P. James Schuck
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Associate Professor
Columbia University
Department of Mechanical Engineering
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Field of Specialization

Specialty: Studying, sensing and engineering phenomena emerging from nanostructures, interfaces and quantum materials, with a focus on developing and applying advanced nano-optical probes, nonlinear materials, and plasmonic and quantum devices.

Summary of Research Aims: We aim to characterize, understand, and control light-matter interactions, with a primary focus on sensing, engineering, and exploiting novel quantum and optoelectronic phenomena emerging from nanostructures and interfaces. A general goal is understanding the nano- and meso-scale interactions between localized/quantum states in materials, which offers unprecedented opportunities for developing innovative device functions that rely on dynamic, local manipulation of single photons and charge carriers. We gain this knowledge by correlating spatially dependent physical properties with chemical information and mechanical structure.

This work is enabled by new multimodal and multidimensional sensing and spectroscopic methods that we are continuously developing, which provide unique access to physical, mechanical, and chemical behavior at relevant length scales in real environments. These are typically grounded in (nano)optical, scan-probe, and single-molecule techniques, exploiting (a) the chemical and physical information and (b) the high spatial, spectral and temporal resolution afforded by them.

Education

1997	B.A. (Physics)	U. C. Berkeley Berkeley, California
1998	M.S. School of Engineering and Applied Science (Applied Physics)	Yale University New Haven, Connecticut
2003	Ph.D. School of Engineering and Applied Science (Applied Physics)	Yale University New Haven, Connecticut

Thesis Topic: Three-dimensional Imaging Spectroscopy of the III-Nitride Material System
Thesis Advisor: Professor Robert Grober

2003-2006 Post-doctoral Scholar (Physical Chemistry) — Stanford University, Stanford, California

Topic(s): Nano-Optics, Plasmonic Sensing and Single-Molecule Imaging
Post-doctoral Advisor: Professor W. E. Moerner

Professional Experience

- Associate Professor, Department of Mechanical Engineering, Columbia University (July 2017 - present)
- Facility Director, Imaging and Manipulation Facility, Molecular Foundry, LBNL (2011-2017)
  - Responsible for the Imaging Facility's future scientific directions and synergistic operation within the nano- and quantum-science community, as well as the continued development of advanced multimodal and multidimensional nano-imaging techniques within the Molecular Foundry. Other responsibilities included operational budget oversight and leading our Facility's twice-yearly user proposal review process.
- Staff Scientist (2006-2016) and Senior Scientist (2016-2017), Imaging and Manipulation Facility, Molecular Foundry, LBNL
  - Established the Nanomaterials Characterization and Nano-optics labs within the Molecular Foundry.

Teaching Experience and Supervision

Ph.D. Candidate Advisees, current:
Myriam Diatta (Columbia, Mechanical Engineering), expected graduation 2028; William Hayes (Columbia, Mechanical Engineering), expected graduation 2027; Zhi Hao Peng (Columbia, Mech. Eng.), expected graduation 2027; Kevin Kwock (Columbia, Electrical Engineering), expected graduation 2024; Emma Xu (Columbia, Mech. Eng.), expected graduation 2024; Emanuil Yanev (Columbia, Mech. Eng.), expected graduation 2024; Benedikt Ursprung (Columbia, Mech. Eng.), expected graduation 2024.

Completed Ph.D. Dissertations:

- Xinyi Xu, Columbia University, 2023, Dissertation Title: "*Integrated and Phased-Matched Nonlinear Optics in 3R Phase Transition Metal Dichalcogenides*."
- Changhwan Lee, Columbia University, 2022, Dissertation Title: "*Photon avalanching in Tm^{3+}:$NaYF_4$ nanocrystals and its applications.*"
- Thomas Darlington, UC Berkeley, 2020, Dissertation Title: *"Localization of Excitons due to Inhomogeneous Nanoscopic Strain in Monolayer Transition Metal Dichalcogenides investigated by nano-PL and nano-Raman Microscopies"*
- Kaiyuan Yao, UC Berkeley, 2019, Dissertation Title: *"Exciton Dominated Optical Properties of Atomically Thin Semiconductors"*
- David Garfield, UC Berkeley, 2017, Dissertation Title: "*Photon upconversion improvements via molecular antennae and their applications*"

- Wei Bao, UC Berkeley, 2015, Dissertation Title: "*Nano-optical Spectroscopy of Low Dimensional Semiconductors*"

Dissertation Committee Member:

- Xin Meng, Columbia University, Department of Mechanical Engineering (2023)
- Wenbin Wang, Columbia University, Department of Mechanical Engineering (2023)
- Sara Shabani, Columbia University, Department of Physics (2023)
- Claudia Cea, Columbia University, Department of Electrical Engineering (2023)
- Aniket Patra, Department of Physics, University of Calabria (2023)
- Adriaan Frencken, Department of Chemistry, University of Victoria (2023)
- Abhinandan Antony, Columbia University, Department of Mechanical Engineering (2022)
- Zhixing Zhang, Columbia University, Department of Mechanical Engineering
- Nathan Finney, Columbia University, Department of Mechanical Engineering
- Michael Spencer, Columbia University, Department of Chemistry
- Joni Mici, Columbia University, Department of Mechanical Engineering
- Jared Ginsberg, Columbia University, Department of Applied Physics
- Bumho Kim, Columbia University, Department of Mechanical Engineering
- Baichang Li, Columbia University, Department of Mechanical Engineering
- Ankur Nipane, Columbia University, Department of Electrical Engineering
- Aaron Sternbach, Columbia University, Department of Physics
- Da Wang, Columbia University, Department of Mechanical Engineering
- Trevor Hull, Columbia University, Department of Chemistry
- Xinjue Zhong, Columbia University, Department of Chemistry
- Braden Czapla, Columbia University, Department of Mechanical Engineering
- Jennifer Ardelean, Columbia University, Department of Mechanical Engineering
- Ghidewon Arefe, Columbia University, Department of Mechanical Engineering
- Yibo Zhu, Columbia University, Department of Mechanical Engineering
- Xu (Alex) Cui, Columbia University, Department of Mechanical Engineering, PhD 2017, Dissertation Title: "High Quality MoS2 Characterization on Boron Nitride with Ohmic Contacts"
- Jeremy Lin, UCSF, PhD 2014, Dissertation Title: "*The Bone-Periodontal ligament-Tooth Fibrous Joint: A Dynamic "User Interface"*"
- Arthur Montazeri, University of Toronto, PhD 2016, Dissertation Title: "*Hyperspectral Light-Trapping within Graded Gratings Using Adiabatically-Coupled Plasmonic Waveguide-Resonators*"

Lectures:

- Fall 2023 & 2022, Summer 2021, Fall semesters 2021, 2020, 2019, 2018 and 2017, MECE 4212, "Microelectromechanical Systems (MEMS)", upper division undergrad/Masters level in Mechanical Engineering Department
- Spring 2023, co-taught "2D Materials" with Prof. J. Hone, MECE 4990 Special Topics in ME course.
- Springs 2023, 2022, 2021, 2020 and 2019, MECE 6137, "Nanoscale actuation and sensing", PhD-level course in Mechanical Engineering Department
- While at LBNL: Each semester at UC Berkeley I regularly delivered 3-5 guest lectures in graduate and undergraduate courses. Courses include MSE 260, "Surface Photon Spectroscopies"; Chemistry/MS&E C150, "Optics: the New Wave – state-of-the-art topics in plasmonics"; EE 298, "Manipulating Nanoscale Light Fields by Controlling Nanoantenna Asymmetries" and "Harnessing Surface Enhanced Raman

Scattering with Optical Nanoantennas"; EE C 235/ NSE 203, "Nanoscale Optical Characterization: Life Beyond Diffraction"

Publications:

Selected Publications (*corresponding author)

1. C. Lee, …, PJS*, "Indefinite and Bidirectional Near Infrared Nanocrystal Photoswitching," ***Nature*** 618, 951 (2023)
2. M. Kapfer, B.S. Jessen, …, PJS, D.N. Basov, J. Hone, C.R. Dean, *et al*., "Program-ming twist angle and strain profiles in 2D materials," ***Science*** 381, 677 (2023)
3. E. Meirzadeh, …,PJS, Nuckolls, Roy, *et al.*, "A few-layer covalent network of fullerenes," ***Nature*** 613, 71 (2023)
4. X. Xu, C. Trovatello, …, G. Cerullo*, PJS*, "Towards compact phase-matched and waveguided nonlinear optics in atomically layered semiconductors," ***Nature Photonics*** 16, 698 (2022)
5. E.A. Schriber, PJS, J Nathan Hohman, *et al*., "Chemical crystallography by serial femtosecond X-ray diffraction," ***Nature*** 601, 7893 (2022)
6. C. Lee, PJS*, *et al*., "Giant nonlinear optical responses from photon-avalanching nanoparticles," ***Nature*** 589, 230 (2021)
7. C. Trovatello, PJS*, *et al*., "Optical parametric amplification by two-dimensional semiconductors," ***Nature Photonics*** 15, 6 (2021)
8. K. Yao, N.R. Finney, J. Hone*, PJS*, *et al*. "Enhanced tunable second harmonic generation from twistable interfaces and vertical superlattices in boron nitride homostructures," ***Science Advances*** 7, eabe8691 (2021)
9. AJ Sternbach, PJS, X Xu, X-Y Zhu, RD Averitt, J Hone, MM Fogler, A Rubio, DN Basov, "Programmable hyperbolic polaritons in van der Waals semiconductors," ***Science*** 371, 617 (2021)
10. T. Darlington, F. Jahnke*, N. Borys*, PJS*, *et al.*, "Imaging strain-localized excitons in nanoscale bubbles of monolayer WSe_2 at room temperature," ***Nature Nanotech.*** (2020)
11. Angel Fernandez-Bravo, PJS*, *et al.*, "Ultralow-threshold, continuous-wave upconverting lasing from subwavelength plasmons," ***Nature Materials*** 18, 1172 (2019)
12. S. Wen, D. Jin*, T. W. Schmidt*, Y. D. Suh*, PJS*, *et al.*, "Future and challenges for hybrid upconversion nanosystems," ***Nature Photonics*** 13, 828 (2019)
13. Angel Fernandez-Bravo, PJS*, *et al.*, "Continuous-Wave Upconverting Nanoparticle Microlasers," ***Nature Nanotech.*** 13, 572 (2018)
14. D. Garfield, Nicholas Borys, PJS*, *et. al.*, "Enrichment of molecular antenna triplets amplifies upconverting nanoparticle emission," ***Nature Photonics*** 12, 402 (2018)
15. K. Yao, PJS*, *et al.*, "Optically discriminating carrier-induced quasiparticle band gap and exciton energy renormalization in monolayer MoS_2," ***Physical Review Letters*** 119, 087401 (2017)
16. Wei Bao, Nicholas Borys, PJS*, *et al.* "Visualizing nanoscale excitonic relaxation properties of disordered edges and grain boundaries in monolayer molybdenum disulfide," ***Nature Commun.*** 6, 7993 (2015)
17. D. J. Gargas, PJS*, *et al.*, "Engineering bright sub-10-nm upconverting nanocrystals for single-molecule imaging," ***Nature Nanotech.*** 9, 300, (2014).

