Marissa L. Weichman

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Appointments

Princeton University Assistant Professor of Chemistry 2020–
Associated Faculty, Princeton Quantum Initiative
Associated Faculty, Princeton Materials Institute
Associated Faculty, High Meadows Environmental Institute

JILA, University of Colorado Boulder NIST/NRC Fellow, Postdoctoral Researcher 2017–2020
Research Advisor: Dr. Jun Ye

Education

University of California, Berkeley Ph.D. Physical Chemistry 2012–2017
Dissertation: *Slow Photoelectron Velocity-Map Imaging and Infrared Photodissociation Spectroscopy of Cryo-Cooled Molecular and Cluster Anions*
Research Advisor: Prof. Daniel M. Neumark

California Institute of Technology B.S. Chemistry with Honors 2008–2012
Research Advisors: Prof. Mitchio Okumura, Prof. Frances Arnold, Prof. Thomas Maniatis

Awards and Honors

Packard Foundation *Packard Fellowship for Science and Engineering* 2023
National Science Foundation *CAREER Award* 2023
Department of Energy *Early Career Award* 2022
American Chemical Society *PRF Doctoral New Investigator* 2021
Telluride Science Research Center *Peter Salamon Award* 2020
APS *Justin Jankunas Doctoral Dissertation Award in Chemical Physics* 2018
NIST/NRC *Postdoctoral Research Fellowship* 2017
National Science Foundation *Graduate Research Fellowship* 2012
Department of Energy, Office of Science *Fellowship for Graduate Study (declined)* 2012
UC Berkeley *Berkeley Fellowship for Graduate Study* 2012
UC Berkeley, College of Chemistry *Chemistry Department Scholar* 2012
Amgen Scholars Program *Amgen Scholar* 2010
State of Massachusetts *Robert C. Byrd Honors Scholarship* 2008

Preprints

1. L. Chen, A. P. Fidler, A. M. McKillop, and **M. L. Weichman**, "Exploring the impact of vibrational cavity coupling strength on ultrafast CN + *c*-C_6H_{12} reaction dynamics", *arXiv*, 2310.19133 (2023).

Publications (since Princeton)

43. A. P. Fidler, L. Chen, A. M. McKillop, and **M. L. Weichman**, "Ultrafast dynamics of CN radical reactions with chloroform solvent under vibrational strong coupling", *J. Chem. Phys.* **159**, 164302 (2023), *Emerging Investigators Special Collection, cover article.*

42. A. D. Wright, J. C. Nelson, and **M. L. Weichman**, "A versatile platform for gas-phase molecular polaritonics", *J. Chem. Phys.* **159**, 164202 (2023).

41. A. D. Wright, J. C. Nelson, and **M. L. Weichman**, "Rovibrational polaritons in gas-phase methane", *J. Am. Chem. Soc.* **145**, 5982 (2023).

40. M. C. Babin, M. DeWitt, J. Lau, **M. L. Weichman**, J. B. Kim, H. Song, H. Guo, and D. M. Neumark, "Observation of resonances in the transition state region of the F + NH_3 reaction using anion photoelectron spectroscopy", *Nat. Chem.* **15**, 194 (2022).

39. L. R. Liu, P. B. Changala, **M. L. Weichman**, Q. Liang, J. Toscano, J. Klos, S. Kotochigova, D. J. Nesbitt, and J. Ye, "Collision-induced C_{60} rovibrational relaxation probed by state-resolved nonlinear spectroscopy", *Phys. Rev. X Quantum* **3**, 030332 (2022). ***Related News:*** Physics.

38. M. C. Babin, M. DeWitt, J. Lau, **M. L. Weichman**, J. B. Kim, L. Cheng, and D. M. Neumark, "Photoelectron spectroscopy of cryogenically cooled NiO_2^- via slow photoelectron velocity-map imaging", *Phys. Chem. Chem. Phys.* **24**, 17496 (2022).

37. J. H. Lehman and **M. L. Weichman**, "Optical frequency combs for molecular spectroscopy, kinetics, and sensing", in *Emerging Trends in Chemical Applications of Lasers*, edited by M. R. Berman, L. Young, and H.-L. Dai (American Chemical Society, 2021) Chap. 4, pp. 61–88.

