Yusong Bai

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August 20, 2026
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Departmental and Institutional Affiliations

- **Assistant Professor** Chemistry, Brown University August 1, 2022-current

Disciplinary Field

- Chemistry-Physical Chemistry-Spectroscopy
- Materials Science-Nano/Low-Dimensional Materials
- Condensed Matter Physics-Strongly Correlated Systems

Professional Positions

- **Postdoctoral Research Associate** Chemistry, Columbia University 2018-2022

Education

- **Ph.D.** Physical Chemistry, Duke University 2011-2017
- **B.S.** Chemistry, Beijing University of Aeronautics and Astronautics (BUAA) 2007-2011

Awards and Honors

- Salomon Award (Brown University) 2026
- NSF Career Award 2026
- Spectroscopy Society of Pittsburg (SSP) Starter Grant Award 2025
- ACS PRF Award 2025-2026
- NSF EPSCoR Research Fellows 2025-2026
- OVPR Research Seed Awards (Brown University) 2024
- OVPR Research Seed Awards (Brown University) 2023
- IOP Outstanding Reviewer Award (Journal: 2D Materials) 2019
- FIP Seminar Student Speaker Award (Fitzpatrick Institute for Photonics) 2017
- Outstanding Student Poster Award (252nd National ACS Meeting, Physical division) 2016
- John Chambers Scholar (Fitzpatrick Institute for Photonics) 2014-2016

- Paul M. Gross Fellowship (Duke, Department of Chemistry) 2014
- GPNANO Fellowship (Duke, Department of Chemistry) 2013
- Undergraduate Distinction Award (First four year at Duke) 2011

Publications

(35) Sun, Z.; Sun, H.; Jia, X.; Li, A.; Zhang, N. J.; Hong, K. S.; DePinho, J.; Long, C. Y.; Watanabe, K.; Taniguchi, T.;Chen, O.; Wang, J.; Li, J.; Rubenstein, B.; **Bai Y.**
Continuously tunable dipolar exciton geometry for controlling bosonic quantum phase transitions.
arXiv preprint arXiv:2602.00419, 2026 (under review)

(34) Dong, Y.; Zhao, Y.; Klebl, L.; Handa, T.; Xu, D.; Trovatello, C.; He, C.; Sun, D.; Darlington, T. P.; Kwock, K. W. C.; Tulyagankhodjaev, J. A.; **Bai, Y.**; Shao, Y.; Fu, M.; Queiroz, R.; Delor, M.; Schuck, P. J.; Zhu, X.-Y.; Wehling, T. O.; Jin, S.; Mele, E. J.; Basov, D. N.
Flat band excitons in a three-dimensional supertwisted spiral transition metal dichalcogenide.
arXiv preprint arXiv:2506.21978, 2025 (under review)

(33) Nagaoka, Y.; Moore, T.; Epishin, A.; Liu, Z.; Cai, T.; Jin, N.; Hong, K.; Saghy, P.; Wang, A.; Liu, Y.; Hwang, S.; **Bai, Y.**; Zou, S.; Li, R.; Reich, S.; Glotzer, S.; Chen, O.
Stabilizing in-transition phases of superlattices through shape control of silver nanocrystals
Science, 392: 951-957 (2026).

(32) Alatis, J. A.; Stephenson, R. H.; Wilcox, A. C.; Mastrocinque, F.; Widel, Z. X. W.; Bullard, G.; Li, E.; Alatis, N. R.; Naquin, J.; **Bai, Y.**; Zhang, P.; Beratan, D. N.; Therien M. J.
Driving Force Dependent Photoinduced Charge Transfer Dynamics in Polymer-Wrapped Semiconducting Single-Walled Carbon Nanotubes.
J. Am. Chem. Soc., 147: 43822-43830 (2025).

(31) Widel, Z. X. W.; Alatis, J. A.; Stephenson, R. H.; Mastrocinque, F.; Wilcox, A. C.; Bullard, G.; Olivier, J. H.; **Bai, Y. S.**; Zhang, P.; Beratan, D. N. & Therien, M. J.
Fluence-Dependent Photoinduced Charge Transfer Dynamics in Polymer-Wrapped Semiconducting Single-Walled Carbon Nanotubes.
J. Am. Chem. Soc., 146: 31169-31176 (2024).