18. P. James Schuck*, “Nanoimaging: Hot Electrons Go Through the Barrier,” ***Nature Nanotech.*** 8, 799 (2013)
19. W. Bao, PJS*, *et al.*, "Mapping local charge recombination heterogeneity by multidimensional nanospectroscopic imaging," ***Science*** 338, 1317 (2012)
20. S.W. Wu, PJS*, *et al*., “Non-blinking and photostable upconverted luminescence from single lanthanide-doped nanocrystals,” ***PNAS*** 106, 10917 (2009)
21. P. J. Schuck, *et al*., “Improving the mismatch between light and nanoscale objects with gold bowtie nanoantennas,” ***Phys. Rev. Lett.*** 94, 017402 (2005).

Full Publication List (*corresponding author, underline = student advisee, h-index = 61)

1. Emanuil S. Yanev, Thomas P Darlington, Sophia A. Ladyzhets, Matthew C Strasbourg, Chiara Trovatello, Song Liu, Daniel A Rhodes, Kobi Hall, Aditya Sinha, Nicholas J Borys*, James C Hone*, **P. James Schuck***, “Programmable nanowrinkle-induced room-temperature exciton localization in monolayer WSe_2,” *Nature Communications* 15, 1543 (2024)
2. Fabian Mooshammer, Xinyi Xu, Chiara Trovatello, Zhi Hao Peng, Birui Yang, Jacob Amontree, Shuai Zhang, James Hone, Cory R Dean, **P. James Schuck***, DN Basov*, “Enabling Waveguide Optics in Rhombohedral-Stacked Transition Metal Dichalcogenides with Laser-Patterned Grating Couplers,” *ACS Nano* 18, 4118 (2024)
3. Matthew Fu, Suheng Xu, Shuai Zhang, Francesco L Ruta, Jordan Pack, Rafael A Mayer, Xinzhong Chen, Samuel L Moore, Daniel J Rizzo, Bjarke S Jessen, Matthew Cothrine, David G Mandrus, Kenji Watanabe, Takashi Taniguchi, Cory R Dean, Abhay N Pasupathy, Valentina Bisogni, **P. James Schuck**, Andrew J Millis, Mengkun Liu, DN Basov, “Accelerated Nano-Optical Imaging through Sparse Sampling,” *Nano Letters* 24, (2024).
4. Surendra B Anantharaman, Jason Lynch, Christopher E Stevens, Christopher Munley, Chentao Li, Jin Hou, Hao Zhang, Andrew Torma, Thomas Darlington, Francis Coen, Kevin Li, Arka Majumdar, **P. James Schuck**, Aditya Mohite, Hayk Harutyunyan, Joshua R Hendrickson, Deep Jariwala*, “ Dynamics of self-hybridized exciton–polaritons in 2D halide perovskites,” *Light: Science & Applications* 13, 1 (2024)
5. Changhwan Lee, Emma Z. Xu, Kevin W. C. Kwock, Ayelet Teitelboim, Yawei Liu, Hye Sun Park, Benedikt Ursprung, Mark E. Ziffer, Yuzuka Karube, Natalie Fardian-Melamed, Cassio C. S. Pedroso, Jongwoo Kim, Stefanie D. Pritzl, Sang Hwan Nam, Theobald Lohmueller, Jonathan S. Owen, Peter Ercius, Yung Doug Suh*, Bruce E Cohen*, Emory M Chan*, **P. James Schuck***, “Indefinite and Bidirectional Near Infrared Nanocrystal Photoswitching,” *Nature* 618, 951 (2023)
6. Shuai Zhang*, Yang Liu, Zhiyuan Sun, Xinzhong Chen, Baichang Li, SL Moore, Song Liu, Zhiying Wang, SE Rossi, Ran Jing, Jordan Fonseca, Birui Yang, Yinming Shao, Chun-Ying Huang, Taketo Handa, Lin Xiong, Matthew Fu, Tsai-Chun Pan, Dorri Halbertal, Xinyi Xu, Wenjun Zheng, **P. James Schuck**, AN Pasupathy, CR Dean, Xiaoyang Zhu, David H Cobden, Xiaodong Xu, Mengkun Liu, MM Fogler, James C Hone, DN Basov*, “Visualizing moiré ferroelectricity via plasmons and nano-photocurrent in graphene/twisted-WSe_2 structures,” *Nature Communications* 14, 6200 (2023)
7. Changhwan Lee, **P. James Schuck***, “Photodarkening, photobrightening, and the role of color centers in emerging applications of lanthanide-based upconverting nanomaterials,” *Annual Review of Physical Chemistry* 74, 415 (2023)
8. Maëlle Kapfer, Bjarke S Jessen, Megan E Eisele, Matthew Fu, Dorte R Danielsen, Thomas P Darlington, Samuel L Moore, Nathan R Finney, Ariane Marchese, Valerie Hsieh, Paulina Majchrzak, Zhihao Jiang, Deepnarayan Biswas, Pavel Dudin, José Avila, Kenji Watanabe, Takashi Taniguchi, Søren Ulstrup, Peter Bøggild, **P. James**

