Stanford

Fang Liu

Assistant Professor of Chemistry

CONTACT INFORMATION

- **Administrative Contact**

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Bio

BIO

Fang Liu is an assistant professor of chemistry at Stanford University. Her reserach is focused on the light induced dynamics of solid low dimensional materials and construction of low dimensional artificial structures. Prior to her current position, she was a DOE Office of Energy Efficiency and Renewable Energy (EERE) postdoctoral fellow in the group of Prof. Xiaoyang Zhu at Columbia University. Her postdoctoral research focused on using femtosecond extreme UV in probing time and angle resolved photoemission spectroscopy of 2D materials. Prior to working in Columbia, she worked under the direction of Prof. Marsha I Lester at University of Pennsylvania. She received her Ph.D. in 2015 and worked as a postdoc in the same group in 2016. At UPenn, she used time resolved spectroscopic techniques to study spectroscopy and photochemistry of Criegee intermediates. She received her B.S. in chemistry at Peking University in 2010.

ACADEMIC APPOINTMENTS

- Assistant Professor, Chemistry
- Principal Investigator, Stanford PULSE Institute

HONORS AND AWARDS

- Office of Energy Efficiency & Renewable Energy (EERE) Postdoctoral Research Award, Solar Energy Technologies Office of the Department of Energy (2018-2020)
- Miller Prize, International Symposium on Molecular Spectroscopy (2019)

PROFESSIONAL EDUCATION

- B.S. in chemistry, Peking University (2010)
- Ph.D. in chemistry, University of Pennsylvania (2015)

PATENTS

- Gregory Zaborski Jr., Fang Liu. "United States Patent 63/660,802 Scalable and reproducible in situ manufacturing method for quantum moire interfaces", Leland Stanford Junior University

LINKS

- My Lab Site: https://fangliulab.su.domains/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The group will develop scalable and controllable processes to produce low dimensional materials and their artificial structures, and unravel their novel static and dynamical properties of broad interest to future photonic, electronic and energy technologies. The topics will include: a) Unraveling time-resolved dynamics in light-induced electronic response of two dimensional (2D) materials artificial structures. b) Fabrication of 1D atomically thin nanoribbon arrays and characterization of the electronic and magnetic properties for the prominent edge states. c) Lightwave manipulation with 2D superlattices. These research projects will provide participating students with broad interdisciplinary training across physics, chemistry, and materials science.

Teaching

COURSES

2025-26

- Advanced Physical Chemistry: CHEM 271 (Aut)
- Instrumental Analysis Principles and Practice: CHEM 131 (Spr)
- Physical Chemistry II: CHEM 173 (Aut)

2024-25

- Advanced Physical Chemistry: CHEM 271 (Aut)
- Instrumental Analysis Principles and Practice: CHEM 131 (Spr)
- Physical Chemistry II: CHEM 173 (Aut)

2023-24

- Advanced Physical Chemistry: CHEM 271 (Aut)
- Instrumental Analysis Principles and Practice: CHEM 131 (Spr)
- Physical Chemistry II: CHEM 173 (Aut)

2022-23

- Instrumental Analysis Principles and Practice: CHEM 131 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Huayue Ai, Aaron Charnay, Yu-Che Chien, Jamie Cleron, Tristan Heck, Nicholas Juntunen, Samantha Le, Joseph Lucero, Divine Mbachu, Amy McKeown-Green, Pournima Narayanan, Bang Nhan, Supavit Pokawanvit, Logan Russo, Kazuki Tayama, Yating Yao, Alexandra Zimmerman, Clara Zwanziger

Postdoctoral Faculty Sponsor

Qile Li, Yidian Li

Doctoral Dissertation Advisor (AC)

Lianne Alson, Samuel Lai, Catherine Thai, Ing-Angsara Thongchai

Publications

PUBLICATIONS

- **Mimicry of Biological Neurons in an Array of MoS₂ Field Effect Transistors with Ionic Liquid Gates** *ACS APPLIED ELECTRONIC MATERIALS*
  Shultz, A., Alzahrani, S., Goul, R., Zaborski, G., Johnson, C., Liu, F., Sadeghi, S., Berrie, C. L., Wu, J. Z.
  2026

