

Dr. Archana Raja

Staff Scientist, Molecular Foundry & Faculty, Kavli Energy NanoScience Institute
Lawrence Berkeley National Laboratory, E-mail: araja@lbl.gov

Education

08/2011–05/2016	PhD in Chemical Physics, Columbia University, New York NY, USA
Dissertation	Optical Spectroscopy of Excitons at the Interfaces of Nanostructures
Advisors	Prof. Tony F. Heinz and Prof. Louis E. Brus
07/2006–08/2011	Integrated MSc in Chemistry, Indian Institute of Technology Bombay, Mumbai, India
Thesis	Studies of Emission from Localized Centers in Quantum Wells
Advisor	Prof. Arindam Chowdhury

Professional Experience

04/2024–present	Faculty, Kavli Energy NanoScience Institute, Berkeley CA, USA
04/2024–present	Career Staff Scientist, Molecular Foundry, Lawrence Berkeley National Laboratory (LBNL), Berkeley CA, USA
07/2019–04/2024	Career-track Staff Scientist, Molecular Foundry, LBNL, Berkeley CA, USA
06/2017–07/2019	Postdoctoral Fellow, Alivisatos group, UC Berkeley, Berkeley CA, USA
06/2016–05/2017	Postdoctoral Scholar, Department of Applied Physics, Stanford University, Stanford CA, USA
05–07/2013 & 2012	Research Intern, Low-k Dielectrics and Phase Change Memory groups, IBM T. J. Watson Research Center, Yorktown Heights, NY, USA
05–07/2010	Research Intern, Laboratory for Quantum Magnetism, EPFL, Lausanne, Switzerland
2008	Summer Fellow, Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR), Bangalore, India

Honors

2023	Lab Director’s Award for Exceptional Achievement in Early Scientific Career, LBNL
2022	Runner-up, Young Investigator Award, SSRL/LCLS Users Meeting, SLAC National Laboratory
2020–2022	Early Career Laboratory Directed Research and Development Award, LBNL
2017–2019	Heising-Simons Junior Fellowship, Kavli Energy NanoScience Institute
2012	Blanche R. and David Kasindorf Fellowship in Physical Chemistry, Columbia University
2011	IIT Bombay Institute Silver Medal for graduating at the top of the class of Chemistry

Research Achievements

Ultrafast and ultrasmall imaging and spectroscopy of excitations in 2D heterostructures: First sub-nanometer imaging of moiré excitons using correlated optical and low-loss electron energy-loss spectroscopy [3], > 100 citations; discovered electron-phonon mediated energy transport mechanism unique to 2D semiconductor interfaces using ultrafast electron diffraction [2]; revealed dynamic nature of the moiré potential via measurements of anomalous exciton transport [1]; determined the effect of hBN encapsulation on cathodoluminescence spatial resolution [4].

Dielectric screening effects in 2D materials: First demonstration of tuning the bandgap of a 2D semiconductor via the dielectric environment [8], > 1000 citations; discovered a new form of electronic disorder from local dielectric fluctuations [5], > 480 citations; correlated optical studies with angle-resolved photoemission to reveal rigid band shifts [6], > 135 citations; clarified competing dielectric screening/dissipation in energy transfer at nanoscale interfaces [10], > 250 citations; delineated role of screening in exciton-phonon scattering [7,9], > 770 combined citations.

Newly Funded Research Directions

AI for scientific discovery in quantum materials: Building AI-driven, closed-loop discovery workflows that connect theory, simulation, and experiment across three multi-institution programs.

- **LEAP** (Low-Energy, AI-Informed Phase Transitions), *co-PI and Project Integration Officer*, University of California AI Science at Scale initiative: Building AI co-scientists that find topological materials for energy-efficient electronics. Introduced LEAP-Bench, the first benchmark that evaluates whether AI agents can reason from raw instrument data to scientific conclusions across multiple measurement modalities [11]. Developed Struct-R1, an agentic framework for materials structure search with multi-fidelity measurements [12]. Leading deployment of agentic DFT workflows (TritonDFT) across the collaboration.
- **Genesis CASCADE**, *co-PI*, DOE Genesis Mission: Developing an AI-driven, closed-loop workflow that bridges atomic-scale defect physics, photonic simulations, and experimental measurements to accelerate the design of quantum materials and devices. Leading the LBNL effort in a team spanning UC Irvine, LBNL, ESnet, and industry partner Single Quantum.
- **AlphaFold for Microelectronics**, *co-PI*, DOE Genesis Mission: Generating high-throughput, correlated optical and structural datasets on ferroelectric HZO and 2D MoS₂ to train AI models for microelectronics materials discovery.