(30) Hong, K. S.; Chen, O. & **Bai, Y. S.**
Emergent Quantum Properties from Low-Dimensional Building Blocks and Their Superlattices.
Nano Res, 17: 10490-10510 (2024).

(29) Xiang, B.; Li, Y. L.; Spencer, M. S.; Dai, Y. N.; **Bai, Y. S.**; Basov, D. N. & Zhu, X. Y.
Optical Spin Hall Effect in Exciton-Polariton Condensates in Lead Halide Perovskite Microcavities.
J. Chem. Phys., 160: 161104 (2024).

(28) Mastrocinque, F.; Bullard, G.; Alatis, J. A.; Albro, J. A.; Nayak, A.; Williams, N. X.; Kumbhar, A.; Meikle, H.; Widel, Z. X. W.; **Bai, Y. S.**; Harvey, A. K.; Atkin, J. M.; Waldeck, D. H.; Franklin, A. D.; Therien, M. J. & Rossky, P. J.
Band Gap Opening of Metallic Single-Walled Carbon Nanotubes via Noncovalent Symmetry Breaking.
Proc. Natl. Acad. Sci. U.S.A., 121: e2317078121 (2024).

(27) **Bai, Y. S.**;# Li, Y. L.;# Liu, S.; Guo, Y. J.; Pack, J.; Wang, J.; Dean, C. R.; Hone, J. & Zhu, X. Y.
Evidence for Exciton Crystals in a 2D Semiconductor Heterotrilayer.
Nano Lett., 23: 11621-11629 (2023). (# equal contribution)

(26) Bae, Y. J.; Wang, J.; Scheie, A.; Xu, J. W.; Chica, D. G.; Diederich, G. M.; Cenker, J.; Ziebel, M. E.; **Bai, Y. S.**; Ren, H. W.; Dean, C. R.; Delor, M.; Xu, X. D.; Roy, X.; Kent, A. D. & Zhu, X. Y.
Exciton-Coupled Coherent Magnons in a 2D Semiconductor.
Nature, 609: 282-286 (2022).

(25) Wang, J.; Manolatou, C.; **Bai, Y. S.**; Hone, J.; Rana, F. & Zhu, X. Y.
Disorder of Excitons and Trions in Monolayer $MoSe_2$.
J. Chem. Phys., 157: 211101 (2022).

(24) Kim, B.; Luo, Y.; Rhodes, D.; **Bai, Y. S.**; Wang, J.; Liu, S.; Jordan, A.; Huang, B. L.; Li, Z. C.; Taniguchi, T.; Watanabe, K.; Owen, J.; Strauf, S.; Barmak, K.; Zhu, X. Y. & Hone, J.
Free Trions with Near-Unity Quantum Yield in Monolayer $MoSe_2$.
ACS Nano, 16: 140-147 (2022).

(23) Policht, V. R.; Russo, M.; Liu, F.; Trovatello, C.; Maiuri, M.; **Bai, Y. S.**; Zhu, X. Y.; Dal Conte, S. & Cerullo, G.
Dissecting Interlayer Hole and Electron Transfer in Transition Metal Dichalcogenide Heterostructures via Two-Dimensional Electronic Spectroscopy.
Nano Lett., 21: 4738-4743 (2021).

(22) Wang, J.; Shi, Q. H.; Shih, E. M.; Zhou, L.; Wu, W. J.; **Bai, Y. S.**; Rhodes, D.; Barmak, K.; Hone, J.; Dean, C. R. & Zhu, X. Y.
Diffusivity Reveals Three Distinct Phases of Interlayer Excitons in $MoSe_2/WSe_2$ Heterobilayers.
Phys. Rev. Lett., 126: 106804 (2021).

(21) Wang, R. B.; Ko, C. H.; Brugh, A. M.; **Bai, Y. S.**; Forbes, M. D. E. & Therien, M. J.
Topology, Distance, and Orbital Symmetry Effects on Electronic Spin-Spin Couplings in Rigid Molecular Systems: Implications for Long-Distance Spin-Spin Interactions.
J. Phys. Chem. A, 124: 7411-7415 (2020).