Schuck, D.N. Basov, J. Hone, C.R. Dean*, "Program-ming twist angle and strain profiles in 2D materials," *Science* 381, 677 (2023)

9. Brian SY Kim*, Aaron J Sternbach, Min Sup Choi, Zhiyuan Sun, Francesco L Ruta, Yinming Shao, Alexander S McLeod, Lin Xiong, Yinan Dong, Ted S Chung, Anjaly Rajendran, Song Liu, Ankur Nipane, Sang Hoon Chae, Amirali Zangiabadi, Xiaodong Xu, Andrew J Millis, **P. James Schuck**, Cory R Dean, James C Hone, DN Basov*, "Ambipolar charge-transfer graphene plasmonic cavities," *Nature Materials* 22, 838 (2023)
10. E. Meirzadeh, A.M. Evans, M. Rezaee, M. Milich, C.J. Dionne, T.P. Darlington, S.T. Bao, A.K. Bartholomew, T. Handa, D.J. Rizzo, R.A. Wiscons, M. Reza, A. Zangiabadi, N. Fardian-Melamed, A.C. Crowther, **P. James Schuck**, D.N. Basov, Xiaoyang Zhu, A. Giri, P.E. Hopkins, P. Kim, M.L. Steigerwald, J. Yang, C. Nuckolls, X. Roy, "A few-layer covalent network of fullerenes," *Nature* 613, 71 (2023)
11. Zhuolei Zhang, Artiom Skripka, Jakob C Dahl, Chaochao Dun, Jeffrey J Urban, Daniel Jaque, **P James Schuck**, Bruce E Cohen, Emory M Chan*, "Tuning Phonon Energies in Lanthanide-doped Potassium Lead Halide Nanocrystals for Enhanced Nonlinearity and Upconversion," *Angewandte Chemie Int. Ed.* 62, e202212549 (2023)
12. Aaron J Sternbach*, Rocco A Vitalone, Sara Shabani, Jin Zhang, Thomas P Darlington, Samuel L Moore, Sang Hoon Chae, Eric Seewald, Xiaodong Xu, Cory R Dean, Xiaoyang Zhu, Angel Rubio, James Hone, Abhay N Pasupathy, **P. James Schuck**, DN Basov, "Quenched Excitons in WSe_2/α-$RuCl_3$ Heterostructures Revealed by Multimessenger Nanoscopy," *Nano Letters* 23, 5070 (2023)
13. Artiom Skripka*, Minji Lee, Xiao Qi, Jia-Ahn Pan, Haoran Yang, Changhwan Lee, **P. James Schuck**, Bruce E Cohen, Daniel Jaque*, Emory M Chan*, "A Generalized Approach to Photon Avalanche Upconversion in Luminescent Nanocrystals," *Nano Letters* 23, 7100 (2023)
14. Kiyoung Jo, Emanuele Marino, Jason Lynch, Zhiqiao Jiang, Natalie Gogotsi, Thomas P Darlington, Mohammad Soroush, **P. James Schuck**, Nicholas J Borys, Christopher B Murray, Deep Jariwala*, "Direct nano-imaging of light-matter interactions in nanoscale excitonic emitters," *Nature Communications* 14, 2649 (2023)
15. Aswin Asaithambi, Nastaran Kazemi Tofighi, Michele Ghini, Nicola Curreli*, **P James Schuck**, Ilka Kriegel*, "Energy transfer and charge transfer between semiconducting nanocrystals and transition metal dichalcogenide monolayers," *Chemical Communications* 59, 7717 (2023)
16. Yinming Shao, Aaron J Sternbach, Brian SY Kim, Andrey A Rikhter, Xinyi Xu, Umberto De Giovannini, Ran Jing, Sang Hoon Chae, Zhiyuan Sun, Seng Huat Lee, Yanglin Zhu, Zhiqiang Mao, James C Hone, Raquel Queiroz, Andrew J Millis, **P James Schuck**, Angel Rubio, Michael M Fogler, Dmitri N Basov, "Infrared plasmons propagate through a hyperbolic nodal metal," *Science Advances* 8, eadd6169 (2022)
17. Xinyi Xu, Chiara Trovatello, Fabian Mooshammer, Yinming Shao, Shuai Zhang, Kaiyuan Yao, Dmitri N Basov, Giulio Cerullo*, **P. James Schuck***, "Towards compact phase-matched and waveguided nonlinear optics in atomically layered semiconductors," *Nature Photonics* 16, 698 (2022)
18. Sara Shabani, Thomas P Darlington, Colin Gordon, Wenjing Wu, Emanuil Yanev, James Hone, Xiaoyang Zhu, Cyrus E Dreyer*, **P James Schuck***, Abhay N Pasupathy*, "Ultralocalized Optoelectronic Properties of Nanobubbles in 2D Semiconductors," *Nano Letters* 22, 7401 (2022)
19. Magdalena Dudek, Marcin Szalkowski, Małgorzata Misiak, Maciej Ćwierzona, Artiom Skripka, Zuzanna Korczak, Dawid Piątkowski, Piotr Woźniak, Radosław Lisiecki, Philippe Goldner, Sebastian Maćkowski, Emory M Chan, **P. James Schuck**, Artur Bednarkiewicz*, "Size-Dependent Photon Avalanching in Tm^{3+} Doped LiYF4 Nano, Micro, and Bulk Crystals," *Advanced Optical Materials* 10, 2201052 (2022)
20. Fabian Mooshammer, Sanghoon Chae, Shuai Zhang, Yinming Shao, Siyuan Qiu, Anjaly Rajendran, Aaron J Sternbach, Daniel J Rizzo, Xiaoyang Zhu, **P. James**