List of Key Publications

10 key publications cited in the Research Achievements section

> 4600 total citations, h-index 27, as of October 2026 <https://scholar.google.com/citations?user=sm4CJXAAAAAJ>

*Equal Contribution, † Corresponding author

1. A. Rossi*†, J. Zipfel*, I. Maity*, M. Lorenzon, L. Francaviglia, E. C. Regan, Z. Zhang, J. H. Nie, E. S. Barnard, K. Watanabe, T. Taniguchi, E. Rotenberg, F. Wang, J. Lischner, **A. Raja**†, A. Weber-Bargioni†. “Anomalous interlayer exciton diffusion in WS₂/WSe₂ moiré heterostructure,” *ACS Nano* 18 (28), 18202-18210 (2024)
2. A. Sood†, J. Haber, J. D. Carlström, E. A. Peterson, E. Barré, A. H. M. Reid, X. Shen, M. E. Zajac, E. C. Regan, J. Yang, T. Taniguchi, K. Watanabe, F. Wang, X. Wang, J. B. Neaton, T. F. Heinz, A. Lindenberg†, F. H. da Jornada†, **A. Raja**†. “Bidirectional phonon emission in two-dimensional heterostructures triggered by ultrafast charge transfer,” *Nature Nanotechnology* 18 (1), 29-35 (2023)
3. S. Susarla*, M. H. Naik*, D. D. Blach, J. Zipfel, T. Taniguchi, K. Watanabe, L. Huang, R. Ramesh, F. H. da Jornada, S. G. Louie†, P. Ercius†, **A. Raja**†. “Hyperspectral imaging of excitons within a moiré unit-cell with a sub-nanometer electron probe,” *Science* 378 (6625), 1235-1239 (2022)
4. L. Francaviglia, J. Zipfel, J. Carlström, S. Sridhar, F. Riminucci, D. Blach, E. Wong, E. S. Barnard, K. Watanabe, T. Taniguchi, A. Weber-Bargioni, D. F. Ogletree, S. Aloni, **Archana Raja**†. “Optimizing cathodoluminescence microscopy of buried interfaces through nanoscale heterostructure design,” *Nanoscale* 14(20), 7569-7578 (2022)
5. **A. Raja***†, L. Waldecker*, J. Zipfel, Y. Cho, S. Brem, J. Ziegler, T. Taniguchi, K. Watanabe, E. Malic, T. C. Berkelbach, T. F. Heinz, and A. Chernikov†. “Dielectric disorder in two-dimensional materials,” *Nature Nanotechnology* 14 (9), 832 (2019)
6. L. Waldecker*, **A. Raja***, M. Rösner, C. Steinke, A. Bostwick, R. J. Koch, C. Jozwiak, T. Taniguchi, K. Watanabe, E. Rotenberg, T. O. Wehling, and T. F. Heinz. “Rigid band shifts in two-dimensional semiconductors through environmental screening,” *Physical Review Letters* 123 (20), 206403 (2019)
7. **A. Raja**†, M. Selig, G. Berghäuser, J. Yu, H. M. Hill, A. F. Rigosi, L. E. Brus, A. Knorr, T. F. Heinz, E. Malic and A. Chernikov†. “Enhancement of exciton-phonon scattering from monolayer to bilayer WS₂,” *Nano Letters*, 18(10), 6135-6143 (2018)
8. **A. Raja**†, A. Chaves, J. Yu, G. Arefe, H. M. Hill, A. F. Rigosi, T. C. Berkelbach, P. Nagler, C. Schüller, T. Korn, C. Nuckolls, J. Hone, L. E. Brus, T. F. Heinz, D. R. Reichman, and A. Chernikov†. “Coulomb engineering of the bandgap and excitons in two-dimensional materials,” *Nature Communications*, 7, 15251 (2017)
9. M. Selig, G. Berghäuser, **A. Raja**, P. Nagler, C. Schüller, T. F. Heinz, T. Korn, A. Chernikov, E. Malic, and A. Knorr. “Excitonic linewidth and coherence lifetime in monolayer transition metal dichalcogenides,” *Nature Communications*, 7, 13279 (2016)
10. **A. Raja**†, A. Montoya–Castillo, J. Zultak, X–X. Zhang, Z. Ye, C. Roquelet, D. A. Chenet, A. M. van der Zande, P. Huang, S. Jockusch, J. Hone, D. R. Reichman, L. E. Brus and T. F. Heinz†. “Energy transfer from quantum dots to graphene and MoS₂: absorption vs. screening,” *Nano Letters*, 16(4), 2328-2333 (2016)

