

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, Department of Chemistry and Biochemistry, UCSD

Kent Wilson Faculty Scholar, 2022 – 2027, Department of Chemistry and Biochemistry, UCSD

Associate Professor, 2020 – 2022, Department of Chemistry and Biochemistry, UCSD

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:

- Fellow, American Association for the Advancement of Science, 2024
- Humboldt Research Fellowship for Experienced Researchers, 2023
- Coblenz Award, Coblenz Society, 2023
- 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
 - Polariton-enabled molecular mechanisms for novel chemistry, i.e., remote energy transfer and modified activation barriers.
- Interface sensitive microscopy for biological and energy materials
 - Hyperspectral sum-frequency generation (VSFG) imaging microscopy to unveil

intricate molecular-level structural insights of disease-related biological tissues, while exploring its potential as a diagnostic tool.

- Multidimensional Widefield Infrared Encoded Spontaneous Emission (MD-WISE) Microscopy for multiplexing imaging of biological systems
- Study complex interfaces of photochemical and electrochemical systems, using transient HD SFG spectroscopy.
 - Reveal charge and spin transfer dynamics at charge transfer interfaces.
- Reveal many body physics of solid-state materials using time-resolved transient EUV spectroscopy.

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 NCE) (collaborative, co-PI, PI: Cronin at USC)
3. Imaging Molecular Level Details of Collagen Fibers by VSFG Microscopy, *NIH-R35*, \$1,973,750.00 (09/15/2020-09/14/2025)
4. Understanding and Controlling Reaction Mechanisms under Vibrational Strong Coupling NSF-CHE, \$508,707 (09/01/2021-08/31/2024)
5. 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)
6. MURI: Polariton Chemistry, AFOSR, \$7,500,000.00 (lead PI, co-PI: Yuen-Zhou, Alu, Menon, Giebink, Isborn)

Selected Publications (*corresponding authors)

Independent Works at UCSD

Key Publications

1. T. Chen, M. Du, Z. Yang, J. Yuen-Zhou*, W. Xiong*, “Cavity-Enabled Enhancement of Ultrafast Intramolecular Vibrational Redistribution over Pseudorotation” *Science*, 378, 790-794, 2022
2. 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
3. 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
4. Z. Yang, H.H. Bhakta, W. Xiong*, “Enabling Multiple Intercavity Polariton Coherences by Adding Quantum Confinements to Cavity Molecular Polaritons”, *Proceedings of the National Academy of Sciences of the United States of America* 120, e2206062120, 2022
5. 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

Full Publications

6. G. Stemo, J. Nishiuchi, H. Bhakta, H. Mao, G. Wiesehan, W. Xiong, and H. Katsuki. "Ultrafast Spectroscopy under Vibrational Strong Coupling in Diphenylphosphoryl Azide" *The Journal of Physical Chemistry A*, 128, 1817-1824, 2024
7. B. Xiang, and W. Xiong "Molecular Polaritons for Chemistry, Photonics, and Quantum Technologies", *Chemical Reviews*, 124, 2512-2552, 2024
8. C. Yan, C. Wang, J. C. Wagner, J. Ren, C. Lee, Y. Wan, S. E. Wang, and W. Xiong. "Multidimensional Widefield Infrared-Encoded Spontaneous Emission Microscopy: Distinguishing Chromophores by Ultrashort Infrared Pulses" *Journal of The American Chemical Society*, 146, 187401886, 2024
9. J. C. Wagner, B. Yang, Z. Wu, and W. Xiong. "Multimodal Nonlinear Hyperspectral Chemical Imaging Using Line-Scanning Vibrational Sum-Frequency Generation Microscopy" *Journal of Visualized Experiments*, 10.3791/65388, 2023
10. O. Hirschmann, H.H.Bhakta, and W. Xiong*. "The Role of IR Inactive Mode in W(CO)₆ Polariton Relaxation Process" *Nanophotonics*, <https://doi.org/10.1515/nanoph-2023-0589>, 2023
11. M. L. Valentine, G. Yin, J. J. Oppenheim, M. Dincă, and W. Xiong*. "Ultrafast Water H-Bond Rearrangement in a Metal–Organic Framework Probed by Femtosecond Time-Resolved Infrared Spectroscopy" *Journal of The American Chemical Society*, 145, 21, 11482, 2023.
12. M. L. Valentine, G. Wiesehan, and W. Xiong. "An Evaluation of Maximum Determination Methods for Center Line Slope Analysis" *The Journal of Physical Chemistry B*, 127, 19, 4268, 2023
13. C.-H. Ho*, M. L. Valentine, Z. Chen, H. Xie, O. Farha, W. Xiong* & F. Paesani*. "Structure and thermodynamics of water adsorption in NU-1500-Cr" *Communications Chemistry*, 6, Article number: 70, 2023, <https://doi.org/10.1038/s42004-023-00870-0>
14. W. Xiong* "Molecular Vibrational Polariton Dynamics: What Can Polaritons Do?" *Accounts of Chemical Research*, 56, 7, 776-786, 2023.
15. B. S. Simpkins*, Z. Yang, A. D. Dunkelberger*, I. Vurgaftman, J. C. Owrutsky*, and W. Xiong*. 'Comment on "Isolating Polaritonic 2D-IR Transmission Spectra"' *Journal of Chemical Physics Letters* 14, 4, 983, 2023
16. Z. Wu*, W. Xiong* "Neumann's Principle Based Eigenvector Approach for Deriving Non-vanishing Tensor Elements for Nonlinear Optics", *Journal of Chemical Physics*, 157, 134702, 2022
17. 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
18. 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
19. Z. Yang, W. Xiong*, "Molecular Vibrational Polaritons towards Quantum Technology", *Advanced Quantum Technologies*, 5, 2100163, 2022
20. H. Wang, W. Xiong*, "Revealing the Molecular Physics of Lattice Self-assembly by Vibrational Hyperspectral Imaging", *Langmuir*, 10, 3017, 2022, Invited Feature Article
21. B. Xiang., Z. Yang., Y-Z. You*, & W. Xiong*. "Ultrafast Coherence Delocalization in Real Space Simulated by Polaritons." *Advanced Optical Materials*, 10, 2102237, 2022
22. 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