- **Enhanced second-harmonic generation from WS2/ReSe2 heterostructure.** *The Journal of chemical physics*
  Shaikh, K., Yoo, T., Zhu, Z., Li, Q., Johnson, A. C., Deng, H., Liu, F., Kobayashi, Y.
  2026; 164 (10)

- **Non-equilibrium entropy production and information dissipation in a non-Markovian quantum dot** *NATURE PHYSICS*
  Shen, Y., Chen, C., Ma, H., Saunders, A. P., Heide, C., Liu, F., Rotskoff, G. M., Shi, J., Lindenberg, A. M.
  2026

- **Low resistance p-type contacts to monolayer WSe2 through chlorinated solvent doping.** *Nature communications*
  Hoang, L., Bennett, R. K., Hoang, A. T., Peña, T., Zhang, Z., Hocking, M., Saunders, A. P., Jaikissoon, M., Liu, F., Pop, E., Mannix, A. J.
  2026; 17 (1): 718

- **Tracking the Photoinduced Dynamics of a Dark Excitonic State in Single-Layer WS_{2} via Resonant Autler-Townes Splitting.** *Physical review letters*
  Montanaro, A., Valiera, F., Giusti, F., Fassioli, F., Trovatello, C., Jarc, G., Rigoni, E. M., Liu, F., Zhu, X., Conte, S. D., Cerullo, G., Eckstein, M., Fausti, et al
  2026; 136 (1): 016902

- **Tracking the Photoinduced Dynamics of a Dark Excitonic State in Single-Layer WS2 via Resonant Autler-Townes Splitting** *PHYSICAL REVIEW LETTERS*
  Montanaro, A., Valiera, F., Giusti, F., Fassioli, F., Trovatello, C., Jarc, G., Rigoni, E., Liu, F., Zhu, X., Dal Conte, S., Cerullo, G., Eckstein, M., Fausti, et al
  2026; 136 (1)

- **Twisted Tin-Chloride Perovskite Single-Crystal Heterostructures.** *Angewandte Chemie (International ed. in English)*
  Cleron, J. L., Chen, C. Y., Pan, F., Saha, S., Marlton, F. P., Stolz, R. M., Li, J., Dionne, J. A., Liu, F., Filip, M. R., Karunadasa, H. I.
  2025: e20140

- **Room-temperature valley-selective emission in Si-MoSe2 heterostructures enabled by high-quality-factor chiroptical cavities.** *Nature communications*
  Pan, F., Li, X., Johnson, A. C., Dhuey, S., Saunders, A., Hu, M. X., Dixon, J. P., Dagli, S., Lau, S. C., Weng, T., Chen, C. Y., Zeng, J. H., Apte, et al
  2025

- **Photoinduced twist and untwist of moiré superlattices.** *Nature*
  Duncan, C. J., Johnson, A. C., Maity, I., Rubio, A., Gordon, M., Bartnik, A. C., Kaemingk, M., Li, W. H., Andorf, M. B., Pennington, C. A., Bazarov, I. V., Tate, M. W., Muller, et al
  2025

- **Determining the complex second-order optical susceptibility in macroscale van der Waals heterobilayers.** *The Journal of chemical physics*
  Zhu, Z., Yoo, T., Shaikh, K., Johnson, A. C., Li, Q., Liu, F., Deng, H., Kobayashi, Y.
  2025; 163 (17)

- **Macroscopic Uniform 2D Moiré Superlattices with Controllable Angles.** *Journal of the American Chemical Society*
  Zaborski, G., Majchrzak, P. E., Lai, S., Johnson, A. C., Li, Q., Saunders, A. P., Zhu, Z., Deng, Y., Lu, D., Hashimoto, M., Shen, Z. X., Liu, F.
  2025

