

K. Marshall Seaton, Ph.D.

Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Dr., Pasadena, CA 91109
(818) 630 2241 · kenneth.m.seaton@jpl.nasa.gov

Personal
(423) 741-1901
k.marshall.seaton@gmail.com

EDUCATION

GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GA 2017 - 2022

Ph.D. in Analytical Chemistry

Thesis: Analytical method development and mission design studies to inform the search for biosignatures on ocean worlds

Advisor: Amanda Stockton

Committee: Facundo Fernández, Thomas Orlando, Morgan Cable, Will Gutekunst

EAST TENNESSEE STATE UNIVERSITY, JOHNSON CITY, TN 2015 - 2017

M.S. in Chemistry

Thesis: Functionalized silica gel for adsorption of cesium from solution

Advisor: Aleksey Vasiliev

Committee: Greg Bishop, Marina Roginskaya

EAST TENNESSEE STATE UNIVERSITY, JOHNSON CITY, TN 2009 - 2014

B.S. in Chemistry

Advisor: Aleksey Vasiliev

SELECTED RESEARCH EXPERIENCE

NASA JET PROPULSION LABORATORY, PASADENA, CA 2023 - PRESENT

NASA Postdoctoral Program (NPP) Fellow, PIs: Morgan Cable, Bryana Henderson

- Development of ion extraction optics for mass spectrometry applications
- Hardware development to enable *in situ* impact ionization mass spectrometry measurements replicating exospheric or plume flythrough ice grain sampling events
- Analysis of *in situ* impact-induced ionization and fragmentation of inorganic and organic species entrained in Europa and Enceladus relevant ice grains at hypervelocity (>4 km/s)

Techniques learned/applied: Optical alignment of laser systems, operation of ultra-high vacuum systems in cryogenic conditions, laser desorption mass spectrometry, impact ionization mass spectrometry

GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GA 2017 - 2022

Graduate Research Assistant, School of Chemistry & Biochemistry, PI: Amanda Stockton

- Synthetic modification of SiO₂ particles to enable the simultaneous preconcentration and fluorescent derivatization of amino acids in highly dilute aqueous systems
- Development of capillary electrophoresis with laser induced fluorescence (CE-LIF) methods for the analysis of trace amino acids, improving on previous limits of detection by an order of magnitude
- Quantitative compositional analysis of amino acids in hypersaline MgCl₂ and NaCl brine systems

Techniques learned/applied: Raman, IR, and UV-Vis spectroscopy, LC, GC-MS, solid-state organic synthesis, CE-LIF, PDMS microdevice fabrication and testing

NASA JET PROPULSION LABORATORY, PASADENA, CA 2018
JPL Summer Intern, Laboratory Studies Group, PI: Isik Kanik

- Development of a novel agarose gel organic extraction protocol with quantitative extraction yield
- Development of chiral amino acid separation and detection methods

Techniques learned/applied: LC-MS, chiral separations

EAST TENNESSEE STATE UNIVERSITY, JOHNSON CITY, TN 2015 - 2017
Graduate Teaching Assistant, School of Chemistry, PI: Aleksey Vasiliev

- Synthesis and characterization of W- and Mo-containing silica gel capable of near-quantitative removal of radioactive Cs from aqueous media
- Application of kinetic models to determine intraparticle transfer rates in porous media

Techniques learned/applied: Inorganic synthesis, dynamic light scattering, porosimetry, atomic absorption spectroscopy, kinetic modeling, X-ray diffraction, IR spectroscopy, TEM imaging, solid-state NMR, thermogravimetric analysis, differential scanning calorimetry

EAST TENNESSEE STATE UNIVERSITY, JOHNSON CITY, TN 2011 - 2014
Undergraduate Researcher, School of Chemistry, PI: Aleksey Vasiliev

- Characterization of a novel modified silica gel in the removal of heavy metals from contaminated water in rural East Tennessee
- Organic functionalization of silica gel using organic cross-coupling reactions

Techniques learned/applied: Solid-state organic synthesis, atomic absorption spectroscopy