Other Publications

11. L. Chen, J. Liu, B. J. Jeong, J. Moon, A. J. Bokka, J. Xie, Z. Hu, S. Kim, A. Mishra, K. E. Brockmeyer, S. S. Fender, Z. Hu, Y. Ding, D. K. Bediako, L. A. Jauregui, R. Seshadri, **A. Raja**, Z. Wang, “LEAP-Bench: Turning Raw Data into Scientific Claims,” *under review, International Conference on Learning Representations (ICLR)* (2027).
12. Z. Hu, K. Talit, J. Liu, Z. Wang, L. A. Jauregui, E. A. Nowadnick, **A. Raja**, Y. Ding, “Struct-R1: Material Structure Search with Multi-Fidelity Measurement in Agentic Loops,” *under review, International Conference on Learning Representations (ICLR)* (2027).
13. S. Miao, I. K. M. R. Rahman, A. Nirmale, I. Kim, D. Urmossy, T. P. Darlington, H. Jayakumar, S. Izawa, **A. Raja**, D. C. Chrzan, Y. Majima, A. Javey, “Narrow-Line-Width Electroluminescence in Monolayer WSe₂ Enabled by a Sub-5 nm Au/Pt Nanogap,” *Nano Letters* (2026), doi:10.1021/acs.nanolett.6c03133.
14. H.-L. Kim, H. Lim, T. Wu, A. Y. Waghmare, G. Gupta, T. Taniguchi, K. Watanabe, **A. Raja**, E. Y. Ma, F. Wang, “Ambipolar metal-insulator transition in bilayer MoSe₂,” *arXiv preprint arXiv:2610.09036* (2026).
15. M. Dandu, S. Sankar, G. Espitia, R. Dutta, P. J. Hays, D. Blach, T. Taniguchi, K. Watanabe, J. R. Chelikowsky, S. A. Tongay, P. Ercius, J. A. Hachtel, M. H. Naik, **A. Raja**, S. Susarla, “(Sub) nanoscale Visualization of Reconstruction-Driven Moiré Exciton Localization and Delocalization,” *arXiv preprint arXiv:2609.34104* (2026).
16. C. Chen, M. E. Leger, N. Trainor, R. Sanikop, A. Kumar, G. R. Ocasio, Y. Sun, Z. Zhang, Y. Zhu, N. U. Sakib, M. U. K. Sadaf, A. R. Graves, D. D. Blach, **A. Raja**, Y. Yang, S. Das, J. M. Redwing, “Effect of Substrate Miscut on the Epitaxial Growth of MoS₂ on Sapphire,” *ACS Applied Materials & Interfaces* 18(36), 49687–49698 (2026).
17. K. Wang, K. Reidy, A. Hu, M. Ma, R. Dhall, X. Chen, K. C. Bustillo, Y. Tang, **A. Raja**, M. F. Crommie, A. M. Minor, “In Situ TEM Observations of Strain-Driven Soliton Dynamics in Twisted Graphene,” *Microscopy and Microanalysis* 32(Supplement_1), ozag053.595 (2026).
18. G. Gupta, M. Chhaperwal, P. Kumar, P. Dasika, K. Watanabe, T. Taniguchi, **A. Raja**, K. Majumdar, “Confined exciton polaron in MoS₂ on twisted-hBN,” *arXiv preprint arXiv:2606.27770* (2026).
