

Curriculum Vitae
Dr. Wei Xiong
UC San Diego
Department of Chemistry and Biochemistry
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Education:

Ph.D. in Chemistry, University of Wisconsin-Madison, Research Advisor: Professor Martin T. Zanni, 2006-2011

Thesis: Development and Applications of Shaper-Based 2D IR and SFG spectroscopy

B.S. in Chemistry, Peking University, China, Research Advisor: Professor Yuan Kou, 2002-2006

Appointments:

Professor, 2022 – Present

Kent Wilson Faculty Scholar, 2022 - 2027

Associate Professor, 2020 – 2022

Assistant Professor, 2014 – 2020

Department of Chemistry and Biochemistry, UCSD

Affiliated Professor, 2020 – Present

Department of Electrical and Computer Engineering, UCSD

Postdoctoral Research Associate, 2011 – 2014

JILA, University of Colorado-Boulder, Research Advisors: Professors Henry Kapteyn and Margaret Murnane

Awards and Honors:

- Kent Wilson Faculty Scholar, 2022
- NIH Maximizing Investigators' Research Award, 2020
- Sloan Research Fellow, 2020
- ACS JPC/PHYS Lectureship Award, 2019
- NSF CAREER Award, 2019
- DARPA Director's Fellow, 2017
- AFOSR Young Investigator Program Award, 2016
- DARPA Young Faculty Award, 2015
- Chinese Government Award for Outstanding Self-Financed Students Abroad, 2012
- K.V. Reddy Award in Physical Chemistry, UW-Madison, 2011
- General Electric Fellowship, Peking University, 2006

Research Interests:

- Dynamics and Nonlinear properties of IR polaritons for novel chemical and photonic applications
- Interface Sensitive Microscopy for biological and energy materials
- Study complex interfaces of photochemical and electrochemical systems, using transient HD SFG and 2D SFG spectroscopy.
- Ultrafast XAS for element specific charge dynamics in solid-state materials.

Grants

Current:

1. CAREER: Coherences and Nonlinear Interactions in Molecular Infrared Polaritons, *NSF-DMR*, \$526,856 (06/2019-06/2024)
2. In situ surface spectroscopy of 2D material-based electrocatalysis and photoelectrocatalysis, *NSF-CBET*, \$300,000 (08/01/2020-07/31/2023) (collaborative, co-PI, PI: Cronin at USC)
3. Ultrafast Dynamics of Molecular Polaritons for Chemistry, Photonics, and Quantum Information, *Sloan Foundation*, \$75,000 (05/01/2020-04/30/2022)
4. Imaging Molecular Level Details of Collagen Fibers by VSFG Microscopy, *NIH-R35*, \$1,973,750.00 (09/15/2020-09/14/2025)
5. Understanding and Controlling Reaction Mechanisms under Vibrational Strong Coupling NSF-CHE, \$508,707 (09/01/2021-08/31/2024)
6. A Synthetic Electronics Route to Scalable and Competitive Molecular Qubit Systems, DOE, \$564,000 (10/01/2021-9/30/2023) (co-PI, PI: Cushing)
7. Multichromophore Cavity Polaritons for Tunable Intermolecular Entanglement and Controlled Photon-to-Electron Quantum Transduction, DOE, \$621,692 (09/01/2021-08/31/2023) (co-PI, PI: Rury)
8. MURI: Polariton Chemistry, AFOSR, \$7,500,000.00 (lead PI, co-PI: Yuen-Zhou, Alu, Menon, Giebink, Isborn)
Completed:
9. Tabletop Time-Resolved Soft X-ray Spectrometer, AFOSR (DURIP), \$400,000.00 (06/15/2018-06/14/2019)
10. Heterodyned 2D SFG Spectromicroscopy– in situ visualization functionality origins at complex nano-assembly interfaces, DARPA(YFA), \$1,000,000.00 (9/15/2015-9/14/2019)
11. Tracking Ultrafast Charge Dynamics in Energy Materials with Atomic Specificity, AFOSR (YIP), \$360,000.00 (4/1/2017-3/31/2021) (NCE))
12. Molecular-Based Studies of Geochemical Interfaces in Complex Environments, ARO, \$435,589 (02/01/2019-01/31/2022) (joint, co-PI, PI: Grassian)
13. Time-Resolved, Electric-Field-Induced Vibrational Spectroscopy for Molecular Conformation Studies, NSF-CHE, \$ 467,196 (08/01/2018 – 07/31/2022) (joint, PI, co-PI: Paesani)
14. Probing the Structure and Dynamics of Water Under Heterogeneous Nanoconfinement Through Ultrafast Vibrational Spectro/microscopy and Many-Body Molecular Dynamics. DOE, \$1,200,164 (09/15/2018-07/14/2023)(joint, co-PI, PI: Paesani)
15. MRI: Development of a 100 kHz, Ultrafast Interfacial-Specific Two-Dimensional Vibrational Spectromicroscope. NSF – MRI, \$611,938 (09/01/2018-08/31/2022)(joint, PI, co-PI: Grassian, Devaraj, Liu)