- **Localized exciton emission from monolayer WS2 nanoribbon at cryogenic temperature.** *Nanophotonics (Berlin, Germany)*
  Qiang, G., Saunders, A. P., Trinh, C. T., Liu, N., Jones, A. C., Liu, F., Htoon, H.
  2025; 14 (11): 1721-1728

- **Dynamic Excitonic Beam Switching with Atomically-Thin Binary Blazed Gratings** *ADVANCED OPTICAL MATERIALS*

Guarneri, L., Bauer, T., Li, Q., Song, J., Selvin, S., Saunders, A. P., Liu, F., Brongersma, M. L., van de Groep, J.
2025

- **Localized exciton emission from monolayer WS₂ nanoribbon at cryogenic temperature** *NANOPHOTONICS*
  Qiang, G., Saunders, A. P., Trinh, C. T., Liu, N., Jones, A. C., Liu, F., Htoon, H.
  2025

- **Facile Tensile Testing Platform for In Situ Transmission Electron Microscopy of Nanomaterials** *ADVANCED MATERIALS INTERFACES*
  Sari, B., Dandu, M., Wood, N., Hochhalter, J., Johnson, A. C., Doeff, M., Liu, F., Raja, A., Scott, M., Dhall, R., Warren, R.
  2024

- **Direct Exfoliation of Nanoribbons from Bulk van der Waals Crystals.** *Small (Weinheim an der Bergstrasse, Germany)*
  Saunders, A. P., Chen, V., Wang, J., Li, Q., Johnson, A. C., McKeown-Green, A. S., Zeng, H. J., Mac, T. K., Trinh, M. T., Heinz, T. F., Pop, E., Liu, F.
  2024: e2403504

- **Solution-phase sample-averaged single-particle spectroscopy of quantum emitters with femtosecond resolution.** *Nature materials*
  Shi, J., Shen, Y., Pan, F., Sun, W., Mangu, A., Shi, C., McKeown-Green, A., Moradifar, P., Bawendi, M. G., Moerner, W. E., Dionne, J. A., Liu, F., Lindenberg, et al
  2024

- **Temperature-Dependent Excitonic Light Manipulation with Atomically Thin Optical Elements.** *Nano letters*
  Guarneri, L., Li, Q., Bauer, T., Song, J. H., Saunders, A. P., Liu, F., Brongersma, M. L., van de Groep, J.
  2024

- **Millimeter-Scale Exfoliation of hBN with Tunable Flake Thickness for Scalable Encapsulation** *ACS APPLIED NANO MATERIALS*
  McKeown-Green, A. S., Zeng, H. J., Saunders, A. P., Li, J., Shi, J., Shen, Y., Pan, F., Hu, J., Dionne, J. A., Heinz, T. F., Wu, S. M., Zheng, F., Liu, et al
  2024

- **Hidden phonon highways promote photoinduced interlayer energy transfer in twisted transition metal dichalcogenide heterostructures.** *Science advances*
  Johnson, A. C., Georgaras, J. D., Shen, X., Yao, H., Saunders, A. P., Zeng, H. J., Kim, H., Sood, A., Heinz, T. F., Lindenberg, A. M., Luo, D., da Jornada, F. H., Liu, et al
  2024; 10 (4): eadj8819

- **Photoluminescence upconversion in monolayer WSe2 activated by plasmonic cavities through resonant excitation of dark excitons.** *Nature communications*
  Mueller, N. S., Arul, R., Kang, G., Saunders, A. P., Johnson, A. C., Sánchez-Iglesias, A., Hu, S., Jakob, L. A., Bar-David, J., de Nijs, B., Liz-Marzán, L. M., Liu, F., Baumberg, et al
  2023; 14 (1): 5726

- **Giant room-temperature nonlinearities in a monolayer Janus topological semiconductor.** *Nature communications*
  Shi, J., Xu, H., Heide, C., HuangFu, C., Xia, C., de Quesada, F., Shen, H., Zhang, T., Yu, L., Johnson, A., Liu, F., Shi, E., Jiao, et al
  2023; 14 (1): 4953