19. Y. Zhu, Z.-H. Zhang, W. Chen, M. A. Sakib, A. Weber-Bargioni, S. Griffin, **A. Raja**, A. Sipahigil, G. Hautier, “Point defects in semiconductors: Friends and foes for quantum technologies,” *MRS Bulletin*, 1–15 (2026).
20. M. A. Sakib, D. Kafeeva, E. P. Garcia, Q. T. Dang, M. Stepanova, **A. Raja**, H. W. H. Lee, A. B. Khanikaev, M. R. Shcherbakov, “Polariton-Mediated High Harmonic Generation with Co-Optimized Metasurfaces,” *CLEO: Fundamental Science*, FW2E.6 (2026).
21. Z. Lu, J. Nie, T. Wang, R. Dutta, R. Qi, J. Xie, C. Uzundal, J. Xiao, Z. Wang, Y. Feng, *et al.*, “Tunable Interlayer Charge-transfer States in MoSe₂/WS₂ Moiré Superlattices,” *arXiv preprint arXiv:2605.05571* (2026).
22. Z. Tian, M. Zhu, J. Kim, P. Behera, M. Xu, T. J. Lee, C.-C. Lin, S. Pamula, **A. Raja**, H. Pan, *et al.*, “Unleashing the Electromechanical Response of Ferroelastic Domain Reorganization in Mixed-Phase Tetragonal Ferroelectric Multilayers,” *Advanced Materials* 38(19), e18417 (2026).
23. **A. Raja** and M. Y. Sfeir, “Advancing nanomaterials research in the legacy of Louis Brus,” *The Journal of Chemical Physics* 164(15) (2026).
24. S. Husremović, W. Zhang, M. Dandu, B. H. Goodge, I. M. Craig, E. Kennedy, M. P. Erodici, K. C. Bustillo, C. Song, J. Ciston, *et al.*, “Topochemically-engineered coexistence of charge and spin orders in intercalated endotaxial heterostructures,” *arXiv preprint arXiv:2604.06453* (2026).
25. P. G. Hegel, O. Gonzalez, M. Li, S. S. Fender, H. Jayakumar, **A. Raja**, S. M. Masina, A. Ray, I. M. Craig, K. H. Stone, and D. K. Bediako, “Enantiopurity-Controlled Magnetism in a Two-Dimensional Organic-Inorganic Material,” *Journal of the American Chemical Society* (2026), doi:10.1021/jacs.6c05938.
26. Z. Lu, R. Qi, R. Dutta, J. Xie, J. Nie, Z. Wang, Y. Feng, W. Kim, K. Watanabe, T. Taniguchi, *et al.*, “Nature of Emergent Moiré Excitations in MoSe₂/WS₂ Moiré Superlattices,” *Nano Letters* 26(12), 4096–4102 (2026).
27. K. Das, K. Reidy, S. Husain, J. H. Park, H. Jayakumar, V. Thampy, C. Klewe, R. Ramesh, A. M. Minor, **A. Raja**, S. Salahuddin, “Ferroelectricity in atomic-scale titanium dioxide dielectric films,” *Science* 392(6795), 280–284 (2026).
28. W. Chen, J. C. Thomas, Y. Xiong, Z. Yu, D. Zhou, S. Kumari, Z. Dai, J. A. Robinson, M. Terrones, **A. Raja**, S. M. Griffin, A. Weber-Bargioni, G. Hautier, “Evidence for Thermodynamically Stable “On-Top” Sulfur Divacancy in Monolayer WS₂,” *ACS Nanoscience Au* (2026), doi:10.1021/acsnanoscienceau.5c00165.