36. M. Babin, M. DeWitt, **M. L. Weichman**, J. A. DeVine, and D. M. Neumark, "High-resolution anion photoelectron spectroscopy of cryogenically cooled 4-atom silicon carbides", *Mol. Phys.* **119**, e1817596 (2021).

Publications (before Princeton)

35. P. B. Changala, **M. L. Weichman**, K. F. Lee, M. E. Fermann, and J. Ye, "Rovibrational quantum state resolution of the C_{60} fullerene", *Science* **363**, 49 (2019). ***Related News:*** c&en; NIST; Gizmodo.

34. **M. L. Weichman**, P. B. Changala, J. Ye, Z. Chen, M. Yan, and N. Picqué, "Broadband molecular spectroscopy with optical frequency combs", *J. Mol. Spec.* **355**, 66 (2019).

33. S. Debnath, X. Song, M. R. Fagiani, **M. L. Weichman**, M. Gao, S. Maeda, T. Taketsugu, W. Schöllkopf, A. Lyalin, D. M. Neumark, and K. R. Asmis, "CO_2 adsorption on $Ti_3O_6^-$: A novel carbonate binding motif", *J. Phys. Chem. C* **123**, 8439 (2019).

32. M. C. Babin, J. A. DeVine, **M. L. Weichman**, and D. M. Neumark, "Slow photoelectron velocity-map imaging of cold C_7 and C_9", *J. Chem. Phys.* **149**, 174306 (2018).

31. T. Wang, T. Yang, C. Xiao, Z. Sun, D. Zhang, X. Yang, **M. L. Weichman**, and D. M. Neumark, "Dynamical resonances in chemical reactions", *Chem. Soc. Rev.* **47**, 6744 (2018).

30. **M. L. Weichman** and D. M. Neumark, "Slow photoelectron velocity-map imaging spectroscopy of cryogenically cooled anions", *Annu. Rev. Phys. Chem.* **69**, 101 (2018).

29. **M. L. Weichman**, S. Debnath, J. T. Kelly, S. Gewinner, W. Schöllkopf, D. M. Neumark, and K. R. Asmis, "Dissociative water adsorption on gas-phase titanium dioxide cluster anions probed with infrared photodissociation spectroscopy", *Top. Catal.* **61**, 92 (2018).

28. J. A. DeVine, **M. L. Weichman**, C. Xie, M. C. Babin, M. A. Johnson, J. Ma, H. Guo, and D. M. Neumark, "Autodetachment from vibrationally excited vinylidene anions", *J. Phys. Chem. Lett.* **9**, 1058 (2018).

27. J. A. DeVine, A. A. Taka, M. C. Babin, **M. L. Weichman**, H. P. Hratchian, and D. M. Neumark, "High-resolution photoelectron sectroscopy of $TiO_3H_2^-$: Probing the $TiO_2^- + H_2O$ dissociative adduct", *J. Chem. Phys.* **148**, 222810 (2018).

26. **M. L. Weichman**, B. Vlaisavljevich, J. A. DeVine, N. S. Shuman, S. G. Ard, T. Shiozaki, D. M. Neumark, and A. A. Viggiano, "Electronic structure of SmO and SmO^- via slow photoelectron velocity-map imaging spectroscopy and spin-orbit CASPT2 calculations", *J. Chem. Phys.* **147**, 234311 (2017).

25. J. A. DeVine*, **M. L. Weichman***, B. Laws, J. Chang, M. C. Babin, G. Balerdi, C. Xie, C. L. Malbon, W. C. Lineberger, D. R. Yarkony, R. W. Field, S. T. Gibson, J. Ma, H. Guo, and D. M. Neumark, "Encoding of vinylidene isomerization in its anion photoelectron spectrum", *Science* **358**, 336 (2017 (*equal contribution)).