Selected Publications (*corresponding authors)

Independent Works at UCSD

1. T. Chen, M. Du, Z. Yang, J. Yuen-Zhou*, W. Xiong*, “Cavity-Enabled Enhancement of Ultrafast Intramolecular Vibrational Redistribution over Pseudorotation” *Science*, Accepted, <https://doi.org/10.26434/chemrxiv-2022-w0lw9>
2. Z. Wu*, W. Xiong* “Neumann’s Principle Based Eigenvecotr Approach for Deriving Non-vanishing Tensor Elements for Nonlinear Optics”, *Journal of Chemical Physics*, 157, 134702, 2022
3. C. Wang, Y. Jing, L. Chen, W. Xiong* “Direct Interfacial Charge Transfer in All-Polymer Donor-Acceptor Heterojunctions”, *Journal of Physical Chemistry Letters*, 12, 8733, 2022
4. J. C. Wagner⁺, Z. Wu⁺, H. Wang, W. Xiong* “Imaging Orientation of a Single Molecular Hierarchical Self-Assembled Sheet: The Combined Power of a Vibrational Sum Frequency Generation Microscopy and Neural Network”, *Journal of Physical Chemistry B*, 126, 7192, 2022
5. Z. Yang, W. Xiong*, “Molecular Vibrational Polaritons towards Quantum Technology”, *Advanced Quantum Technologies*, 5,2100163, 2022
6. H. Wang, W. Xiong*, “Revealing the Molecular Physics of Lattice Self-assembly by Vibrational Hyperspectral Imaging”, *Langmuir*, 10, 3017, 2022, Invited Feature Article