29. K. Zhang, M. Dandu, N. T. Hung, T. Zhang, E. Barré, R. Saito, J. Kong, **A. Raja**, S. Huang, “Optomechanical Tuning of Second Harmonic Generation Anisotropy in Janus MoSSe/MoS₂ Heterostructures,” *ACS Nano* 19(44), 38371–38380 (2025).
30. Y. Dou, X. Wang, N. W. G. Smith, P. Behera, R. H. Mudiyansele, B. Guzelturk, D. A. Walko, Y. Pleimling, S. Liu, N. Nici, C. Slebodnick, B. Dryzhakov, B. Hu, **A. Raja**, R. Ramesh, G. A. Khodaparast†, Y. Yan†, & L. Quan†, “Long-lived photoinduced polar states in metal halide perovskites,” *Nature Communications* 16(1), 7230 (2025).
31. S. Husremović, V. S. McGraw, M. Dandu, L. S. Xie, S. H. Ryu, O. Gonzalez, S. S. Fender, M. Van Winkle, K. C. Bustillo, and T. Taniguchi, *et al.*, “Local Interface Effects Modulate Global Charge Order and Optical Properties of 1T-TaS₂/1H-WSe₂ Heterostructures,” *ACS Nano* 19(36), 32218–32230 (2025).
32. K. Wang, K. Reidy, T. P. Darlington, **A. Raja**, M. F. Crommie, and A. Minor, “In-Situ Dynamics of Moiré Superlattice Epitaxy as a Platform for Site-Selective Adhesion and Growth,” *Microscopy and Microanalysis* 31(Supplement_1), oza048–851 (2025).
33. S. Sankar, M. Dandu, P. J. Hays, D. Blach, T. Taniguchi, K. Watanabe, S. A. Tongay, P. Ercius, J. A. Hachtel, M. H. Naik, *et al.*, “Seeing (Sub) Nanoscale Moiré Excitons with meV Scale Energy Resolution,” *Microscopy and Microanalysis* 31(Supplement_1), oza048–705 (2025).
34. S. Sankar, M. Dandu, P. J. Hays, D. Blach, T. Taniguchi, K. Watanabe, S. A. Tongay, P. Ercius, J. A. Hachtel, M. H. Naik, *et al.*, “STEM Defocus Influenced Misinterpretations in Imaging Exciton Confinements,” *Microscopy and Microanalysis* 31(Supplement_1), oza048–724 (2025).
35. A. C. Johnson, S. Warkander, **A. Raja**, and F. Liu, “Extreme Thermal Insulation in Nano-Bubble Wrap Materials,” *arXiv preprint arXiv:2507.12685* (2025).
36. A. Rossi*, J. C. Thomas*, J. T. Küchle, E. Barré, Z. Yu, D. Zhou, S. Kumari, H-Z. Tsai, E. Wong, C. Jozwiak, A. Bostwick, J. A. Robinson, M. Terrones, **A. Raja**, A. Schwartzberg, D. F. Ogletree, J. B. Neaton, M. F. Crommie, F. Allegretti, W. Auwärter, E. Rotenberg, A. Weber-Bargioni†. “Graphene-driven correlated electronic states in one dimensional defects within WS₂,” *Nature Communications* 16, 5809 (2025)
37. R. M. Brinn, P. Meisenheimer, M. Dandu, E. Barré, P. Behera, **A. Raja**, R. Ramesh, P. Stevenson†, “Epitaxial strain tuning of Er³⁺ in ferroelectric thin films,” *Journal of Applied Physics* 137, 134402 (2025)
38. B. Sari, M. Dandu, N. Wood, J. Hochhalter, A. C. Johnson, M. Doeff, F. Liu, **A. Raja**, M. Scott, R. Dhall, & R. Warren, “Facile Tensile Testing Platform for In Situ Transmission Electron Microscopy of Nanomaterials,” *Advanced Materials Interfaces*, 12(7), 2400750 (2025)
39. P. Behera, A. M. Ross, N. Shanker, P. Meisenheimer, M. Manna, C. C. Lin, S. L. Hsu, I. Harris, P. Kavle, S. Husain, S. K. Ojha, S. Das, **A. Raja**, L. W. Martin, S. Susarla, S. Salahuddin, L-Q. Chen, R. Ramesh†, “Anisotropic Ferroelectricity in Polar Vortices,” *Advanced Materials*, 37(1), 2410149 (2025)
40. M. Erdi, J. Kapeghian, P. Hays, M. Dandu, D. D. Blach, M. Sayyad, J. Kopaczek, R. Sailus, **A. Raja**, S. Susarla, A. S. Botana, & S. A. Tongay†, “Structural and angle-resolved optical and vibrational properties of chiral trivial insulator InSe,” *Applied Physics Reviews* 11(4), 041422 (2024)
41. E. Barré*, M. Dandu*, S. Kundu*, A. Sood, F. H. da Jornada & **A. Raja**†. “Engineering interlayer hybridization in van der Waals bilayers,” *Nature Reviews Materials* 9, 499–508 (2024)
42. P. Meisenheimer, A. Ghosal, E. Hoglund, Z. Wang, P. Behera, F. Gomez-Ortiz, P. Kavle, E. Karapetrova, P. Garcia-Fernandez, L. W. Martin, **A. Raja**, L-Q. Chen, P. E. Hopkins, J. Junquera & R. Ramesh. “Interlayer Coupling Controlled Ordering and Phases in Polar Vortex Superlattices,” *Nano Letters* 24 (10), 2972-2979 (2024)
43. E. Barré, M. Dandu & **A. Raja**†. “Quadrupolar excitons take the stage,” *Nature Materials* 22, 1437 (2023)
44. J. Thomas, W. Chen, Y. Xiong, B. Barker, J. Zhou, W. Chen, A. Rossi, N. Kelly, Z. Yu, D. Zhou, S. Kumari, E. Barnard, J. Robinson, M. Terrones, A. Schwartzberg, D. F. Ogletree, E. Rotenberg, M. Noack, S. Griffin, **A. Raja**, D. Strubbe, G-M. Rignanese, A. Weber-Bargioni & Geoffroy Hautier. “A substitutional quantum defect in WS₂ discovered by high-throughput computational screening and fabricated by site-selective STM manipulation,” *Nature Communications* 15, 3556 (2024)
45. **A. Raja**† & L. E. Brus. “Non-Local Dielectric Effects in Nanoscience,” *The Journal of Chemical Physics* 159(2) (2023)
46. M. Van Winkle, I. M. Craig, S. Carr, M. Dandu, K. C. Bustillo, J. Ciston, C. Ophus, T. Taniguchi, K. Watanabe, **A. Raja**, S. M. Griffin & D. K. Bediako†. “Rotational and dilational reconstruction in transition metal dichalcogenide moiré bilayers,” *Nature Communications* 14, 2989 (2023)