24. **M. L. Weichman**, J. A. DeVine, M. C. Babin, J. Li, J. Ma, H. Guo, and D. M. Neumark, "Feshbach resonances in the exit channel of the $F + CH_3OH \longrightarrow HF + CH_3O$ reaction observed using transition-state spectroscopy", *Nat. Chem.* **9**, 950 (2017). ***Related News:*** Nature Chemistry News & Views.

23. **M. L. Weichman**, L. Cheng, J. B. Kim, J. F. Stanton, and D. M. Neumark, "Low-lying vibronic level structure of the ground state of the methoxy radical: Slow-electron velocity map imaging (SEVI) spectra and Köppel-Domcke-Cederbaum (KDC) vibronic Hamiltonian calculations", *J. Chem. Phys.* **146**, 224309 (2017).

22. J. D. Gaynor and **M. L. Weichman**, "Viewpoints on the 2017 Pacific Conference on Spectroscopy and Dynamics", *J. Phys. Chem. A* **121**, 2863 (2017).

21. J. A. DeVine, **M. L. Weichman**, M. C. Babin, and D. M. Neumark, "Slow photoelectron velocity-map imaging of cold *tert*-butyl peroxide", *J. Chem. Phys.* **147**, 013915 (2017).

20. J. A. DeVine, **M. L. Weichman**, J. Ma, B. Jiang, H. Guo, and D. M. Neumark, "Non-adiabatic effects on excited states of vinylidene observed with slow photoelectron velocity-map imaging", *J. Am. Chem. Soc.* **138**, 16417 (2016).

19. J. A. DeVine, **M. L. Weichman**, S. J. Lyle, and D. M. Neumark, "High-resolution photoelectron imaging of cryogenically cooled α-and β-furanyl anions", *J. Mol. Spec.* **332**, 16 (2017).

18. **M. L. Weichman**, J. A. DeVine, and D. M. Neumark, "High-resolution photoelectron imaging of cryogenically cooled Fe_4O^- and Fe_5O^-", *J. Chem. Phys.* **145**, 054302 (2016).

17. **M. L. Weichman**, X. Song, M. R. Fagiani, S. Debnath, S. Gewinner, W. Schöllkopf, D. M. Neumark, and K. R. Asmis, "Gas phase vibrational spectroscopy of cold $(TiO_2)_n^-$ (n=3-8) clusters", *J. Chem. Phys.* **144**, 124308 (2016).

16. **M. L. Weichman**, J. A. DeVine, D. S. Levine, J. B. Kim, and D. M. Neumark, "Isomer-specific vibronic structure of the 9-, 1-, and 2-anthracenyl radicals via slow photoelectron velocity-map imaging", *Proc. Natl. Acad. Sci. U.S.A.* **113**, 1698 (2016).

15. J. B. Kim, **M. L. Weichman**, T. F. Sjolander, D. M. Neumark, J. Kłos, M. H. Alexander, and D. E. Manolopoulos, "Spectroscopic observation of resonances in the $F + H_2$ reaction", *Science* **349**, 510 (2015).

14. **M. L. Weichman**, J. B. Kim, and D. M. Neumark, "Slow photoelectron velocity-map imaging spectroscopy of the *ortho*-hydroxyphenoxide anion", *J. Phys. Chem. A* **119**, 6140 (2015).

13. J. B. Kim, **M. L. Weichman**, and D. M. Neumark, "Low-lying states of FeO and FeO^- by slow photoelectron spectroscopy", *Mol. Phys.* **113**, 2105 (2015).

12. **M. L. Weichman**, J. B. Kim, J. A. DeVine, D. S. Levine, and D. M. Neumark, "Vibrational and electronic structure of the α- and β-naphthyl radicals via slow photoelectron velocity-map imaging", *J. Am. Chem. Soc.* **137**, 1420 (2015).