(20) **Bai, Y. S.**;# Zhou, L.;# Wang, J.; Wu, W. J.; McGilly, L. J.; Halbertal, D.; Lo, C. F. B.; Liu, F.; Ardelean, J.; Rivera, P.; Finney, N. R.; Yang, X. C.; Basov, D. N.; Yao, W.; Xu, X. D.; Hone, J.; Pasupathy, A. N. & Zhu, X. Y.

Excitons in Strain-Induced One-Dimensional Moiré Potentials at Transition Metal Dichalcogenide Heterojunctions.
Nat. Mater., 19: 1068-1073 (2020). (# equal contribution)

(19) McGilly, L. J.; Kerelsky, A.; Finney, N. R.; Shapovalov, K.; Shih, E. M.; Ghiotto, A.; Zeng, Y. H.; Moore, S. L.; Wu, W. J.; **Bai, Y. S.**; Watanabe, K.; Taniguchi, T.; Stengel, M.; Zhou, L.; Hone, J.; Zhu, X. Y.; Basov, D. N.; Dean, C.; Dreyer, C. E. & Pasupathy, A. N.
Visualization of Moiré Superlattices.
Nat. Nanotechnol., 15: 580-584 (2020).

(18) Wang, L.; Shih, E. M.; Ghiotto, A.; Xian, L.; Rhodes, D. A.; Tan, C.; Claassen, M.; Kennes, D. M.; **Bai, Y. S.**; Kim, B.; Watanabe, K.; Taniguchi, T.; Zhu, X. Y.; Hone, J.; Rubio, A.; Pasupathy, A. N. & Dean, C. R.
Correlated Electronic Phases in Twisted Bilayer Transition Metal Dichalcogenides.
Nat. Mater., 19: 861-866 (2020).

(17) Liu, F.; Wu, W. J.; **Bai, Y. S.**; Chae, S. H.; Li, Q. Y.; Wang, J.; Hone, J. & Zhu, X. Y.
Disassembling 2D van der Waals Crystals into Macroscopic Monolayers and Reassembling into Artificial Lattices. ***Science***, 367: 903-906 (2020).

(16) Jiang, T.;# **Bai, Y. S.**;# Zhang, P.; Han, Q. W.; Mitzi, D. B. & Therien, M. J.
Electronic Structure and Photophysics of a Supermolecular Iron Complex Having a Long MLCT-state Lifetime and Panchromatic Absorption.
Proc. Natl. Acad. Sci. U.S.A., 117: 20430-20437 (2020). (# equal contribution)

(15) Wang, J.;# Ardelean, J.;# **Bai, Y. S.**;# Steinhoff, A.; Florian, M.; Jahnke, F.; Xu, X. D.; Kira, M.; Hone, J. & Zhu, X. Y.
Optical Generation of High Carrier Densities in 2D Semiconductor Heterobilayers.
Sci. Adv., 5: eaax0145 (2019). (# equal contribution)

(14) **Bai, Y. S.**; Bullard, G.; Olivier, J. H. & Therien, M. J.
Quantitative Evaluation of Optical Free Carrier Generation in Semiconducting Single-Walled Carbon Nanotubes.
J. Am. Chem. Soc., 140: 14619-14626 (2018).

(13) Han, Q. W.; Ding, J.; **Bai, Y. S.**; Li, T. Y.; Ma, J. Y.; Chen, Y. X.; Zhou, Y. H.; Liu, J.; Ge, Q. Q.; Chen, J.; Glass, J. T.; Therien, M. J.; Liu, J.; Mitzi, D. B. & Hu, J. S.
Carrier Dynamics Engineering for High-Performance Electron-Transport-Layer-free Perovskite Photovoltaics.
Chem, 4: 2405-2417 (2018).

(12) He, X. W.; Velizhanin, K. A.; Bullard, G.; **Bai, Y. S.**; Olivier, J. H.; Hartmann, N. F.; Gifford, B. J.; Kilina, S.; Tretiak, S.; Htoon, H.; Therien, M. J. & Doorn, S. K.
Solvent- and Wavelength-Dependent Photoluminescence Relaxation Dynamics of Carbon Nanotube sp^3 Defect States.
ACS Nano, 12: 8060-8070 (2018).