7. B. Xiang., Z. Yang., Y-Z. You*, & W. Xiong*. "Ultrafast Coherence Delocalization in Real Space Simulated by Polaritons." *Advanced Optical Materials*, 10, 2102237, 2022
8. J.C. Wagner, K. Hunter, F. Paesani*, W. Xiong*. "Water Capture Mechanisms at Zeolitic Imidazolate Framework Interfaces." *Journal of the American Chemical Society*, 143, 50, 21189, 2021
9. G. D. Wiesehan, W. Xiong*, "Negligible rate enhancement from reported cooperative vibrational strong coupling catalysis", *Journal of Chemical Physics*, 155, 241103 2021
10. H. Wang, W. Xiong* "Vibrational Sum-Frequency Generation Hyperspectral Microscopy for Molecular Self-Assembled Systems", *Annual Review of Physical Chemistry*, 72, 279-306, 2021
11. R. F. Ribeiro, J. A. Campos-Gonzalez-Angulo, N.C. Giebink, W. Xiong, J. Yuen-Zhou, "Enhanced optical nonlinearities under collective strong light-matter coupling", *Physical Review A* 103, 063111, 2021
12. B. Xiang, W. Xiong*, "Molecular Vibrational Polariton: Its dynamics and potentials in novel chemistry and quantum technology", *Journal of Chemical Physics (Featured Cover Article)*, 155, 050901, 2021
13. B. Xiang, J. W. B. Xiang, J. Wang, Z. Yang, W. Xiong*, "Nonlinear Infrared Polaritonic Interaction between Cavities Mediated by Molecular Vibrations at Ultrafast Timescale", *Science Advances*, 7, eaf6397, 2021
14. ang, Z. Yang, W. Xiong*, "Nonlinear Infrared Polaritonic Interaction between Cavities Mediated by Molecular Vibrations at Ultrafast Timescale", *Science Advances*, 7, eaf6397, 2021
15. B. Xiang, J. Wang, Z. Yang, W. Xiong*, "Nonlinear Infrared Polaritonic Interaction between Cavities Mediated by Molecular Vibrations at Ultrafast Timescale", *Science Advances*, 7, eaf6397, 2021
16. K. Hunter, J. C. Wagner, M. Kalaj, S. Cohen, W. Xiong*, F. Paesani*, "Simulation Meets Experiment: Unraveling the Properties of Water in Metal-Organic Frameworks Through Vibrational Spectroscopy" *Journal of Physical Chemistry C*, 125(22), 12451, 2021
17. W. Chen, W. Xiong*, "Polaron-formation revealed by transient XUV imaginary refractive index changes in different iron compounds", *Physical Chemistry Chemical Physics*, 23, 4487, 2021
18. A.P. Ault, V.H. Grassian, N. Carslaw, D. B. Collins, H. Destailhats, D. J. Donaldson, D.K. Farmer, J. L. Jimenez, V. Faye. McNeil, G. G. Morrison, R. E. O'Brien, M. Shiraiwa, M. E. Vance, J. R. Wells, W. Xiong, "Indoor Surface Chemistry: Developing a Molecular Picture of Reactions on Indoor Interfaces", *Chem*, 6, 32-3, 2020
19. H. Wang, J.C. Wagner, W. Chen, C. Wang, W. Xiong*, "Spatial Dependent H-bond Dynamics at Interfaces of Water/Biomimetic Self-Assembled Lattice Materials", *Proceedings of the National Academy of Sciences of the United States of America*, 117(38), 23385, 2020
20. C. Wang, Y. Li, W. Xiong*, "Extracting molecular responses from ultrafast charge dynamics at material interfaces", *Journal of Material Chemistry C*, 8, 12062, 2020
21. B. Xiang, R.F. Ribeiro, M. Du, L. Chen, Z. Yang, J. Wang, J. Yuen-Zhou*, W. Xiong*, "Intermolecular Vibrational Energy Transfer Enabled by Microcavity Strong Light-Matter Coupling", *Science*, 368(6491), 665, 2020
22. Z. Yang, B. Xiang, W. Xiong*, "Controlling Quantum Pathways in Molecular Vibrational Polaritons", *ACS Photonics*, 7(4), 919, 2020
23. H. Qian, S. Li, Y. Li, C.-F. Chen, S. Bopp, Y.-U. Lee, W. Xiong, Z. Liu*, "Nanoscale optical pulse limiter enabled by refractory metallic quantum wells", *Science Advances*, 6(20), eaay3456, 2020