11. J. B. Kim, **M. L. Weichman**, and D. M. Neumark, "Assignment of electronic bands in the photoelectron spectrum of the VO_2^- anion", *J. Chem. Theory Comput.* **10**, 5235 (2014).
10. J. B. Kim, **M. L. Weichman**, and D. M. Neumark, "Slow photoelectron velocity-map imaging spectroscopy of the Fe_3O^- and Co_3O^- anions", *J. Chem. Phys.* **141**, 174307 (2014).
9. J. B. Kim, **M. L. Weichman**, and D. M. Neumark, "Structural isomers of Ti_2O_4 and Zr_2O_4 anions identified by slow photoelectron velocity-map imaging spectroscopy", *J. Am. Chem. Soc.* **136**, 7159 (2014).
8. **M. L. Weichman**, J. B. Kim, and D. M. Neumark, "Rovibronic structure in slow photoelectron velocity-map imaging spectroscopy of CH_2CN^- and CD_2CN^-", *J. Chem. Phys.* **140**, 104305 (2014).
7. J. B. Kim, **M. L. Weichman**, and D. M. Neumark, "Vibronic structure of VO_2 probed by slow photoelectron velocity-map imaging spectroscopy", *J. Chem. Phys.* **140**, 034307 (2014).
6. T. Westermann, J. B. Kim, **M. L. Weichman**, C. Hock, T. I. Yacovitch, J. Palma, D. M. Neumark, and U. Manthe, "Resonances in the entrance channel of the elementary reaction of fluorine and methane", *Angew. Chem., Int. Ed.* **53**, 1122 (2014).
5. J. B. Kim, **M. L. Weichman**, and D. M. Neumark, "High-resolution anion photoelectron spectra of TiO_2^-, ZrO_2^-, and HfO_2^- obtained by slow electron velocity-map imaging", *Phys. Chem. Chem. Phys.* **50**, 20973 (2013).
4. **M. L. Weichman**, J. B. Kim, and D. M. Neumark, "Vibrational fine structure of C_5 via anion slow photoelectron velocity-map imaging", *J. Chem. Phys.* **139**, 144314 (2013).
3. J. B. Kim, **M. L. Weichman**, T. I. Yacovitch, C. Shih, and D. M. Neumark, "Slow photoelectron velocity-map imaging spectroscopy of the C_9H_7 (indenyl) and $C_{13}H_9$ (fluorenyl) anions", *J. Chem. Phys.* **139**, 104301 (2013).
2. C. Hock, J. B. Kim, **M. L. Weichman**, T. I. Yacovitch, and D. M. Neumark, "Slow photoelectron velocity-map imaging spectroscopy of cold negative ions", *J. Chem. Phys.* **137**, 244201 (2012).
1. M. K. Sprague, E. R. Garland, A. K. Mollner, C. Bloss, B. D. Bean, **M. L. Weichman**, L. A. Mertens, and M. Okumura, "Kinetics of *n*-butoxy and 2-pentoxy isomerization and detection of primary products by infrared cavity ringdown spectroscopy", *J. Phys. Chem. A* **116**, 6327 (2012).

Invited Presentations (since 2020)

19.	Coblentz Society Award Symposium Honoring Wei Xiong, SciX Meeting, Reno, NV	Oct. 2023
18.	Wintergreen Meeting of Phyiscal Chemists, Wintergreen, VA	Sept. 2023
17.	Symposium in Honor of Marsha Lester, ACS National Meeting, San Francisco, CA	Aug. 2023
16.	International Conference on Chemical Bonding, Kauai, HI	Jul. 2023
15.	Telluride Workshop on Polariton Chemistry and Molecular Cavity QED, Telluride, CO	Jun. 2023
14.	UNC Charlotte Chemistry Department Seminar, Charlotte, NC	Apr. 2023
13.	Conference on Molecular Quantum Technologies, Puerto Natales, Chile	Dec. 2022
12.	Gordon Research Conference on Molecular Interactions & Dynamics, Easton, MA	Jul. 2022
11.	Cavity Enhanced Spectroscopy Meeting, Lecco, Italy	Jun. 2022
10.	Quantum Frontiers in Molecular Science Telluride Workshop, webinar	Jun. 2022
9.	Andlinger Center & PPPL Retreat on Solar Geoengineering, Princeton, NJ	May 2022
8.	Princeton Institute for Materials Symposium, Princeton, NJ	Apr. 2022
7.	Stony Brook University AMO Physics Seminar, Stony Brook, NY	Nov. 2021