- **A Purcell-enabled monolayer semiconductor free-space optical modulator** *NATURE PHOTONICS*
  Li, Q., Song, J., Xu, F., van de Groep, J., Hong, J., Daus, A., Lee, Y., Johnson, A. C., Pop, E., Liu, F., Brongersma, M. L.
  2023

- **Controlling Valley-Specific Light Emission from Monolayer MoS2 with Achiral Dielectric Metasurfaces.** *Nano letters*
  Liu, Y., Lau, S. C., Cheng, W., Johnson, A., Li, Q., Simmerman, E., Karni, O., Hu, J., Liu, F., Brongersma, M. L., Heinz, T. F., Dionne, J. A.
  2023

- **Time- and angle-resolved photoemission spectroscopy (TR-ARPES) of TMDC monolayers and bilayers.** *Chemical science*
  Liu, F.
  2023; 14 (4): 736-750

- **High-harmonic generation from artificially stacked 2D crystals** *NANOPHOTONICS*
  Heide, C., Kobayashi, Y., Johnson, A. C., Heinz, T. F., Reis, D. A., Liu, F., Ghimire, S.
  2023

- **Floquet engineering of strongly driven excitons in monolayer tungsten disulfide** *NATURE PHYSICS*

Kobayashi, Y., Heide, C., Johnson, A. C., Tiwari, V., Liu, F., Reis, D. A., Heinz, T. F., Ghimire, S.
2023

- **High-harmonic generation from artificially stacked 2D crystals.** *Nanophotonics (Berlin, Germany)*
  Heide, C., Kobayashi, Y., Johnson, A. C., Heinz, T. F., Reis, D. A., Liu, F., Ghimire, S.
  2023; 12 (2): 255-261
- **Time- and angle-resolved photoemission spectroscopy (TR-ARPES) of TMDC monolayers and bilayers** *CHEMICAL SCIENCE*
  Liu, F.
  2022
- **The Reststrahlen Effect in the Optically Thin Limit: A Framework for Resonant Response in Thin Media.** *Nano letters*
  Ma, E. Y., Hu, J., Waldecker, L., Watanabe, K., Taniguchi, T., Liu, F., Heinz, T. F.
  2022
- **Probing electron-hole coherence in strongly driven 2D materials using high-harmonic generation** *OPTICA*
  Heide, C., Kobayashi, Y., Johnson, A. C., Liu, F., Heinz, T. F., Reis, D. A., Ghimire, S.
  2022; 9 (5): 512-516
- **Bright and Dark Exciton Coherent Coupling and Hybridization Enabled by External Magnetic Fields.** *Nano letters*
  Mapara, V., Barua, A., Turkowski, V., Trinh, M. T., Stevens, C., Liu, H., Nugera, F. A., Kapuruge, N., Gutierrez, H. R., Liu, F., Zhu, X., Semenov, D., McGill, et al
  2022
- **Dissecting Interlayer Hole and Electron Transfer in Transition Metal Dichalcogenide Heterostructures via Two-Dimensional Electronic Spectroscopy.** *Nano letters*
  Policht, V. R., Russo, M., Liu, F., Trovatello, C., Maiuri, M., Bai, Y., Zhu, X., Dal Conte, S., Cerullo, G.
  2021
- **Mechanical exfoliation of large area 2D materials from vdW crystals** *PROGRESS IN SURFACE SCIENCE*
  Liu, F.
  2021; 96 (2)
- **The effect of photo-carrier doping on the generation of high harmonics from MoS2**
  Heide, C., Kobayashi, Y., Liu, F., Ghimire, S., Heinz, T. F., Reis, D. A., IEEE
  IEEE.2021
- **Excitons in strain-induced one-dimensional moire potentials at transition metal dichalcogenide heterojunctions** *NATURE MATERIALS*
  Bai, Y., Zhou, L., Wang, J., Wu, W., McGilly, L. J., Halbertal, D., Lo, C., Liu, F., Ardelean, J., Rivera, P., Finney, N. R., Yang, X., Basov, et al
  2020
- **Direct determination of momentum-resolved electron transfer in the photoexcited van der Waals heterobilayer WS2/MoS2** *PHYSICAL REVIEW B*
  Liu, F., Li, Q., Zhu, X.
  2020; 101 (20)
- **Strong polaronic effect in a superatomic two-dimensional semiconductor** *JOURNAL OF CHEMICAL PHYSICS*
  Li, Q., Liu, F., Russell, J. C., Roy, X., Zhu, X.
  2020; 152 (17): 171101
- **Disassembling 2D van der Waals crystals into macroscopic monolayers and reassembling into artificial lattices** *SCIENCE*
  Liu, F., Wu, W., Bai, Y., Chae, S., Li, Q., Wang, J., Hone, J., Zhu, X.
  2020; 367 (6480): 903-+
- **Broad-Band Near-Infrared Doublet Emission in a Tetrathiafulvalene-Based Metal-Organic Framework** *JOURNAL OF PHYSICAL CHEMISTRY LETTERS*
  Wang, F., Wang, J., Maehrlein, S. F., Ma, Y., Liu, F., Zhu, X.
  2020; 11 (3): 762–66
- **Variation of Interfacial Interactions in PC61BM-like Electron-Transporting Compounds for Perovskite Solar Cells** *ACS APPLIED MATERIALS & INTERFACES*