(11) **Bai, Y. S.**; Olivier, J. H.; Bullard, G.; Liu, C. R. & Therien, M. J.

Dynamics of Charged Excitons in Electronically and Morphologically Homogeneous Single-Walled Carbon Nanotubes. ***Proc. Natl. Acad. Sci. U.S.A.***, 115: 674-679 (2018).

(10) **Bai, Y. S.**; Olivier, J. H.; Yoo, H.; Polizzi, N. F.; Park, J.; Rawson, J. & Therien, M. J.
Molecular Road Map to Tuning Ground State Absorption and Excited State Dynamics of Long-Wavelength Absorbers.
J. Am. Chem. Soc., 139: 16946-16958 (2017).

(9) Han, Q. W.; **Bai, Y. S.**; Liu, J.; Du, K. Z.; Li, T. Y.; Ji, D.; Zhou, Y. H.; Cao, C. Y.; Shin, D.; Ding, J.; Franklin, A. D.; Glass, J. T.; Hu, J. S.; Therien, M. J.; Liu, J. & Mitzi, D. B.
Additive Engineering for High-Performance Room-Temperature-Processed Perovskite Absorbers with Micron-Size Grains and Microsecond-Range Carrier Lifetimes. ***Energy Environ. Sci***, 10: 2365-2371 (2017).

(8) **Bai, Y. S.**; Rawson, J.; Roget, S. A.; Olivier, J. H.; Lin, J. X.; Zhang, P.; Beratan, D. N. & Therien, M. J.
Controlling the Excited-State Dynamics of Low Band Gap, Near-Infrared Absorbers Proquinoidal Unit Electronic Structural Modulation.
Chem. Sci., 8: 5889-5901 (2017).

(7) Depotter, G.; Olivier, J. H.; Glesner, M. G.; Deria, P.; **Bai, Y. S.**; Bullard, G.; Kumbhar, A. S.; Therien, M. J. & Clays, K.
First-Order Hyperpolarizabilities of Chiral, Polymer-Wrapped Single-Walled Carbon Nanotubes.
Chem. Commun., 52: 12206-12209 (2016).

(6) Olivier, J. H.; Park, J.; Deria, P.; Rawson, J.; **Bai, Y. S.**; Kumbhar, A. S. & Therien, M. J.
Unambiguous Diagnosis of Photoinduced Charge Carrier Signatures in a Stoichiometrically Controlled Semiconducting Polymer-Wrapped Carbon Nanotube Assembly.
Angew. Chem. Int. Ed., 54: 8133-8138 (2015.

(5) Olivier, J. H.; **Bai, Y. S.**; Uh, H.; Yoo, H.; Therien, M. J. & Castellano, F. N.
Near-Infrared-to-Visible Photon Upconversion Enabled by Conjugated Porphyrinic Sensitizers under Low-Power Noncoherent Illumination.
J. Phys. Chem. A, 119: 5642-5649 (2015).

(4) Wang, H.; **Bai, Y. S.**; Yang, J. T.; Lang, X. F.; Li, J. H. & Guo, L. 2012. A Facile Way to Rejuvenate Ag_3PO_4 as a Recyclable Highly Efficient Photocatalyst. ***Eur. J. Chem.***, 18: 5524-5529.

(3) Wang, H.; Wu, Y. M.; **Bai, Y. S.**; Zhou, W.; An, Y. R.; Li, J. H. & Guo, L.
The Self-Assembly of Porous Microspheres of Tin Dioxide Octahedral Nanoparticles for High Performance Lithium Ion Battery Anode Materials.
J. Mater. Chem., 21: 10189-10194 (2011).

(2) Wang, H.; **Bai, Y. S.**; Wu, Q. O.; Zhou, W.; Zhang, H.; Li, J. H. & Guo, L.
Rutile TiO_2 Nano-Branched Arrays on FTO for Dye-Sensitized Solar Cells.
Phys. Chem. Chem. Phys., 13: 7008-7013 (2011).

