Laura C. Motta

Assistant Scientist
Theoretical Chemistry and Isotope Biogeochemistry Group
Marine Chemistry and Geochemistry
Woods Hole Oceanographic Institution
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Current Position

Assistant Scientist/MIT-WHOI Program Faculty 2023–Present
Marine Chemistry and Geochemistry

Research Interests

Inspired by environmental processes that challenge our current chemical knowledge, the *Theoretical Chemistry and Isotope Biogeochemistry Group at WHOI* is interested in advancing our fundamental understanding of chemistry through studying non-traditional stable isotopes. *Isotope effects are Nature's guide to chemistry. The question is: how should we interpret them when there is no chemical framework?*

Education

Double Ph.D. in Earth Sciences and Chemistry 2014–2019
Rackham Student Initiated Doctoral Program - University of Michigan
Earth Sciences Advisor: Professor Joel D. Blum
Theoretical Chemistry Advisor: Professor Paul M. Zimmerman
"Student Initiated Doctoral Programs provide students with the opportunity to combine studies from two Ph.D. programs, which will lead to a single Ph.D. citation for a double/dual PhD *(Earth Sciences and Chemistry)*."

B.A in Chemistry – Honors 2009–2013
Rutgers University-New Brunswick
Advisor: Professor John R. Reinfelder

Professional Experience

Theoretical Chemistry - Postdoctoral Fellow 2021–2023
The State University of New York at Buffalo
Advisor: Professor Jochen Autschbach

Environmental Sciences - Postdoctoral Researcher 2020
Pohang Institute of Science and Technology (POSTECH), Pohang**,** South Korea
Advisor: Assistant Professor Sae Yun Kwon

Theoretical Chemistry - Predoctoral Student International Fellowship 2019
Centre National De La Recherche Scientifique (CNRS) Toulouse, France
Visiting Scholar to learn Relativistic Quantum Chemistry. Mentor: Dr. Trond Saue

Ph.D. Student, NSF GRFP Predoctoral Fellow 2014–2019
University of Michigan, Rackham Student Initiated Doctoral Program
Advisors: Professors Joel D. Blum and Paul M. Zimmerman

NSF international REU, São Pablo, Brazil, Organic synthesis 2011
Universidade de São Pablo
Advisor: Professor Luiz F. Silva

Cruise or Fieldwork Participation

1. Periodic Magi Cicadae Collection (Massachusetts; *Lead Fieldwork*) 05/2025 (4 days)
2. Periodic Magi Cicadae Collection (Illinois; *Lead Fieldwork*) 05/2024 (3 days)
3. Western Antarctic Peninsula 12/2023 (38 days)
4. Eastern Pacific Ocean (Puntarenas – San Diego) 05/2023 (39 days)
5. Central Pacific Ocean (8° and 5° N, 155° W) 09/2015 (28 days)
6. Station ALOHA (22° 45'N, 158° 00'W) 09/2014 (15 days)
7. Station ALOHA (22° 45'N, 158° 00'W) 02/2014 (15 days)

Planned Cruise and Fieldwork Participation

1. Atlantic Ocean: Gulf Stream *(Chief Scientist)* 09/2025 (7 days)
2. Western Antarctic Peninsula (*Corinne Richard) 12/2025 (38 days)

Awards

1. National Academy of Sciences Kavli Fellow (Early Career Recognition). 2025
2. International Institute Fellowship, U. Michigan (Theoretical Chemistry; Toulouse, France) 2019
3. W. Linfiled Award Fellowship, U. Michigan (Theoretical Chemistry; Toulouse, France) 2019
4. Karle Symposium Best Poster Award, U. Michigan (Physical Chemistry Cluster) 2018
5. Rackham Graduate Research Award, U. Michigan 2018
6. National Science Foundation Graduate Research Fellowship 2014
7. Rackham Graduate School Merit Fellowship, U. Michigan 2014

Participation in Education

Teaching:

Marine Isotope Chemistry Co-Lecturer 2025
MIT-WHOI Joint Program

Guest Lecture Marine Bioinorganic 2023
MIT-WHOI Joint Program

Isotope Geochemistry Workshop 2020
Mercury isotope group, POSTECH, South Korea
4 lectures on understanding photochemical isotope effects of heavy elements

Physical Chemistry II – Thermodynamics and Kinetics 2018
CHEM463, Department of Chemistry, University of Michigan
Future Faculty Graduate Instructor. Course Head: Paul M. Zimmerman

Isotope Geochemistry 2018
EARTH480, Department of Earth and Environmental Sciences, University of Michigan
Guest Lecturer (2-lectures) Photochemical isotopes effects in the environment and how to interpret them

Supervision/Mentoring:

Technical Staff
Corinne Richard (2024-present)

Postdoctoral Scholar
Yipeng He (2025-present)

Visiting Students
Seung Hyeon Kim (2025) POSTECH, South Korea

WHOI Summer Students
Frank Dorman (2024)

Professional Service & Community Involvement at WHOI

Summer Student Fellow Department Representative	2025 – Present
Reviewer WHOI internal grants	2025
Chemistry Search Committee	2025
Junior WHOI/MIT JPCO joint program advisor	2024 – Present
Member of CDEI	2024 – Present
Ask A scientist - Outreach	2024
Summer Lecture Series – Undergraduate Lecture	2024
Recruitment at the AISES (American Indian Science and Engineering Society)	2024
Employee Resource Group - Latinx Co-founder	2024 – Present
Chemistry Seminar Organizer	2023 – Present
WHOI Postdoctoral Symposium Presenter/Panel – DEI Statement	2023

Professional Service & Community Involvement outside WHOI

Reviewer for: Environmental Science and Technology, Environmental Science and Technology Letters, Nature Geoscience, Science Advances, Nature Communications, Geophysical Letters, ACS Inorganic Chemistry, ACS Earth and Space Chemistry, and Water Research.

Reviewer for US NSF (MRI – EAR and GRFP)

Volunteer at the GeoFORCE program at U. of Texas at Austin Career Spotlight. 2021

Session Co-Chair, Mercury Isotopes: The 14th International Conference of Mercury as a Global Pollutant, Krakow, Poland

Grants

(Theoretical Chemistry) Lead PI. NSF-CHEM-Chemical Theory, Model, and Computation Models: *Understanding Spin-Forbidden Reactions Mediated by Relativistic Nuclear-Electronic Hyperfine Coupling*.
Collaborator: Prof. Jochen Autschbach, SUNY Buffalo**. (*Funded* 05/01/25 $545,607)**

Development of new stable isotope theory for mass independent isotope fractionation from relativistic quantum mechanisms principals.

(Fieldwork) Lead PI. Seaver Institute: *Opening the Door to Isotope Trace Gas Analysis in Aquatic Systems.*
Collaborator: Dr. Alan Seltzer WHOI **(Funded** 10/01/25 $500,000**)**

Development, and application of a novel system for the quantitative extraction of dissolved gases in the field from large volumes of water for isotope analysis (water column and hydrothermal vents).

Publications

11 First authors papers (1 in revision). High-impact first author papers in the Geosciences and Theoretical Chemistry.

Manuscripts in review

22. Ju Hyeon, Lee, **Laura C. Motta** et al., Isotope analysis reveals new pathway of mercury bioaccumulation in an upwelling ocean. *Nature Communications (In review; 03/29/2025; Impact Factor (IF) 16.6)*

21. **Laura C. Motta**, Joel D. Blum, and Brian Popp. Photoreduction of Inorganic Mercury in Surface Seawater. *ACS Earth and Space Chemistry (In revision; 04/01/202; IF 2.9).*

