, S Eckert, I T W Flynn, S Gyalay, C I Honniball, S Hume, C L Kling, J C Marohnic, J Milton, C A Mondro, R G Nuno, C M Rooney, B E Strauss, G Stucky de Quay, A Nash, J Scully. (2022) *Mission implementation for a New Frontiers mission concept: The Astrobiology Exploration at Enceladus (AXE)*. 53rd Lunar and Planetary Science Conference, The Woodlands, TX.
4. **K M Seaton**, B Henderson, I Kanik, T Orlando, A M Stockton. (2019) *Examining biomarker survivability in Enceladus plume capture conditions using laser-induced projectile impact testing: Implications in future icy moon sampling strategies*. Astrobiology Science Conference, Bellevue, WA
5. **K M Seaton**, A M Stockton. (2019) *Chiral analysis of amino acid distributions in Europa and Enceladus analogues using analyte preconcentration*. National ACS Meeting, Orlando, FL.
6. **K M Seaton**, B Henderson, M Nyugen, I Kanik, A M Stockton. (2018) *Hypervelocity impact experiments with amino acids using agarose gels: Informing future icy moon sampling strategies*. Symposium on Space Innovations, Atlanta, GA.
7. **K M Seaton**, B Henderson, M Nyugen, I Kanik, A M Stockton. (2018) *Amino acid extraction from agarose gels for high-velocity impact experiments: Implications in future icy moon sampling strategies*. NASA Astrobiology Institute 20th Anniversary Celebration, Atlanta, GA.
8. **K M Seaton**, A M Stockton. (2018) *Microfluidic amine and amino acid pre-concentration for improved limits of detection*. Astrobiology Graduate Conference, Atlanta, GA.
9. **K M Seaton**, A M Stockton. (2018) *Microfluidic on-chip preconcentration for trace amino acid quantification: Applications to outer-planetary missions*. Georgia Tech Astrobiology Colloquium, Atlanta, GA.

Instrumentation Proficiency

Spectroscopy: Fluorescence, Raman, absorbance (UV/vis, FTIR), laser-induced fluorescence (LIF), and nuclear magnetic resonance (NMR). **Chromatography/Separations:** Gas chromatography/mass spectrometry (GC-MS), liquid chromatography/mass spectrometry (LC-MS), capillary electrophoresis (CE), thin layer chromatography (TLC), and column chromatography. **Materials Characterization:** Particle size analysis (dynamic light scattering), porosimetry, differential scanning calorimetry (DSC), and thermogravimetric analysis (TGA).

Teaching Experience

CHEM 3216 Lab - Analytical Chemistry

2017-2019

Instructed students in the theory and operating principles of analytical instruments including fluorescence, UV/vis, IR, Raman, and atomic absorption spectroscopy, flow-injection analysis, GC-MS, LC-MS, and CE-LIF.

CHEM 2011/2021 Lab - Organic Chemistry

2016-2017

Assisted students in the synthesis and characterization of various organic compounds, instructed students in organic chemical principles, and prepared solutions for use in laboratory experiments.

ETSU Upward Bound Program

2016-2017

Taught college-preparatory level chemistry courses to various groups of underprivileged high school students in different areas of rural Appalachia. Duties included developing course structure and materials, writing exams, keeping records of student performance, and developing illustrative lectures and laboratory experiments to promote student engagement.

CHEM 1111/1121 Lab - General Chemistry

2015-2016

Instructed entry-level college students in the principles of general chemistry, basic laboratory technique, and laboratory safety procedures. Led bi-weekly review sessions to reinforce key lecture concepts and improve student comprehension.