23. 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
24. G. D. Wiesehan, W. Xiong*, "Negligible rate enhancement from reported cooperative vibrational strong coupling catalysis", *Journal of Chemical Physics*, 155, 241103 2021
25. H.Wang, W. Xiong* "Vibrational Sum-Frequency Generation Hyperspectral Microscopy for Molecular Self-Assembled Systems", *Annual Review of Physical Chemistry*, 72,279-306,2021
26. 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
27. 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
28. 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
29. 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
30. A.P. Ault, V.H. Grassian, N.Carlsaw, D. B. Collins, H.Destaillats, 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
31. C.Wang, Y.Li, W. Xiong*, "Extracting molecular responses from ultrafast charge dynamics at material interfaces", *Journal of Material Chemistry C*, 8,12062, 2020
32. Z. Yang, B. Xiang, W. Xiong*, "Controlling Quantum Pathways in Molecular Vibrational Polaritons", *ACS Photonics*, 7(4), 919,2020
33. 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
34. 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
35. 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
36. 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.
37. 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
38. 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

39. 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
40. 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
41. 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
42. 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
43. H. Wang, T. Gao, W. Xiong*, “Self Phase-Stabilized Heterodyne Vibrational Sum Frequency Generation Microscopy”, *ACS Photonics*, 4, 1839, 2017
44. 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
45. 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
46. 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
47. 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
48. 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

49. 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
50. 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
51. 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
52. D.D. Hickstein, F. Dollar, J. Gaffney, M. Ford, 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
53. 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

54. 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

55. 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

56. 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

57. 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

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

59. 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:

- 2024 Plenary Speaker/Panelist, Ultrafast Phenomena, Barcelona, Spain, TBD
- 2024 Ultrafast System Lecturer, University of Illinois Chicago, Chicago, IL, “Ultrafast Dynamics of Molecular Polaritons”
- 2023 Plenary Speaker, SciX, Sparks, NV, " Ultrafast Dynamics of Molecular Vibrational Polaritons "
- 2022 Keynote Speaker, OMQ Symposium, University of Oregon, Eugene, OR “Ultrafast Dynamics of Molecular Vibrational Polaritons”
- 2022 Keynote speaker, The 10th International Conference on Coherent Multidimensional Spectroscopy (CMDS), Austin, TX, “Ultrafast Dynamics of Molecular Vibrational Polaritons”
- 2022 Invited Tutorial Talk, Telluride Workshop – Quantum Frontiers in Molecular Science, “Ultrafast Dynamics of Molecular Vibrational Polaritons for Chemistry and Quantum Simulation”
- 2022 JCP/DCP Editor’s Choice Lecture, APS March Meeting, Chicago, IL, “Ultrafast Dynamics of Molecular Vibrational Polaritons for Chemistry and Quantum Simulation”
- 2021 Panelist, Strong Coupling with Organic Molecules (SCOM 2021), Virtual
- 2019 JPCC/Phys Lectureship, ACS National Meeting, San Diego, CA, “Ultrafast IR Spectroscopy for Molecular Vibrational Polaritons and Self-assembled Materials”

Professional Affiliations:

Members, American Chemical Society, American Physical Society, AAAS