24. V.O. Ozcelik, Y.Li, W. Xiong, F. Paesani*, “Modeling Spontaneous Charge Transfer at Metal/Organic Hybrid Heterostructures”, *Journal of Physical Chemistry C*, 124(8), 4802, 2020
25. Y. Li, M. Shrestha, M. Luo, B. Xiang, V. H. Grassian*, W. Xiong*, “Salting Up of Proteins at the Air/Water Interface”, *Langmuir*, 35(43), 13815-13810, 2019
26. H. Wang, W. Chen, J.C. Wagner, W. Xiong*, “Local Ordering of Lattice Self-Assembled SDS@2 β -CD Materials and Adsorbed Water Revealed by Vibrational Sum Frequency Generation Microscope.”, *Journal of Physical Chemistry B, Invited Research Article, Special Issue for Hai-Lung Dai Festschrift*, 123(29) 6212-6221, 2019
27. B. Xiang, R. F. Ribeiro, L. Chen, J. Wang, M. Du, J. Yuen-Zhou, W. Xiong*, “State-Selective Polariton to Dark State Relaxation Dynamics”, *Journal of Physical Chemistry A, Invited Research Article, Special Issue of Pacific Conference on spectroscopy and Dynamics*, 123(28) 5918-5927, 2019
28. B. Xiang⁺, R. F. Ribeiro⁺, Y. Li, A. D. Dunkelberger, B.S. Simpkins, J. Yuen-Zhou, W.Xiong*, “Manipulating Optical Nonlinearities of Molecular Polaritons by Delocalization”, *Science Advances*, 5, eaax5196, 2019.
29. Y. Li, B. Xiang, W. Xiong*, “Heterodyne Transient Vibrational SFG to Reveal Molecular Responses to Interfacial Charge Transfer”, *Journal of Chemical Physics, Invited Research Article, Special Topic on Nonlinear Spectroscopy and Interfacial Structure and Dynamics*. 150, 114706, 2019
30. T. M. Porter, J. Wang, Y. Li, B. Xiang, C. Salsman, J. S. Miller, W. Xiong*, C. P. Kubiak*, “Observation of a Three-state Picosecond Dynamic Equilibrium by 2D IR Spectroscopy”, *Chemical Science*, 10, 113-117, 2019
31. S. Wang, Z. Huang, X. Wang, Y. Li, M. Günther, S. Valenzuela, P. Parikh, W. Xiong*, Y. S. Meng*, “Formation and Influence of tBP-LiTFSI Complexes in Perovskite Solar Cells”, *Journal of the American Chemical Society*, 140 (48), 16720–16730, 2018
32. R. F. Ribeiro, A. D. Dunkelberger, B. Xiang, W. Xiong, B. S. Simpkins, J. C. Owrutsky, J. Yuen-Zhou*, “Theory for Nonlinear Spectroscopy of Vibrational Polaritons”, *Journal of Physical Chemistry Letters*, 9, 3766-3771, 2018
33. B. Xiang, R. F. Ribeiro, A. D. Dunkelberger, J. Wang, Y. Li, B. S. Simpkins, J. C. Owrutsky, J. Yuen-Zhou, W. Xiong*, “Two-dimensional Infrared Spectroscopy of Vibrational Polaritons”, *Proceedings of the National Academy of Sciences of the United States of America*, 115, 4845-4850, 2018
34. H. Wang, T. Gao, W. Xiong*, “Self Phase-Stabilized Heterodyne Vibrational Sum Frequency Generation Microscopy”, *ACS Photonics*, 4, 1839, 2017
35. B. Xiang⁺, Y. Li⁺, C.H. Pham, F. Paesani, W. Xiong*, “Ultrafast Direct Electron Transfer at Organic Semiconductor and Metal Interfaces”, *Science Advances*, 3: e1701508, 2017
36. Z. Li, J. Wang, Y. Li, W. Xiong*, “Solving the “Magic Angle” Challenge in Determining Molecular Orientation Heterogeneity at Interfaces”, *Journal of Physical Chemistry C*, 120, 20239, 2016
37. Y. Li, J. Wang, M. L. Clark, C. P. Kubiak, W. Xiong*, “Characterizing Interstate Vibrational Coherent Dynamics of Surface Adsorbed Catalysts by Fourth-order 3D SFG Spectroscopy”, *Chemical Physics Letter, Frontier Cover Article*. 650, 1, 2016
38. Y. Li, J. Wang, W. Xiong*, “Probing Band Gaps and Molecular Orderings of Organic Semiconductors at Buried Interfaces by Electronic Sum Frequency Generation Spectroscopy”, *Journal of Physical Chemistry C*, 119, 28083, 2015
39. J. Wang, M. L. Clark, Y. Li, C.L. Kaslan, C.P. Kubiak, W. Xiong*, “Short Range Catalyst-

Surface Interactions Revealed by Heterodyne Two Dimensional Sum Frequency Generation Spectroscopy”, *Journal of Physical Chemistry Letters*, 6, 4204, 2015