47. J. Zhou, J. Thomas, E. Barré, E. S. Barnard, **A. Raja**, S. Cabrini, K. Munechika, A. Schwartzberg, A. Weber-Bargioni†. “Near-field Coupling with a Nanoimprinted Probe for Dark Exciton Nanoimaging in Monolayer WSe₂,” *Nano Letters* 23, 11, 4901 (2023)
48. F. Anwar†, M. Tao, A. Schwartzberg, D. F. Ogletree, M. V. Altoe, **A. Raja**, S. Cabrini. “Transferable nano-patterned ALD Membrane,” *Nanotechnology* 34 (34), 345301 (2023)
49. R. Xu*, K. J. Crust*, V. Harbola*, R. Arras, K. Y. Patel, S. Prosandeev, H. Cao, Y-T. Shao, P. Behera, L. Caretta, W. J. Kim, A. Khandelwal, M. Acharya, M. M. Wang, Y. Liu, E. S. Barnard, **A. Raja**, L. W. Martin, X. W. Gu, H. Zhou, R. Ramesh, D. A. Muller, L. Bellaiche, H. Y. Hwang†. “Size-Induced Ferroelectricity in Antiferroelectric Oxide Membranes,” *Advanced Materials* 35(17), 2370121 (2023)
50. L. Caretta, Y-T. Shao, J. Yu, A. B. Mei, B. F. Grosso, C. Dai, P. Behera, D. Lee, M. McCarter, E. Parsonnet, K. P. Harikrishnan, F. Xue, X. Guo, E. S. Barnard, S. Ganschow, Z. Hong, **A. Raja**, L. W. Martin, L. Q. Chen, M. Fiebig, K. Lai, N. A. Spaldin, D. A. Muller, D. G. Schlom, R. Ramesh†. “Non-volatile electric-field control of inversion symmetry,” *Nature Materials* 22 (2), 207-215 (2023)
51. L. Chong† & **A. Raja**†. “It’s your lab: collaborative, multidisciplinary science at the Molecular Foundry,” *Nature Reviews Materials* 8, 142–143 (2023)
52. J. C. Thomas, A. Rossi, D. Smalley, L. Francaviglia, Z. Yu, T. Zhang, S. Kumari, J. A. Robinson, M. Terrones, M. Ishigami, E. Rotenberg, E. S. Barnard, **A. Raja**, E. Wong, D. F. Ogletree, M. M. Noack, A. Weber-Bargioni†. “Autonomous scanning probe microscopy investigations over WS₂ and Au(111),” *npj Computational Materials* 8.1 (2022): 99.
53. Y. Zhang, E. Parsonnet, A. Fernandez, S. M. Griffin, H. Huyan, C. K. Lin, T. Lei, J. Jin, E. S. Barnard, **A. Raja**, P. Behera, X. Pan, R. Ramesh, P. Yang†. “Ferroelectricity in a semiconducting all-inorganic halide perovskite,” *Science Advances*, 8(6), eabj5881 (2022)
54. P. Behera, M. A. May, F. Gómez-Ortiz, S. Susarla, S. Das, C. T. Nelson, L. Caretta, S-L. Hsu, M. R. McCarter, B. H. Savitzky, E. S. Barnard, **A. Raja**, Z. Hong, P. García-Fernandez, S. W. Lovesey, G. van der Laan, P. Ercius, C. Ophus, L. W. Martin, J. Junquera, M. B. Raschke, R. Ramesh†. “Electric field control of chirality,” *Science Advances* 8(1), eabj8030 (2022)
55. K. M. Siddiqui, D. B. Durham, F. Cropp, C. Ophus, S. Rajpurohit, Y. Zhu, J. D. Carlström, C. Stavarakas, Z. Mao, **A. Raja**, P. Musumeci, L. Z. Tan, A. M. Minor, D. Filippetto, and R. A. Kaindl. “Ultrafast optical melting of trimer superstructure in layered 1T'-TaTe₂,” *Communications Physics* 4(1), 1-7 (2021)
56. J. Gu, V. Walther, L. Waldecker, D. Rhodes, **A. Raja**, J. C. Hone, T. F. Heinz, S. Kéna-Cohen, T. Pohl, and V. M. Menon. “Enhanced nonlinear interaction of polaritons via excitonic Rydberg states in monolayer WSe₂,” *Nature Communications* 12(1), 1-7 (2021)
57. S. Brem, J. Zipfel, M. Selig, **A. Raja**, L. Waldecker, J. Ziegler, T. Taniguchi, K. Watanabe, A. Chernikov, and E. Malic. “Intrinsic Lifetime of Higher Excitonic States in Tungsten Diselenide Monolayers,” *Nanoscale*, 11, 12381 (2019)
58. H. M. Hill, A. F. Rigosi, **A. Raja**, A. Chernikov, C. Roquelet and T. F. Heinz, “Exciton broadening in WS₂/graphene heterostructures,” *Physical Review B*, 96(20), 205401 (2017)
59. E. M. Mannebach, R. Burdett, L. S. Langof, N. Seaberg, B. Exarhos, A. Grimm, D. R. Reichman, **A. Raja**, L. E. Brus, E. R. Eliel, J. A. Misewich, T. F. Heinz, X. Xu, A. H. MacDonald, E. Reed, H. Wen and A. M. Lindenberg†. “Dynamic optical tuning of interlayer interactions in the transition metal dichalcogenides,” *Nano Letters*, 17(12), 7761-7766 (2017)
60. E. G. Liniger, R. B. Laibowitz, T. M. Shaw, S. A. Cohen and **A. Raja**, “Effect of H₂O on TDDB for a range of ULK ILD materials with varying damage resistance for robust and weak liners,” *In Reliability Physics Symposium (IRPS)*, 2016 IEEE International, pp. DI-7. IEEE, (2016)
61. **A. Raja**, R. Laibowitz, E. G. Liniger, T. M. Shaw, and T. F. Heinz, “Impedance spectroscopy studies of moisture uptake in low-k dielectrics and its relation to reliability,” *Microelectronic Engineering*, 147, 100-103 (2015)
62. Y. Guo, D. Sun, B. Ouyang, **A. Raja**, J. Song, T. F. Heinz, and L. E. Brus, “Probing the dynamics of the metallic-to-semiconducting structural phase transformation in MoS₂ crystals,” *Nano Letters*, 15(8), 5081-5088 (2015)
63. G. J. Nilsen, **A. Raja**, A. A. Tsirlin, H. Mutka, D. Kasinathan, C. Ritter, and H. M. Rønnow, “One-dimensional quantum magnetism in the anhydrous alum KTi(SO₄)₂,” *New Journal of Physics*, 17(11), 113035 (2015)