Schuck, James C Hone, DN Basov, "In-Plane Anisotropy in Biaxial ReS_2 Crystals Probed by Nano-Optical Imaging of Waveguide Modes," *ACS Photonics* 9, 443 (2022)

21. Kaiyuan Yao, Shuai Zhang, Emanuil Yanev, Kathleen McCreary, Hsun-Jen Chuang, Matthew R. Rosenberger, Thomas Darlington, Andrey Krayev, Berend T. Jonker, James C. Hone, D.N. Basov, **P. James Schuck***, "Nanoscale Optical Imaging of 2D Semiconductor Stacking Orders by Exciton-Enhanced Second Harmonic Generation," *Advanced Optical Materials* 10, 202200085 (2022)
22. Shuai Zhang, Baichang Li, Xinzhong Chen, Francesco L Ruta, Yinming Shao, Aaron J Sternbach, AS McLeod, Zhiyuan Sun, Lin Xiong, SL Moore, Xinyi Xu, Wenjing Wu, Sara Shabani, Lin Zhou, Zhiying Wang, Fabian Mooshammer, Essance Ray, Nathan Wilson, **P. James Schuck**, CR Dean, AN Pasupathy, Michal Lipson, Xiaodong Xu, Xiaoyang Zhu, AJ Millis, Mengkun Liu, James C Hone, DN Basov, "Nano-spectroscopy of excitons in atomically thin transition metal dichalcogenides," *Nature Communications* 13, 1 (2022)
23. Elyse A Schriber, Daniel W Paley, Robert Bolotovsky, Daniel J Rosenberg, Raymond G Sierra, Andrew Aquila, Derek Mendez, Frédéric Poitevin, Johannes P Blaschke, Asmit Bhowmick, Ryan P Kelly, Mark Hunter, Brandon Hayes, Derek C Popple, Matthew Yeung, Carina Pareja-Rivera, Stella Lisova, Kensuke Tono, Michihiro Sugahara, Shigeki Owada, Tevye Kuykendall, Kaiyuan Yao, **P. James Schuck**, Diego Solis-Ibarra, Nicholas K Sauter, Aaron S Brewster, J Nathan Hohman, "Chemical crystallography by serial femtosecond X-ray diffraction," *Nature* 601, 7893 (2022)
24. Marcin Szalkowski, Magdalena Dudek, Zuzanna Korczak, Changhwan Lee, Łukasz Marciniak, Emory M Chan, **P. James Schuck**, Artur Bednarkiewicz*, "Predicting the impact of temperature dependent multi-phonon relaxation processes on the photon avalanche behavior in Tm3+: NaYF4 nanoparticles," *Optical Materials: X* 12, 100102 (2021)
25. Emma Z Xu, Changhwan Lee, Stefanie D Pritzl, Allen S Chen, Theobald Lohmueller, Bruce E Cohen, Emory M Chan, **P. James Schuck***, "Infrared-to-ultraviolet upconverting nanoparticles for COVID-19-related disinfection applications," *Optical Materials: X* 12, 100099 (2021)
26. Long Yuan, Jeeyoon Jeong, Kevin Wen Chi Kwock, Emanuil S Yanev, Michael Grandel, Daniel A Rhodes, Ting S Luk, **P. James Schuck**, Dmitry Yarotski, James C Hone, Igal Brener, Rohit P Prasankumar, "Manipulation of Exciton Dynamics in Single-Layer WSe2 Using a Toroidal Dielectric Metasurface," *Nano Letters* 21, 9930 (2021)
27. Kevin WC Kwock, Changhwan Lee, Ayelet Teitelboim, Yawei Liu, Kaiyuan Yao, Sardar B Alam, Bruce E Cohen*, Emory M Chan*, **P. James Schuck***, "Surface-Sensitive Photon Avalanche Behavior Revealed by Single-Avalanching-Nanoparticle Imaging," *Journal of Physical Chemistry C* 125, 23976 (2021)
28. SL Moore, CJ Ciccarino, Dorri Halbertal, LJ McGilly, NR Finney, Kaiyuan Yao, Yinming Shao, Guangxin Ni, Aaron Sternbach, EJ Telford, BS Kim, SE Rossi, Kenji Watanabe, Takashi Taniguchi, AN Pasupathy, CR Dean, James Hone, **P. James Schuck**, Prineha Narang, DN Basov, "Nanoscale lattice dynamics in hexagonal boron nitride moire superlattices," *Nature Communications* 12, 1 (2021)
29. Agnieszka Paściak, Aleksandra Pilch-Wróbel, Łukasz Marciniak, **P. James Schuck**, Artur Bednarkiewicz, "Standardization of methodology of light-to-heat conversion efficiency determination for colloidal nanoheaters," *ACS Applied Materials and Interfaces* 13, 44556 (2021)
30. Michele Ghini, Emanuil Sashev Yanev, Christoph Kastl, Kehao Zhang, Adam W Jansons, Brandon M Crockett, Kristopher M Koskela, Edward S Barnard, Erika Penzo, James E Hutchison, Joshua A Robinson, Liberato Manna, Nicholas J Borys*, **P. James Schuck***, Ilka Kriegel*, "0D Nanocrystals as Light-Driven, Localized Charge-Injection Sources for the Contactless Manipulation of Atomically Thin 2D Materials," *Advanced Photonics Research* 2, 2000151 (2021)