Prior to UCSD

40. J. L. Ellis, D. D. Hickstein, K. J. Schnitzenbaumer, M. B. Wilker, B. B. Palm, J. L. Jimenez, G. Dukovic, H. C. Kapteyn, M. M. Murnane, W. Xiong, “Solvents effects on charge transfer from quantum dots”, *Journal of the America Chemical Society*, 137, 3759, 2015

41. D. D. Hickstein, F. Dollar, J. L. Ellis, K. J. Schnitzenbaumer, K. E. Keister, G. M. Petrov, C. Ding, B. B. Palm, J. A. Gaffney, M. E. Ford, S. B. Libby, G. Dukovic, J. L. Jimenez, H. C. Kapteyn, M. M. Murnane, and W. Xiong, "Mapping nanoscale absorption of intense femtosecond laser pulses using plasma explosion imaging", *ACS Nano*, 8, 8810, 2014

42. C. Ding, W. Xiong, T. Fan, D. D. Hickstein, T. Popmintchev, X. Zhang, M. Walls, M.M. Murnane, H.C. Kapteyn, “High flux coherent super-continuum soft X-ray source driven by a single-stage, 10mJ, Ti: sapphire amplifier-pumped OPA”, *Optical Express*, 22, 6194, 2014

43. D.D. Hickstein, F. Dollar, J. Gaffney, M. Foord, G. Petrov, B.E. Palm, K.E. Keister, J.L. Ellis, C. Ding, S. Libby, J.L. Jimenez, H.C. Kapteyn, M.M. Murnane, W. Xiong “Observation and control of shock waves in individual nanoplasmas”, *Physical Review Letters*, 112, 115004, 2014

44. W. Xiong*, D. D. Hickstein, K.J. Schnitzenbaumer, J.L. Ellis, B.B. Palm, K.E. Keister, C. Ding, L. Miaja-Avila, G. Dukovic, J.L. Jimenez, M. M. Murnane, H.C. Kapteyn, “ Photoelectron spectroscopy of CdSe nanocrystals in the gas phase: a direct measure of the evanescent electron wavefunction of quantum dots”, *Nano Letters*, 13, 2924, 2013

45. W.Xiong, J.E. Laaser, R.D. Mehlenbacher, M.T. Zanni, “Adding a dimension to the infrared spectra of interfaces using heterodyne detected 2D sum-frequency generation (HD 2D SFG) spectroscopy,” *Proceedings of the National Academy of Sciences of the United States of America*, 108, 20902, 2011

46. J.E. Laaser, W. Xiong, M.T. Zanni, “Time-domain SFG spectroscopy using mid-IR pulse shaping: Practical and intrinsic advantages,” *Journal of Physical Chemistry B* 115, 2536, 2011

47. A.M. Woys, Y.S. Lin, A.S. Reddy, W. Xiong, J.J de Pablo, J.L. Skinner, and M. T. Zanni, "2D IR Line Shapes Probe Ovispirin Peptide Conformation and Depth in Lipid Bilayers," *Journal of the America Chemical Society*. 132, 2832, 2010

48. W. Xiong, J.E. Laaser, P. Paoprasert, R. Franking, R. J. Hamers, P. Gopalan, and M.T. Zanni, “Transient 2D IR spectroscopy of charge injection in dye-sensitized nanocrystalline thin films,” *Journal of the America Chemical Society* 131, 18040, 2009

49. W. Xiong, D.B. Strasfeld, S.H. Shim, M.T. Zanni, “Automated 2D IR spectrometer mitigates

50. W. Xiong and M.T. Zanni, "Signal enhancement and background cancellation in collinear 2D spectroscopies", *Optics Letters*. 33, 1371, 2008

Research Presentation

- **Keynote/Award talks:** 2022 OMQ Symposium (University of Oregon, Keynote speaker), 2022 CMDS (Austin, keynote speaker), 2022 APS March Meeting (Chicago, JCP/DCP Editor’s Choice Lecture), 2019 ACS National Meeting (San Diego, JPCC/Phys Lectureship)