64. S. De, A. Layek, **A. Raja**, A. Kadir, M. R. Gokhale, A. Bhattacharya, S. Dhar, and A. Chowdhury, “Two distinct origins of highly localized luminescent centers within InGa_N/Ga_N quantum-well light-emitting diodes,” *Advanced Functional Materials*, 21(20), 3828-3835 (2011)
65. S. De, D. K. Das, A. Layek, **A. Raja**, M. K. Singh, A. Bhattacharya, S. Dhar, and A. Chowdhury, “Optoelectronic behaviors and carrier dynamics of individual localized luminescent centers in InGa_N quantum-well light emitting diodes,” *Applied Physics Letters*, 99(25), 251911 (2011)

Selected Invited Presentations

> **60** invited seminars since starting independent career in 2019. Invited presentations between July 2024 and October 2026 are listed below.

1. Bay Area Light Sources Joint Users’ Meeting (ALS/SSRL/LCLS), SLAC National Accelerator Laboratory, Menlo Park, CA, September 2026, Invited talk at the MeV-UED Workshop “Mapping Structural Evolution with Relativistic Ultrafast Electrons” “Phonon and Exciton Engineering in Moiré-Patterned van der Waals Superlattice Heterostructures”
2. Flatlands Beyond Graphene 2026, Dresden, Germany, September 2026 “Multimodal Studies of Quantum Materials at the Atomically Sharp Interface: From Non-Equilibrium Phonons to Moiré Excitons”
3. 10th Fundamental Optical Processes in Semiconductors (FOPS 2026), Sugarbush, VT, August 2026 “Visualizing Energy Transfer and Phonons During Charge Transfer at 2D van der Waals Heterojunctions Using Ultrafast Electron Diffraction”
4. 2D TMDs 2026 Symposium, National University of Singapore, Singapore, June 2026 “Long-Lived Non-Equilibrium Phonons in Twisted Van der Waals Heterostructures”
5. Institute for Materials Science Seminar, Los Alamos National Laboratory, Los Alamos, NM, June 2026 “Multimodal Studies of Atomically Sharp Interfaces: From Non-Equilibrium Phonons to Moiré Excitons”
6. Keynote Speaker at Computational Science Research Center Workshop, San Diego State University, CA, May 2026 “Engineering Nanostructured Materials for Novel Quantum Functionality: Research Stories Bridging Experiment, Theory, and AI”
7. Arizona State University Department of Physics Colloquium, Tempe, AZ, April 2026 “Long-Lived Non-Equilibrium Phonons in Twisted Van der Waals Heterostructures”
8. Photonics West, San Francisco, January 2026, in the symposium on Ultrafast Phenomena and Nanophotonics “Visualizing energy transport at 2D semiconductor interfaces using ultrafast electron diffraction”
9. CU Boulder, Department of Chemistry Physical Chemistry Seminar, September 2025 “Spatial and temporal dynamics of excitons in van der Waals heterostructures”
10. 2D TMDs Invited Speaker, Cambridge University, UK, July 2025 “Painting potential landscapes on an atomically thin canvas”
11. Purdue University Department of Chemistry Physical Chemistry Seminar, April 2025 “Painting potential landscapes on an atomically thin canvas”
12. Seminar at EMPA, the Swiss Federal Laboratories for Materials Science and Technology, Dübendorf, Switzerland, March 2025 “Painting potential landscapes on an atomically thin canvas”
13. International Winter School on Electronic Properties of Novel Materials (IWEPM), Kirchberg, Austria, March 2025 “Painting potential landscapes on an atomically thin canvas”
14. Photonics West, San Francisco, January 2025, in the symposium on Ultrafast Phenomena and Nanophotonics “Anomalous Interlayer Exciton Diffusion in WSe₂/WS₂ Moiré Heterostructure”
15. MIT.nano seminar, Cambridge, MA, December 2024 “Painting potential landscapes on an atomically thin canvas”
16. MRS Fall meeting, Boston, December 2024 Invited talk at Symposium CH05: Frontiers of Imaging and Spectroscopy in Transmission Electron Microscopy “Sub-nanometer hyperspectral imaging of exciton confinement within a moiré unit cell in a WSe₂/WS₂ heterostructure”
17. MRS Fall meeting, Boston, December 2024 Invited talk at CH06: Exploring Fast and Ultrafast Dynamics of Matter with Electrons and Photons “Visualizing ultrafast energy and charge transport in semiconducting van der Waals heterostructures”