FELLOWSHIPS, HONORS & AWARDS

| | |
|--|-----------|
| NASA Postdoctoral Program (NPP) Fellowship | 2023-2026 |
| Science Lead, NASA Planetary Science Summer School Program | 2021 |
| Future Investigator in NASA Earth & Space Science and Technology (FINESST) Award | 2019-2022 |
| NASA Astrobiology Program, AbSciCon travel grant to Seattle, WA | 2019 |
| NASA (NAI) Astrobiology Early Career Collaboration Award | 2018 |
| 1 st Place Oral Presentation, Appalachian Student Research Forum | 2017 |
| Distinguished Graduate Student Award for excellence in teaching | 2016 |

PUBLICATIONS

Peer - Reviewed Publications

2024 C. I. Pozarycki, **K. M. Seaton**, E. K. Crawford, C. Novak, N. Nuñez, M. Castillo, E. Ingall, B. Klempay, A. Pontefract, L. A. Fisher, E. Paris, S. Bussecker, N. B. Alansson, C. E. Carr, P. T. Doran, J. S. Bowman, B. Schmidt, A. M. Stockton. Biogisntaure molecules accumulate and persist in evaporitic brines: Implications for planetary exploration. *Astrobiology* 24 (8), 795-812.

- 2023 **K. M. Seaton**, C. I. Pozarycki, N. Nuñez, A. M. Stockton. A robust capillary electrophoresis with laser-induced fluorescence detection (CE-LIF) method for quantitative compositional analysis of trace amino acids in hypersaline samples. *ACS Earth and Space Chemistry* 7 (11), 2214-2221.
- 2023 **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. Astrobiology eXploration at Enceladus (AXE): A new frontiers mission concept study. *Planetary Science Journal* 4 (116).
- 2022 **K. M. Seaton**, M. L. Cable, A. M. Stockton. Analytical chemistry throughout this solar system. *Annual Reviews in Analytical Chemistry* 15, 197-219.
- 2021 **K. M. Seaton**, M. L. Cable, A. M. Stockton. Analytical chemistry in astrobiology. *Analytical Chemistry* 93 (15), 5981 - 5997. (invited feature)
- 2021 **K. M. Seaton**, A. M. Stockton, C. O'Mahony. 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. *Journal of Chemical Education* 98 (6), 2097-2103.
- 2017 I. Little, **K. M. Seaton**, E. Alorkpa, A. Vasiliev. Adsorption of cesium on bound porous materials containing embedded phosphotungstic acid. *Adsorption* 23 (6), 809-819.
- 2017 **K. M. Seaton**, I. Little, C. Tate, R. Mohseni, M. Roginskaya, P. Volodymyr, A. Vasiliev. Adsorption of cesium on silica gel containing embedded phosphotungstic acid. *Microporous and Mesoporous Materials* 244, 55-66.
- 2014 G. Appiah-Kubi, **K. M. Seaton**, A. Vasiliev. Functionalization of silica surfaces using Chan-Lam coupling. *Tetrahedron Letters* 55 (16), 2722-2726.
- 2013 L. Brown, **K. M. Seaton**, R. Mohseni, A. Vasiliev. Immobilization of heavy metals on pillared montmorillonite with a grafted chelate ligand. *Journal of Hazardous Materials* 261 (15), 181-187.

Manuscripts in Review or in Preparation

- in prep.* **K. M. Seaton**, B. L. Henderson, S. Kempf, M. E. C. Miller, Sarah E. Waller, Morgan L. Cable. Replicating hypervelocity sampling of ocean world plume and exospheric ice grains using impact ionization mass spectrometry.
- in prep.* **K. M. Seaton**, B. L. Henderson, Morgan L. Cable. Frontiers in replicating hypervelocity ice grain sampling at an Ocean World In the laboratory.
- in prep.* M. L. Cable, J. Weber, **K. M. Seaton**, J. Rabinovitch, K. McCoy, L. Spilker. Modeling the Enceladus plume: Review of latest efforts and implications for future mission concepts.

FUNDING HISTORY

Awarded Proposals

Co-I, NASA Exobiology, "Hypervelocity sampling of microorganisms: Detecting and classifying organisms from different Ocean World habitats with impact ionization mass spectrometry" (PI: Morgan Cable, Jet Propulsion Laboratory), Total Budget: \$947,170 (1 October 2024 to 30 September 2027), Funds to Seaton: \$129,307.