- Invited seminar: UCI, UCLA, Utah State, University of Washington, MIT (2022), UIUC, UNC- Chapel Hill, UT-Austin (2021), Columbia, Caltech, UC Berkeley (2020), UC-Merced, University of Chicago, University of Southern California, University of Michigan, Boston College, Yale University, Princeton University, University of Wisconsin, University of Chicago, University of Nevada – Reno, Stanford

University (2019), Emory University, Georgia Tech, Spelman College, University of Pennsylvania, UC Irvine, University of Colorado-Boulder, Colorado University, University of Southern California, UC Davis, University of Minnesota (2018), Naval Research Laboratory (2017), San Diego State University, UC Riverside (2016), Peking University (2015), UCSD Physics (2014), Institute of Physics, China Academy of Science (2014), MIT, Lehigh University, UC San Diego, Andrews University, (2013)

- Invited talks: CMDS Austin, ICSCE-11, Telluride workshop: *Advances of Multidimensional Vibrational Spectroscopy in Water, Biology, and Material Science*, Telluride Nonlinear Optics at Interfaces workshop, Gordon Research Conference on Molecular Interaction and Dynamics, ACS Spring Meeting (2022), CMDS online, SCOM 2021 (invited speaker and panelists), TRVS 2021, Caltech Symposium on the Frontiers in Chemical Physics, Telluride Vibrational Dynamics workshop, ACS Fall meeting, PacificChem (2021), GRC Plasmonically-Powered Processes, Hong Kong (2019); Telluride Vibrational Dynamics workshop (2019), ACS Orlando (2019), Pacific Conference on Spectroscopy and Dynamics (2019), Spectroscopic Imaging Workshop (2018), Telluride Nonlinear Optics at Interfaces workshop (2018), Gordon Conference on Vibrational Spectroscopy (2018), ACS New Orleans (2018), NSYSU-UCSD Bilateral Research Symposium (2018), The 9th 10+10 workshop (2018), Sloan Reactions on Indoor Surfaces Workshop (2018), SciX Conference (2017), Sino-China Young Scientist Symposium on Surface Structure and Dynamics (2017), Telluride Vibrational Dynamics workshop (2017), The International Workshop on Nonlinear Optics at Interfaces (2017), Gordon Conference on Photoionization & Photodetachment (2014), Gordon Research Conference on Gaseous Ions (2013) 246th ACS National Meeting (2013), SPIE NanoScience+Engineering Conference (2011)

Professional Service Activities

Academic service

- Conference Organizers: Polariton webinar series (with Prof. Yuen-Zhou, April 2020-Present), Telluride workshop: *Advances of Multidimensional Vibrational Spectroscopy in Water, Biology, and Material Science* (with Prof. Lu Wang, July 2018 and 2022), ACS National Meeting Symposium organizer (with Prof. Lu Wang, Aug 2019; with Profs. Yuen-Zhou and Rury, Mar 2022), 10+10 symposium (Jan 2020), APS March Meeting (with Prof. Yuen-Zhou, March 2020 (canceled due to COVID)), International Conference on Strong Coupling of Organic Molecules (SCOM) (with Prof. Yuen-Zhou, 2023)
- Reviewer: JACS, Journal of Physical Chemistry, Journal of Physical Chemistry Letter, Chemical Physics, Nature Communications, Nature Physics, Science Advances, Biophysics Journal, Optics Letters, Nature Physics, Angewandte Chemie, Journal of Materials Chemistry C, Journal of Chemical Physics, Small and Nanoscale, Proceedings of the National Academy of Sciences, Physical Review X, Physical Chemistry Chemical Physics, ACS Photonics, Optics Communication, Joule (2014- Present)
- Grant Referee: NSF (Referee and Panelist), DOE, ACS PRF, AFOSR, European Research Council, RGC of Hong Kong, Israel Science Foundation, Israel Science Foundation (2014- Present)
- Editorial Advisory Board Member: Journal of Physical Chemistry (2020-2022)
- Guest Editor: Journal of Chemical Physics, Special Issue on Polariton Chemistry: Molecules in Cavities and Plasmonic Media (2020), PNAS

Professional Affiliations:

Members, American Chemical Society, American Physical Society, AAAS