31. Kaiyuan Yao, Nathan R Finney, Jin Zhang, Samuel L Moore, Lede Xian, Nicolas Tancogne-Dejean, Fang Liu, Jenny Ardelean, Xinyi Xu, Dorri Halbertal, Kenji Watanabe, Takashi Taniguchi, Hector Ochoa, Ana Asenjo-Garcia, Xiaoyang Zhu, DN Basov, Angel Rubio, Cory R Dean, James Hone*, **P. James Schuck***, "Enhanced tunable second harmonic generation from twistable interfaces and vertical superlattices in boron nitride homostructures," *Science Advances* 7, eabe8691 (2021)
32. AJ Sternbach, SH Chae, Simone Latini, AA Rikhter, Yinming Shao, Baichang Li, Daniel Rhodes, Brian Kim, **P. James Schuck**, X Xu, X-Y Zhu, RD Averitt, J Hone, MM Fogler, A Rubio, DN Basov, "Programmable hyperbolic polaritons in van der Waals semiconductors," *Science* 371, 617 (2021)
33. DN Basov, Ana Asenjo-Garcia, **P. James Schuck**, Xiaoyang Zhu, Angel Rubio, "Polariton Panorama," Nanophotonics 10, 549 (2021)
34. Changhwan Lee, Emma Z Xu, Yawei Liu, Ayelet Teitelboim, Kaiyuan Yao, Angel Fernandez-Bravo, Agata M Kotulska, Sang Hwan Nam, Yung Doug Suh*, Artur Bednarkiewicz*, Bruce E Cohen*, Emory M Chan*, **P James Schuck***, "Giant nonlinear optical responses from photon-avalanching nanoparticles," *Nature* 589, 230 cover article (2021)
35. Chiara Trovatello, Andrea Marini, Xinyi Xu, Changhwan Lee, Fang Liu, Nicola Curreli, Cristian Manzoni, Stefano Dal Conte, Kaiyuan Yao, Alessandro Ciattoni, James Hone, Xiaoyang Zhu, **P. James Schuck***, Giulio Cerullo*, "Optical parametric amplification by two-dimensional semiconductors," *Nature Photonics* 15, 6 (2021)
36. Lorenzo Maserati, Sivan Refaely-Abramson, Christoph Kastl, Christopher T Chen, Nicholas J Borys, Carissa N Eisler, Mary S Collins, Tess E Smidt, Edward S Barnard, Elyse A Schriber, Brian Shevitski, Kaiyuan Yao, J Nathan Hohman, **P James Schuck**, Shaul Aloni, Jeffrey B Neaton, Adam M Schwartzberg*, "Anisotropic 2D excitons unveiled in organic–inorganic quantum wells," *Materials Horizons* 8, 197 (2021)
37. Kaiyuan Yao, Mary S Collins, Kara M Nell, Edward S Barnard, Nicholas J Borys, Tevye Kuykendall, J Nathan Hohman, **P. James Schuck***, "Strongly quantum-confined blue-emitting excitons in chemically configurable multiquantum wells," *ACS Nano* 15, 4085 (2021)
38. Ankur Nipane, Min Sup Choi, Punnu Jose Sebastian, Kaiyuan Yao, Abhinandan Borah, Prathmesh Deshmukh, Younghun Jung, Bumho Kim, Anjaly Rajendran, Kevin WC Kwock, Amirali Zangiabadi, Vinod M Menon, **P. James Schuck**, Won Jong Yoo, James Hone, James T Teherani, "Damage-Free Atomic Layer Etch of WSe2: A Platform for Fabricating Clean Two-Dimensional Devices," *ACS Applied Materials and Interfaces* 13, 1930 (2020)
39. Thomas P Darlington, Andrey Krayev, Vishal Venkatesh, Ravindra Saxena, Jeffrey W Kysar, Nicholas J Borys, Deep Jariwala, **P. James Schuck***, "Facile and quantitative estimation of strain in nanobubbles with arbitrary symmetry in 2D semiconductors verified using hyperspectral nano-optical imaging," *Journal of Chemical Physics* 153, 024702 (2020)
40. Christian Schäfer, Pradeep N Perera, Florian Laible, Deirdre L Olynick, Adam M Schwartzberg, Alexander Weber-Bargioni, Stefano Cabrini, **P James Schuck**, Dieter P Kern, Monika Fleischer*, Selectively accessing the hotspots of optical nanoantennas by self-aligned dry laser ablation," *Nanoscale* 12, 19170 (2020)
41. Ilka Kriegel*, Michele Ghini, Sebastiano Bellani, Kehao Zhang, Adam W Jansons, Brandon M Crockett, Kristopher M Koskela, Edward S Barnard, Erika Penzo, James E Hutchison, Joshua A Robinson, Liberato Manna, Nicholas J. Borys*, **P. James Schuck***, "Light-Driven Permanent Charge Separation across a Hybrid 0D-2D Interface," *J. Phys. Chem. C* 124, 8000 (2020)
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133. Feng Wang, David Cho, Brian Kessler, Jack Deslippe, **P. James Schuck**, Steven G. Louie, Alex Zettl, Tony F. Heinz and Y. Ron Shen, "Observation of excitons in one-dimensional metals," *Phys. Rev. Lett.* 99, 227401 (2007)
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151. R.D. Grober, J. Acimovic, **J. Schuck**, D. Hessman, P.J. Kindlemann, J. Hespanha, A.S. Morse, K. Karrai, I. Tiemann, S. Manus. "Fundamental limits to force detection using quartz tuning forks." *Rev. Sci. Instrum.* 71, 2776 (2000).
152. J. Larsson, P.A. Heimann, A. Lindenberg, **P. J. Schuck**, P. H. Bucksbaum, R. W. Lee, H. A. Padmore and R.W. Falcone. "Ultrafast structural changes measured by time-resolved X-ray diffraction." *Appl. Phys. A* 66, 587 (1998)
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Book Chapters