6. CSU Chico Chemistry Department, webinar Oct. 2021
5. Princeton Catalysis Initiative Symposium, Princeton, NJ Oct. 2021
4. International Symposium on Molecular Beams, webinar Jun. 2021
3. Johns Hopkins Chemistry Department, webinar Oct. 2020
2. Princeton Summer Physical Chemistry Webinar Series, webinar Jul. 2020
1. Telluride Science Summer Lecture Series, webinar Jul. 2020

Current Funding

- **The David and Lucile Packard Foundation, Packard Fellowships for Science and Engineering**, 2023-2028, $875k, "The stratosphere in focus: New spectroscopic tools for single-particle aerosol science."
- **National Science Foundation, AST/AAG Laboratory Astronomy program**, 2023-2026, $519k, "Precision spectroscopy of fullerenes: Towards resolving astrophysical molecular complexity" (AST-2307443).
- **National Science Foundation, CHE/CSDM-A, CAREER Award**, 2023-2028, $650k, "CAREER: Gas-phase molecular polaritons: A new platform for chemistry under strong light-matter coupling" (CHE-2238865).
- **High Meadows Environmental Institute, Climate and Energy Grand Challenge Award**, 2023–2025, $150k, co-PI with Luc Deike, "Aerosol-cloud-turbulence interactions."
- **Department of Energy, Early Career Award**, 2022-2027, $750k, "Polariton reaction dynamics: Exploiting strong light-matter interactions for new chemistry" (DE-SC0022948).
- **Princeton Fund for New Ideas in the Natural Sciences**, 2022-2024, $200k, "Quantum-state-resolved spectroscopy of endohedral fullerenes."
- **Princeton Catalysis Initiative**, 2022-2024, $120k, "Strong light-matter interactions in WTe_2, a novel 2D excitonic insulator."
- **Simons Foundation**, 2022-2023, $500k, co-PI with Luc Deike, "An initial small-scale experimental facility for solar geoengineering science" (award #1019423).

Completed Funding

- **Princeton Center for Complex Materials MRSEC**, 2022-2023, $60k, "Chiral polaritonics for materials functionalization."
- **ACS Petroleum Research Fund, Doctoral New Investigator**, 2021-2023, $110k, "Gas-phase polariton chemistry: Reaction kinetics of methane under vibrational strong coupling" (PRF-62543-DNI6).
- **Princeton Center for Complex Materials MRSEC**, 2021-2022, $60k, "Strong light-matter coupling of molecular and material monolayers"

Synergistic Activities

Professional Activities and Leadership

Journal of Molecular Spectroscopy, editorial board member	2023–
Molecular Underpinnings of Astrophysics Telluride Workshop, organizer	2023–
Conference on Cold and Controlled Molecules and Ions, advisory panel member	2022–
Mentor in Chemistry Women Mentorship Network (ChemWMN)	2020–
Polariton Chemistry and Molecular Cavity Quantum Electrodynamics Telluride Workshop, organizer	2023
ACS Spring 2023 National Meeting, PHYS symposium organizer	2023
Gordon Research Conference on Molecular Interactions & Dynamics, Power Hour organizer	2022

Department Service

Princeton Chemistry Physical Chemistry seminar series, organizer	2021–
Princeton Physical Chemistry Supergroup meetings, organizer	2021–
Princeton Chemistry Graduate Admissions Committee, committee member	2020–
Princeton Inclusive Community in Chemistry Committee, committee member	2020–
McCay Prize Exam in Physical Chemistry, writer and grader	2023
Princeton Chemistry Junior Faculty Search Committee, committee member	2022–2023
Princeton Chemistry Department Retreat, organizer and panelist	2022
Princeton Chemistry Teaching and Curriculum Committee, committee member	2020–2021

Ph.D. Dissertation Committees: served on 7 total, Shuhui Yin (2020), Hwon Kim (2021), Nhu Tran (2022), Robert Kirby (2022), Ben Zhang (2022), Clarissa Ding (2023), Jackson Deobald (2023)