Referred Publications

2025

20. **Laura C. Motta**, Seung Hyeon Lim et al., Pathway of anthropogenic mercury to Marine Biota. *Communications Earth and Environment.* **Accepted** *(IF 8.1)*

2024

19. Seung Hyeon Lim, Younggwang Kim, **Laura C. Motta**, Eun Jin Yang, Tae Siek Rhee, Jong Kuk Hong, Seunghee Han, Sae Yun Kwon. Near surface oxidation of gaseous elemental mercury explains high mercury levels in the Arctic Ocean food web. *Nature Communications.* **2024** (*IF* 16.6 – *Citations* 2)

18. Blaire Umhau, **Laura C. Motta**, Hilary Close et al., Particulate Mercury Export in the Central Pacific Ocean Using 234Th-238U Disequilibria. *Marine Chemistry* **2024** (*IF* 3 – *Citations* 1)

2023

17. **Laura C. Motta,** Jochen Autschbach. Actinide inverse trans influence versus cooperative pushing from below and multi-center bonding. *Nature Communications* **14, 4307 2023.** (*IF* 16.6 – *Citations* 23)

2022

16. **Laura C. Motta,** Joel D. Blum, Brian Popp, Blaire Umhau, Claudia Benitez-Nelson, Spencer Washburn, Hilary Close, and Jeffrey Drazen. "Mercury Isotopic Evidence for Importance of Particles as a Source of Mercury to Marine Organisms". *Proceeding of the National Academy of Sciences* **2022** (*IF* 11.1 – *Citations* 21)

15. **Laura C. Motta** and Jochen Autschbach. "Theoretical evaluation of Metal-Ligand Bonding in Neptunium Compounds in Relation to 237Np Mössbauer spectroscopy". *Inorganic Chemistry* **2022** (*IF* 4.3 – *Citations* 5)

14. Yo Han Yang, Sae Yun Kwon, Martin Tsui, **Laura C. Motta,** Spencer Washburn, Jaeseon Park, Kim Minseob, and Shin Kyung-Hoon. "Ecological traits of fish for mercury biomonitoring: Insights from compound specific nitrogen and stable mercury isotopes". *Environmental Science and Technology* **2022**. (*IF* 11.4 – *Citations* 13)

13 Miling Li, Sae Yun Kown, Martin T. K. Tsui, Brett Poulin, **Laura C. Motta**, Moonkyoung Cho. "Internal dynamics and metabolism of mercury in biota: a review of insights from mercury stable isotopes". *Environmental Science and Technology.* **2022** (*IF* 11.4 – *Citations* 55)

12. **Laura C. Motta** and Jochen Autschbach. "^{237}Np Mössbauer Isomer Shift: A Lesson About the Balance of Static and Dynamic Electron Correlation in Heavy Element Complexes". *Journal of Chemical Theory and Computation.* **2022** (*IF* 5.5 – *Citations* 2)

2021

11. **Laura C. Motta** and Jochen Autschbach. "Theoretical prediction and interpretation of ^{237}Np Mössbauer isomer shifts". *Journal of Chemical Theory and Computation.* **2021** (*IF* 5.5 – *Citations* 4)

10. Ju Hyeon Lee, Sae Yun Kwon, Runsheng Yin, Aaron Y. Kurz, **Laura C. Motta**, Seung-Il Nam. "Spatiotemporal characterization of mercury isotope baselines and anthropogenic influences in sediment cores". *Global Biogeochemical Cycles,* **2021** (*IF* 5.2 – *Citations* 23)

9. Saebom, Jung, Sae Yun Kown, Yongseok Hong, Runsheng Yin, **Laura C. Motta**. "Isotope investigation of mercury sources in a creek impacted by multiple anthropogenic activities". *Chemosphere.* **2021** (*IF 8 – Citations 19)*

2020

8. Spencer J. Washburn, Joel D. Blum, **Laura C. Motta**, Bridget Bergquist, Peter Weiss-Penzias. "Isotopic composition of Hg in Fog Waters of Coastal California, USA". *Environmental Science and Technology Letters*. **2020** (*IF 10.9 – Citations 17)*