1. Kaiyuan Yao, Shuai Zhang, Emanuil Yanev, Kathleen McCreary, Hsun-Jen Chuang, Matthew R. Rosenberger, Thomas Darlington, Andrey Krayev, Berend T. Jonker, James C. Hone, D.N. Basov, **P. James Schuck,** "Exciton-Enhanced Nanoscale Second Harmonic Generation and Imaging of Two-Dimensional Transition Metal Dichalcogenide Stacking," in *Nanoscopy and Nano-spectroscopy*, Sandip Dhara, Deep Jariwala, and Soumen Das, Editors; CRC Press, Taylor & Francis Group, 2022
2. M. Schmidt, P. N. Perera, P. D. Adams, A. Weber-Bargioni, **P. J. Schuck***, "Raman Spectroscopic Imaging of Biological Systems," in *Imaging Life: Biological Systems from Atoms to Tissues*; G. C. Howard, W. E. Brown, M. Auer, Editors; Oxford University Press, 2014
3. S. Cabrini, **P. James Schuck**, et al., "Nanophotonics Applications of Nanofabriction," Handbook of Nanofabrication, Taylor & Francis (Chapman & Hall, CRC Press, Garland Science, Marcel Dekker), 2012
4. Moerner, W. E.; **Schuck, P. J.**; Fromm, D. P.; Kinkhabwala, A.; Lord, S. J.; Nishimura, S. N.; Willets, K. A.; Sundaramurthy, A.; Kino, G.; He, M.; Lu, Z.; Twieg, R. J. "Nanophotonics and Single Molecules" in *Single Molecules and Nanotechnology*; R. Rigler and H. Vogel, Eds.; Springer Series in Biophysics, Vol. 12; Springer-Verlag: Berlin, 2008; pp 1–23.
5. G. S. Kino, A. Sundaramurthy, **P. J. Schuck**, D. P. Fromm, and W. E. Moerner, "Optical Field Enhancement with Plasmon Resonant Bowtie Nanoantennas," Chapter 9 of *Surface Plasmon Nanophotonics*, M. Brongersma and P. Kik, Editors (Kluwer, Dordrecht, The Netherlands, May 2007).

Patents

Recent patents, provisionals, and disclosures:

- "Method and system for efficiently disinfecting n95 mask(s) with upconverting nanoparticles, and disinfected mask(s)." US Patent App. 17/682,053 (9/2022)
- "Ultra-compact semiconductors for nonlinear optics and quantum communications." Columbia IR# CU23019 (7/2022)
- "Avalanching nanoparticles enabled cost-effective, sub-100nm resolution multiphoton lithography." Columbia IR# CU23212 (1/2023)
- "Infrared driven displays." Columbia IR# CU23211 (1/23)
- "System and Method for Providing and/or Facilitating Giant Nonlinear Optical Responses from Photon Avalanching Nanoparticles," (300586US02-109198-0000240)
- "Probes for multidimensional nanospectroscopic imaging and methods of fabrication thereof," (US Patent 8,984,661)
- "Controlled synthesis of bright and compatible Lanthanide-doped upconverting nanocrystals," (US Patent No. 9556379)
- "A nanowire AFM probe for imaging soft materials," (WO2010091311 A3)
- "Lithographic dry development using optical absorption," (US Patent No. 8512937)
- "Nanofabricated plasmonic optical transformer," (US Patent No. 9052450)
- "Variable gap bowtie tip based on thermal bimorph technology," (US20110055985 A1)
- "Device and method for an atomic force microscope for the study and modification of surface properties," (US Patent 8,479,311)

Honors and Distinctions

- Chair and Organizer of the 2023 Gordon Research Conference on UCNPs
- 2023 Keynote Speaker, 20th International Conference on Luminescence (ICL)
- 2021 Plenary Speaker, SPIE Optics + Photonics, San Diego, CA
- 2019 Plenary Speaker, Ramanfest 2019, Oxford, UK
- 2018 Keynote Speaker, UpCon 18
- Selected to 2014 LBNL/Haas Business School Emerging Leader Program
- 2013 LBNL Director's Award for Exceptional Achievement
- 2013 R&D Magazine's "R&D 100" Awardee
- 2003 NRC Postdoctoral Fellowship Award, NIST Boulder (declined)
- 1998 Yale Applied Physics Special Fellowship