General Exam Committees: served on 8 total, Graciela Villalpando (2021), Adam Reinhold (2021), Catrina Oberg (2021), Shaojun Gui (2021), Teresa Lee (2022), Connor Pollak (2023), Chirag Arora (2023), Liying Chen (2023)

Other University Service

Faculty Advisor, Yeh College	2022–
Quantum Science and Engineering PhD Program Quantum Undergraduate Research at IBM and Princeton (QURIP) Admissions Committee	2023
Faculty Fellow, Whitman College	2021–2022

Funding Agency Reviewing Activity

National Science Foundation AST/AAG (panel)	Department of Energy BES (ad hoc)
National Science Foundation CHE/CSDM-A (panel)	Department of Energy BES Early Career (ad hoc)
National Science Foundation CHE/CCI (ad hoc)	Stanford Linear Accelerator LCLS-II (panel)
National Science Foundation PHY/AMO-E (ad hoc)	

Journal Reviewing Activity

ACS Photonics	Nanophotonics
Chemical Reviews	Physical Chemistry Chemical Physics
Journal of the American Chemical Society	Proceedings of the National Academy of Sciences
Journal of Physical Chemistry	Review of Scientific Instruments
Journal of Physical Chemistry Letters	Science

Teaching

Princeton

Advanced Quantum Mechanics (CHM 502) Spring 2023
The Quantum World (CHM 305) Fall 2020, Fall 2021, Fall 2022
Related News: Princeton Office of Communications
Molecular Spectroscopy (CHM 504) Spring 2022

Feedback on CHM 305 from Undergraduate Teaching Evaluations (2020-2022)

- "Take it if Professor Weichman is teaching it! She is very well organized and really takes the time to make sure each student understands the material. I felt like she made these difficult concepts totally manageable."
- "Professor Weichman was a great lecturer, clearly explaining the material and very responsive to questions. Her explanations really helped with understanding the concepts and equations!"
- "I loved Professor Weichman's lectures. I think she did an excellent job making the difficult topics of quantum approachable for her students."
- "Professor Weichman was exceptionally helpful in answering questions and overall greatly improved both my understanding of and interest in quantum chemistry!"
- "Prof. Weichman's lectures are so organized and easy to follow. She also answers questions in a concise but super clear way."
- "Professor Weichman's notes were fantastic; I never really had to open the textbook, as Professor Weichman's notes were very detailed and informative."
- "Super clear and thorough! Learned a ton!"
- "This was one of my favorite courses at Princeton!"
- "Amazing! Prof Weichman is one of the best lecturers in the department in my opinion!"
- "Professor Weichman was the best STEM professor I have had."

CU Boulder (as a postdoctoral researcher)

Evidence-Based Introduction to Teaching workshop July 2019

UC Berkeley (as a graduate teaching assistant)

Statistical Mechanics (Chemistry 120b) Fall 2014
General Chemistry and Quantitative Analysis for Majors (Chemistry 4b) Spring 2014
General Chemistry and Quantitative Analysis for Majors (Chemistry 4a) Fall 2012

Caltech (as an undergraduate teaching assistant)

General Chemistry Lab (Chemistry 3a) Winter 2012

Research Mentoring

Postdoctoral Researchers

Dr. Adam Wright 2021–2023
(*now Asst. Prof., Department of Physics, University of Warwick, UK)*

Dr. Ashley Fidler 2021–
2021 Princeton Presidential Postdoctoral Research Fellow

Dr. Cole Sagan 2023–

Dr. Dominik Charczun 2023–

Ph.D. Students

Liying Chen 2021–
2023 Ada and Meyer Packer Memorial Fellow in Physical Chemistry

Negar Baradaran 2022–

Alexander McKillop 2022–

Jane Nelson 2022–
2023 DoD National Defense Science and Engineering Graduate Fellow

Undergraduate Students

Cameron Khan, Princeton University (*now PhD student at UPenn Chemistry*) 2021–2023

Victoria Zhang, Harvard University (QURIP student) 2022

Christopher Tong, MIT (QURIP student) 2023

Tanay Nambiar, Princeton University 2023–

Daniel Tajes, Princeton University 2023–