18. University of Chicago Department of Chemistry, Physical Chemistry Seminar, November 2024 “Painting potential landscapes on an atomically thin canvas”
19. Kavli Japanese-American-German Frontiers of Science symposium, Kyoto, Japan, October 2024 “Painting potential landscapes on an atomically thin canvas” (Invited Poster)
20. University of Kyoto, Institute of Advanced Energy Seminar, Uji, Japan, October 2024 “Spatial and temporal dynamics of excitons in semiconducting van der Waals heterostructures”
21. UC Irvine, Department of Physics Condensed Matter Seminar, October 2024 “Spatial and temporal dynamics of excitons in semiconducting van der Waals heterostructures”
22. Gordon Research Conference on Colloidal Semiconductor Nanocrystals, Les Diablerets, Switzerland, July 2024 “Energy and Charge Transport in Quantum Dot Coupled Van der Waals Heterostructures”

Selected Professional Activities

Conference & Workshop Organization

1. Co-organizer, Molecular Foundry User Meeting Workshop “AI Agents for Automating Computational Materials Science Workflows,” with hands-on TritonDFT tutorial, Berkeley CA, August 2026
2. Co-organizer, Molecular Foundry User Meeting Symposium “Scalable Solid-State Platforms for Photonic Quantum Technologies,” with closing panel of academic, national laboratory, and industry speakers, Berkeley CA, August 2026
3. Co-organizer, Molecular Foundry User Meeting Symposium “Nanohybrids for Next Generation Optoelectronics and Sensing,” LBNL, Berkeley CA, August 2025
4. Co-organizer, APS 2023 March Meeting Symposium “2D Materials: Multi-layer Moiré and Functionalities,” Las Vegas NV, March 2023
5. Co-organizer, MRS 2022 Fall Meeting Symposium “EQ04: Emerging Chalcogenide Electronic Materials—Theory to Applications,” Boston, December 2022
6. Lead organizer, MRS 2022 Spring Meeting Symposium “Reconfiguring the Properties of 2D Materials by Post-Synthesis Design,” Hawai’i, May 2022
7. Co-organizer, Molecular Foundry User Meeting Symposium “Quantum Materials for Classical Computing,” LBNL, Berkeley CA, August 2020
8. Workshop Chair, ALS User Meeting Workshop “Layered Quantum Materials: Electronic and Magnetic Properties,” Berkeley CA, October 2019

Editorial & Peer Review

Guest Editor, Journal of Chemical Physics, Festschrift in honor of Louis E. Brus (2024)

Reviewer for Nature family (incl.: Materials, Nature Photonics, Physics, Communications, Reviews), ACS Nano, Nano Letters, Physical Review (incl. PRL, PRX, PRB, PRA, PRM)

Mentorship

Postdocs Current – Dr. Laisi Chen, Dr. Garima Gupta, Dr. Ajit Dash; Former – Dr. Elyse Barré (Senior Optical Engineer, Viavi Solutions, Canada), Dr. Medha Dandu (Assistant Professor, JNCASR, India), Dr. Daria Blach (Scientist, ABB), Dr. Jonas Zipfel (Scientist, ZEISS, Germany), Dr. Luca Francaviglia (Senior R&D Engineer, Lumiphase, Switzerland), Dr. Camille Stavrakas (R&D Engineer, PsiQuantum), Dr. Sunphil Kim (Research Engineer, Western Digital)

Graduate students Misael Campos (current), Dr. Ethan Curling (Founding Scientist, Roca Water); Johan Carlström (Master’s thesis, currently PhD Student at Stanford)

DOE Office of Science Graduate Student Research (SCGSR): Mashnoon Alam Sakib (current), Meghan Leger (Penn State University), Dr. Amalya Johnson (Stanford University), Dr. Daria Blach

Undergraduate alumni Aadhish Ramanathan (UCSB graduate program), Vergil Schreiber (Purdue PhD), Justin Tolentino (UC Berkeley senior), Thy Huynh (MIT PhD), Sriram Sridhar (Apple), Xiaoda Liu (PSU PhD), Rui Xue (U. Pittsburgh PhD), Ting Gao (Weizmann PhD)