Fernandez-Delgado, O., Castro, E., Ganivet, C. R., Fosnacht, K., Liu, F., Mates, T., Liu, Y., Wu, X., Echegoyen, L.
2019; 11 (37): 34408–15

- **Direct Determination of Band-Gap Renormalization in the Photoexcited Monolayer MoS2** *PHYSICAL REVIEW LETTERS*
  Liu, F., Ziffer, M. E., Hansen, K. R., Wang, J., Zhu, X.
  2019; 122 (24): 246803
- **Bimodal Bandgaps in Mixed Cesium Methylammonium Lead Bromide Perovskite Single Crystals** *JOURNAL OF PHYSICAL CHEMISTRY C*
  Liu, F., Wang, F., Hansen, K. R., Zhu, X.
  2019; 123 (23): 14865–70
- **Enhanced Open-Circuit Voltage in Perovskite Solar Cells with Open-Cage [60]Fullerene Derivatives as Electron-Transporting Materials** *MATERIALS*
  Castro, E., Artigas, A., Pla-Quintana, A., Roglans, A., Liu, F., Perez, F., Lledo, A., Zhu, X., Echegoyen, L.
  2019; 12 (8)
- **How lasing happens in CsPbBr3 perovskite nanowires** *NATURE COMMUNICATIONS*
  Schlaus, A. P., Spencer, M. S., Miyata, K., Liu, F., Wang, X., Datta, I., Lipson, M., Pan, A., Zhu, X.
  2019; 10: 265
- **Three-Dimensional Graphene Nanostructures** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
  Peurifoy, S. R., Castro, E., Liu, F., Zhu, X., Ng, F., Jockusch, S., Steigerwald, M. L., Echegoyen, L., Nuckolls, C., Sisto, T. J.
  2018; 140 (30): 9341–45
- **Competition Between Hot-Electron Cooling and Large Polaron Screening in CsPbBr3 Perovskite Single Crystals** *JOURNAL OF PHYSICAL CHEMISTRY C*
  Evans, T. J. S., Miyata, K., Joshi, P. P., Maehrlein, S., Liu, F., Zhu, X.
  2018; 122 (25): 13724–30
- **Superatomic Two-Dimensional Semiconductor** *NANO LETTERS*
  Zhong, X., Lee, K., Choi, B., Meggiolaro, D., Liu, F., Nuckolls, C., Pasupathy, A., De Angelis, F., Batail, P., Roy, X., Zhu, X.
  2018; 18 (2): 1483–88
- **Cove-Edge Nanoribbon Materials for Efficient Inverted Halide Perovskite Solar Cells** *ANGEWANDTE CHEMIE-INTERNATIONAL EDITION*
  Castro, E., Sisto, T. J., Romero, E. L., Liu, F., Peurifoy, S. R., Wang, J., Zhu, X., Nuckolls, C., Echegoyen, L.
  2017; 56 (46): 14648–52
- **Hydroxyacetone Production From C-3 Criegee Intermediates** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Taatjes, C. A., Liu, F., Rotavera, B., Kumar, M., Caravan, R., Osborn, D. L., Thompson, W. H., Lester, M. I.
  2017; 121 (1): 16–23
- **Deep tunneling in the unimolecular decay of CH3CHOO Criegee intermediates to OH radical products** *JOURNAL OF CHEMICAL PHYSICS*
  Fang, Y., Liu, F., Barber, V. P., Klippenstein, S. J., McCoy, A. B., Lester, M. I.
  2016; 145 (23): 234308
- **Direct observation of unimolecular decay of CH3CH2CHOO Criegee intermediates to OH radical products** *JOURNAL OF CHEMICAL PHYSICS*
  Fang, Y., Liu, F., Klippenstein, S. J., Lester, M. I.
  2016; 145 (4): 044312
- **UV plus VUV double-resonance studies of autoionizing Rydberg states of the hydroxyl radical** *JOURNAL OF CHEMICAL PHYSICS*
  Green, A. M., Liu, F., Lester, M. I.
  2016; 144 (18): 184311
- **Communication: Real time observation of unimolecular decay of Criegee intermediates to OH radical products** *JOURNAL OF CHEMICAL PHYSICS*
  Fang, Y., Liu, F., Barber, V. P., Klippenstein, S. J., McCoy, A. B., Lester, M. I.
  2016; 144 (6): 061102
- **Direct observation of vinyl hydroperoxide** *PHYSICAL CHEMISTRY CHEMICAL PHYSICS*
  Liu, F., Fang, Y., Kumar, M., Thompson, W. H., Lester, M. I.