8. Joel D. Blum, Jeffrey C. Drazen, Marcus W. Johnson, Brian N. Popp, **Laura C. Motta**, Alan J. Jamieson. "Mercury Isotope Identify Near-Surface Marine Mercury in Deep Sea Trench Biota". *Proceeding of the National Academy of Sciences*. **2020** (*IF 11.1 – Citations 65)*

6. **Laura C. Motta,** Alan D. Chien, Alan Rask, and Paul Zimmerman. "Mercury Magnetic Isotope Effect: A Plausible Photochemical Mechanism". *J. Phys. Chem. A.* **2020** (*IF 3.3 – Citations 19)*

5. **Laura C. Motta,** Kritee, K, Joel D. Blum, Martin Tsui, John R. Reinfelder. "Mercury Isotope Fractionation During the Photochemical Reduction of Hg(II) Coordinated With Organic Ligands". *J. Phys. Chem. A* **2020** (*IF 3.3 – Citations 69)*

4. **Laura C. Motta,** Joel D. Blum, Brian N. Popp, Jeffrey C. Drazen, and Hilary G. Close. "Mercury Stable Isotopes in Flying Fish as a Monitor of Photochemical Degradation of Methylmercury in the Atlantic and Pacific Oceans". *Marine Chemistry* **2020** (*IF* 3 – *Citations* 25)

2019

3. Blaire P. Umhau, Claudia R. Benitez-Nelson, Hilary G. Close, Cecelia C. S. Hannides, **Laura C. Motta**, Brian N. Popp, Joel Blum, and Jeffrey C. Drazen. "Seasonal and spatial changes in estimates of Carbon flux using 234Th:238U disequilibria in the North Pacific Subtropical Gyre". *Marine Chemistry,* **2019** (*IF* 3 – *Citations* 24)

2. **Laura C. Motta**, Joel D. Blum, Marcus W. Johnson, Blaire P. Umhau, Brian N. Popp, Spencer J. Washburn, Jeffrey C. Drazen, Claudia R. Benitez-Nelson, Cecelia C.C.S. Hannides, Hilary G. Close, and Carl Lamborg. "Mercury cycling in the North Pacific Subtropical Gyre as reveled by mercury stable isotope ratios". *Global Biogeochemical Cycle,* **2019** (*IF* 5.2 – *Citations* 77)

2017

1. K. Kritee, **Laura C. Motta,** Joel D. Blum, Martin T. K. Tsui, and John R. Reinfelder. "Photomicrobial Visible Light-Induced Magnetic Mass Independent Fractionation of Mercury in a Marine Microalga". *ACS Earth and Space Chemistry,* **2017** (*IF* 2.9 – *Citations* 81)

Invited Presentations

2025

1. Discovering Chemistry in the World Around US. Falmouth High School Lecture
2. Isotope Effects: Nature's Guide to Chemistry. National Academy of Sciences Kavli Frontiers of Science Symposium (Flask Poster Talk and Poster)
3. Isotope Effects: Nature's Guide to Chemistry. Washington State University Chemistry Department Seminar.

2024

4. Actinide inverse trans influence: Cooperative 'Pushing from Below' and multi-center bonding. Angular Momentum Virtual Symposium.
5. Electronic Structure and Covalency of Actinide Complexes. Pacific Northwest National Laboratory – Heavy Element/Energy.
6. Unraveling Marine Mysteries and Global Mercury Pollution using Mercury Stable Isotopes. Department Seminar at Marine Sciences UConn.
7. The Journey of Anthropogenic Mercury to Marine Biota. ASLO
8. A Theoretical Investigation of Actinide Covalency. International Conference on Coordination Chemistry.

2023

9. Reveling the Mysteries of Marine Mercury with Non-Traditional Stable Isotopes. *Invited presentation,* Gordon Research Conference – Chemical Oceanography.