Fellowships

NASA Postdoctoral Program Fellowship (\$189,500 + benefits, 2 years), Jet Propulsion Laboratory, California Institute of Technology, 2023

Future Investigator in NASA Earth and Space Science & Technology (\$135,000, 3 years), Department of Chemistry & Biochemistry, Georgia Institute of Technology, 2019

CONFERENCE PRESENTATIONS

- 2024 **K. M. Seaton**, S. E. Waller, M. E. C. Miller, M. L. Cable, B. L. Henderson. Simulating *in situ* Enceladus and Europa flyby plume analysis in the laboratory using impact ionization mass spectrometry. *Astrobiology Science Conference*, Providence, RI.
- 2024 **K. M. Seaton**, S. E. Waller, M. E. C. Miller, M. L. Cable, B. L. Henderson. Preparing for icy moon characterization through *in situ* impact ionization mass spectrometry of simulated plume material. *55th Lunar and Planetary Science Conference*, The Woodlands, TX.
- 2023 **K. M. Seaton**, S. E. Waller, M. E. C. Miller, M. L. Cable, B. L. Henderson. Preparing for plume characterization with the Hypervelocity Ice grain Impact Validation Experiment (HIIVE). *American Geophysical Union Annual Meeting*, San Diego, CA.
- 2023 **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. AXE: A New Frontiers Enceladus astrobiology mission concept study. *Astrobiology Graduate Conference*, San Diego, CA.
- 2022 **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. AXE: The Astrobiology eXploration at Enceladus New Frontiers mission concept. *Astrobiology Science Conference*, Atlanta, GA.
- 2022 **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. Science objectives for a mission concept to Enceladus: The Astrobiology eXploration at Enceladus (AXE). *53rd Lunar and Planetary Science Conference*, The Woodlands, TX.
- 2022 **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. Mission implementation for a New Frontiers mission concept: The Astrobiology eXploration at Enceladus (AXE). *53rd Lunar and Planetary Science Conference*, The Woodlands, TX.
- 2019 **K. M. Seaton**, B. L. Henderson, I. Kanik, T. Orlando, A. M. Stockton. 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.
- 2019 **K. M. Seaton**, A. M. Stockton. Chiral analysis of amino acid distributions in Europa and Enceladus analogues using analyte preconcentration. *American Chemical Society National Meeting*, Orlando, FL.
- 2018 **K. M. Seaton**, B. L. Henderson, M. Nyugen, I. Kanik, A. M. Stockton. Hypervelocity impact experiments with amino acids using agarose gels: Informing future icy moon sampling strategies. *Symposium on Space Innovations*, Atlanta, GA.
- 2018 **K. M. Seaton**, B. L. Henderson, M. Nyugen, I. Kanik, A. M. Stockton. 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.
- 2018 **K. M. Seaton**, A. M. Stockton. Microfluidic amine and amino acid preconcentration for improved limits of detection. *Astrobiology Graduate Conference*, Atlanta, GA.
- 2018 **K. M. Seaton**, A. M. Stockton. Microfluidic on-chip preconcentration for trace amino acid quantification: Applications to outer-planetary missions. *Georgia Tech Astrobiology Colloquium*, Atlanta, GA.

SYNERGISTIC ACTIVITIES & OUTREACH

Additional Education

| | |
|---|------|
| How to write NASA ROSES proposals, workshop for NPPs | 2023 |
| NASA Planetary Science Summer School (PSSS) | 2021 |
| Georgia Tech IEN Microdevice Fabrication Short Course | 2019 |

Professional

| | |
|--|---------|
| Panelist reviewer for the NASA Solar System Workings (SSW) Program | 02/2024 |
| Panelist reviewer for the NASA FINESST Program | 04/2024 |
| Organizing Committee: Astrobiology Graduate Conference | 2018 |

Community

| | |
|---|-----------|
| Student development - Paths to becoming a scientist, Corvalis Middle school | 2024 |
| AbSciCon Meeting Mentor Program | 2024 |
| Letters to a Pre-Scientist (LPS) program | 2023-2024 |

PERSONAL

I love to cook, run, lift, play the guitar, and play videogames (mostly RPGs), but most of all I LOVE to fish. I'm also the biggest Tolkein fan I know of currently. I have a beautiful sort of feral black cat aptly named Shelob (my partner wouldn't let me name her Ungoliant). I love being a scientist, and I consider myself extremely lucky to have the opportunity to do what I feel like is a super cool hobby for a living.