2015; 17 (32): 20490–94

- **Direct production of OH radicals upon CH overtone activation of (CH3)(2)COO Criegee intermediates** *JOURNAL OF CHEMICAL PHYSICS*
  Liu, F., Beames, J. M., Lester, M. I.
  2014; 141 (23): 234312
- **Infrared-driven unimolecular reaction of CH3CHOO Criegee intermediates to OH radical products** *SCIENCE*
  Liu, F., Beames, J. M., Petit, A. S., McCoy, A. B., Lester, M. I.
  2014; 345 (6204): 1596–98
- **1+1 ' resonant multiphoton ionisation of OH radicals via the A(2)sigma(+) state: insights from direct comparison with A-X laser-induced fluorescence detection** *MOLECULAR PHYSICS*
  Beames, J. M., Liu, F., Lester, M. I.
  2014; 112 (7): 897–903
- **UV Spectroscopic Characterization of Dimethyl- and Ethyl-Substituted Carbonyl Oxides** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Liu, F., Beames, J. M., Green, A. M., Lester, M. I.
  2014; 118 (12): 2298–2306
- **UV spectroscopic characterization of an alkyl substituted Criegee intermediate CH3CHOO** *JOURNAL OF CHEMICAL PHYSICS*
  Beames, J. M., Liu, F., Lu, L., Lester, M. I.
  2013; 138 (24): 244307
- **Ultraviolet Spectrum and Photochemistry of the Simplest Criegee Intermediate CH2OO** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
  Beames, J. M., Liu, F., Lu, L., Lester, M. I.
  2012; 134 (49): 20045–48
- **Communication: A new spectroscopic window on hydroxyl radicals using UV plus VUV resonant ionization** *JOURNAL OF CHEMICAL PHYSICS*
  Beames, J. M., Liu, F., Lester, M. I., Murray, C.
  2011; 134 (24): 241102
- **Liquid-phase Fischer-Tropsch synthesis over Fe nanoparticles dispersed in polyethylene glycol (PEG)** *GREEN CHEMISTRY*
  Fan, X., Tao, Z., Xiao, C., Liu, F., Kou, Y.
  2010; 12 (5): 795–97