2022

10. Reveling the Mysteries of Marine Mercury with Non-Traditional Stable Isotopes. *Invited presentation,* Arizona State University.
11. Unraveling the Secrets of the Marine Biogeochemical Mercury Cycle Using Stable Isotopes. Texas A&M, seminar.
12. Unraveling the Secrets of the Marine Biogeochemical Mercury Cycle Using Stable Isotopes. POSTECH, South Korea, seminar.
13. Unraveling the Secrets of the Marine Biogeochemical Mercury Cycle Using Stable Isotopes. WHOI, Marine Chemistry and Geochemistry seminar.
14. The Marine Mercury Cycle in a Changing Climate. University at Buffalo, MEETS (Materials, Energy, EnvironmenT)

2020

15. Mercury cycling in the ocean. POSTECH, South Korea

Contributed Presentations and Abstracts

1. **Laura C. Motta** and Jochen Autschbach. "Actinide Inverse Transinfluence and Pushing from Below". American Chemical Society, San Franscisco 2023
2. **Laura C. Motta**, Joel D. Blum, Paul. M. Zimmerman. "Mechanisms for Mercury Stable Isotope Fractionation during Aqueous Photodecomposition". Goldschmidt. Barcelona, Spain 2019
3. **Laura C. Motta,** Joel D. Blum, Alan D. Chain, Paul M. Zimmerman. "Magnetic Isotope Effect: Anomalous Case Study of Mercury Stable Isotopes". The 16th International Spin Chemistry Meeting, Schluchsee, Germany 2017. *Limited number of graduate student oral presentations*
4. **Laura C. Motta,** Joel D. Blum, Hilary Close, Brian Popp, Jeff Drazen. "Mercury Isotopes in Flying Fish as a Monitor of Photodemethylation in the Atlantic and Pacific Oceans". The 13th International Conference of Mercury as a Global Pollutant, Providence, RI, USA 2017
5. **Laura C. Motta,** Joel D. Blum, Marcus W. Johnson, Brian N. Popp, Blaire Umhau, Hilary Close, Cecilia Hannides, Clauida Benitez-Nelson. "Mercury Stable Isotopes Reveal Deep Methylation of Mercury and its Uptake into the Open Ocean Food Web". Ocean Science Meeting, New Orleans, LA, USA 2016
6. **Laura C. Motta**, Joel D. Blum, John Reinfelder, Brian Popp, Hilary Close. "Photochemical Transformations of Inorganic Mercury and Methylmercury in the Oceans revealed through Stable Isotope Fractionation of Mercury". The 12th International Conference of Mercury as a Global Pollutant**,** Jeju, Korea 2015
7. Reinfelder, J.R., Kritee, **Laura C. Motta**. "Photomicrobial reduction and dark oxidation of mercury in marine surface waters". Goldschmidt, Sacramento, CA, 2014.
8. **Laura C. Motta,** K. Kritee, Joel D. Blum, Martin Tsui, John Reinfelder. "Mercury Stable Isotope Biogeochemistry – Effects of pH, dissolved oxygen, and wavelength of light on Hg stable isotope fractionation during photochemical reduction of organically complexed Hg(II)". The 11th International Conference of Mercury as a Global Pollutant, Edinburg, Scotland 2013

Other Publications (Media)

9. Feature story on our work on terrestrial mercury cycling using periodic cicadas. https://www.cbsnews.com/amp/boston/news/cicadas-emerge-cape-cod-testing-mercury-levels/ (06/01/25)
10. WCVB Interview - CityLine: Breaking the "green ceiling": women at the waterfront (01/19/25) https://www.wcvb.com/article/cityline-breaking-the-green-ceiling-women-at-the-waterfront/63462861

11. Voices of the Sea (2-14 Episode: Science Journalists at Sea; 2016) Highlight of our research on board of the R/V Kilo Moana