(1) Wang, H.; **Bai, Y. S.**; Zhang, H.; Zhang, Z. H.; Li, J. H. & Guo, L.
CdS Quantum Dots-Sensitized TiO_2 Nanorod Array on Transparent Conductive Glass Photoelectrodes.
J. Phys. Chem. C, 114: 16451-16455 (2010).

Presentations

- Invited Talk, QFARM, Quantum Frontiers of Light-Matter Interactions in 2D Materials Workshop, Stanford University, Stanford, CA (**Invited**) 2026
  Title: Low-Dimensional Excitonic and Moiré Quantum Materials
- Seminar, Department of Physics, The Hong Kong University of Science and Technology, Hong Kong (**Invited**) 2026
  Title: Emergent Tunability of Excitonic Interactions and Superlattices in Complex Two-Dimensional Heterostructures
- Seminar, Department of Chemistry, Stanford University, Stanford, CA (**Invited**) 2024
  Title: Designing and probing exciton quantum phase transitions in 2D semiconductors
- XII Ultrafast Dynamics and Ultrafast Photonics Conferences, Tucson, AZ (**Invited**) 2024
  Title: Exciton quantum phase transitions in 2D semiconductor heterostructures
- ACS Fall 2024 (Symposium for 2D Materials and Interfaces: Theory, Fundamentals, and Applications), Denver, CO (**Invited**) 2024
  Title: Designing and probing exciton quantum phase transitions in 2D semiconductors
- Seminar, Department of Physics, Lehigh University, Bethlehem, PA (**Invited**) 2024
  Title: Designing and probing exciton quantum phase transitions in 2D semiconductors
- 2024 American Photochemical Society, Miramar Beach, FL (**Invited**) 2024
  Title: Coulomb drag of excitons in 2D Bose-Fermi systems
- APS March Meeting, Las Vegas, NV (Oral) 2023
  Title: Evidence for exciton crystals and quantum phase transitions in a 2D semiconductor trilayer
- Seminar, Department of Physics, Brown University, Providence, RI (**Invited**) 2022
  Title: Designing and probing emergent quantum phenomena at low-dimensional interfaces.
- Colloquium, Department of Chemistry, Brown University, Providence, RI (**Invited**) 2022
  Title: Designing and probing emergent quantum phenomena at low-dimensional interfaces.
- Special Chemical Physics Seminar, Caltech, Pasadena, CA (**Invited**) 2022
  Title: Ordering excitons in two dimensions
- Ultrafast Webinar Summer Series (**Invited**) 2020
  Title: Excitons in strain-induced one-dimensional moiré potentials
- Graphene for US 2020, International Conference, New York, NY (Oral) 2020
  Title: 1D moiré excitons
- Max Planck-New York Center for Nonequilibrium Quantum Phenomena (**Invited**) 2019
  Title: One-dimensional moiré excitons in transition metal dichalcogenide heterobilayers

- 231st ECS Meeting, New Orleans, LA (**Invited**) 2017
  Title: Excited-state dynamical studies of positively and negatively charged excitons in polymer-wrapped single-walled carbon nanotube superstructures
- 231st ECS Meeting, New Orleans, LA (**Invited**) 2017
  Title: Photoinduced charge transfer reactions in chiral, semiconducting polymer-wrapped single-walled carbon nanotube superstructures
- Fitzpatrick Institute for Photonics Special Seminar, Durham, NC (**Invited**) 2017
  Title: Dynamics of charge excitons in electronically and morphologically homogeneous single-walled carbon nanotubes
- Gordon Research Conferences on Photochemistry, Lewiston, ME (Poster) 2017
  Title: Dynamics of charge excitons in semiconducting single-walled carbon nanotubes
- 252nd National ACS Meeting, Philadelphia, PA (Oral) 2016
  Title: Regulating Long-Wavelength Absorptivity and Photophysics of Oligo(porphinato)metal(II) chromophores through variation of electronically excited state proquinoidal character
- 252nd National ACS Meeting, Philadelphia, PA (Poster) 2016
  Title: Molecular roadmap to tuning ground state absorption and excited state dynamics of near-infrared chromophores