Invited Presentations (>100 invited presentations at leading universities and international conferences and workshops)

2014 – Present:

1. "Strain-localized excitons, strong coupling, and nonlinear van der Waals quantum photonics in 2D semiconductors," University of Connecticut Chemistry Department Colloquium, January 31, 2024
2. "Tip-Enhanced Raman Spectroscopy and Nano-Imaging of 2D Semiconductors," Eastern Analytical Symposium and Exposition, Crowne Plaza Princeton Conference Center, New Jersey, November 15, 2023
3. "Highly tunable room-temperature exciton-polariton strong coupling from monolayer WSe2 in nanocavities," AVS 69, Portland, OR, November 7, 2023
4. "Strain-localized excitons, strong coupling, and nonlinear van der Waals photonics in 2D semiconductors," Sharp Meets Bright Symposium, Stanford Univ., CA, Sept. 14, 2023
5. "Photon Avalanching and Indefinite NIR Photoswitching in Ln-based Nanocrystals," International Conference on Luminescence, Keynote, Paris, France, August 28, 2023
6. "Seeing and Manipulating with NanoLight," Lawrence Berkeley National Lab, Molecular Foundry Annual Users Meeting, Berkeley, CA, August 10, 2023
7. "Nano-photoluminescence and Raman imaging of TMD moire domains and excitons strongly coupled to nanocavities," SPIE Optics + Photonics, San Diego, CA, August 20, 2023
8. "Amplifying Upconversion," 21st International Conference on Dynamical Processes in Excited States of Solids, Wroclaw, Poland Sept. 4-9, 2022
9. "Amplifying the Potential of Upconverting Nanoparticles," Molecular Foundry Annual Users Meeting, Berkeley, CA, August 18, 2022
10. "Strain-localized excitons, strong coupling, and nonlinear van der Waals photonics in 2D semiconductors," Gordon Research Conference on Plasmonics, Sunday River, ME, July 14, 2022
11. "Straining to make a quantum leap," CLEO, San Jose, CA, May 19, 2022
12. "Signatures of quantum-dot-like states and strong exciton-plasmon coupling in monolayer WSe2-gold heterostructures," GrapheneForUs, April 6, 2022
13. "Signatures of quantum-dot-like states and strong exciton-plasmon coupling in monolayer WSe2-gold heterostructures," ACS Spring Meeting, March 22, 2022
14. "Photon Avalanching Nanoparticles: A new class of nonlinear optical nano-probes," Advanced Imaging Methods, January 20, 2022
15. "Photon Avalanching Nanoparticles: A new class of nonlinear optical nano-probes," Pacifichem 2021, Honolulu, HI, December 217, 2021

16. “Engineering new nonlinear optical nanomaterials and nanophotonic structures,” Plenary, SPIE Optics + Photonics, San Diego, CA, August 2, 2021
17. “Life Beyond Diffraction: Nano-Imaging Spectroscopy with Optical Antennas,” Society for Applied Spectroscopy and Spectroscopy magazine, Spectroscopy Virtual Symposium on Raman and IR Imaging, July 27, 2021
18. “Amplifying the prospects of upconverting nanoparticles,” Materials Challenges in Alternative and Renewable Energy 2021 (MCARE 2021), July 22, 2021
19. “Next-generation upconverting nanoparticles for low-threshold micro- and nano-lasing,” ACS Spring Meeting 2021, April 13, 2021
20. “Nonlinear twistoptics at symmetry-broken interfaces,” GrapheneForUs, February 24, 2021
21. “The exciting world of lanthanide-based nanoparticles: from photon avalanches to nanoscale lasers,” University of Georgia Physics Colloquium, January 28, 2021
22. “Applying TERS Toward the Development of Strain-Tunable Single-Photon Sources,” Photonics Spectra Conference, December 10, 2020
23. “From twistoptics to tip-enhanced quantum emitters: mechanically tuning nonlinear and nano-optical properties in 2D quantum materials,” University of Delaware Physics Colloquium, October 5, 2020
24. “Quantitative determination of nanoscale strain in 2D semiconductors using hyperspectral nano-optical imaging,” SPIE Optics + Photonics, August 2020
25. “Imaging strain-localized exciton states in 2D semiconductors at room temperature,” SPIE Optics + Photonics, August 2020
26. “Extremely nonlinear lanthanide-based nanoparticles: A new class of upconverting nanocrystals,” SPIE Optics + Photonics, August 2020
27. “Amplifying the Prospects of Upconverting Nanoparticles and Their Hybrids,” IEEE RAPID, August 11, 2020
28. “Discovering Tomorrow” Panel on Science in Film, Sundance Film Festival, Park City, Utah, January 28, 2020
29. “From Localized Excitons to Lanthanide-Based Luminescent Nanoparticles and Nano-Lasers,” Department of Physics Colloquium, CCNY, October 29, 2019
30. “Visualizing localized excitons in 2D semiconductors”, Sharp Meets Bright Workshop: Combining SPM with Light, New York, Sept. 27, 2019
31. “Scalable, Controllable and Tunable Room-Temperature Quantum Emitters in Monolayer WSe_2,” NSF Quantum Optics Workshop, University of Pennsylvania, September 19-20, 2019
32. “Nano and nonlinear studies of 2D semiconductors,” Center for Integrated Nanotechnologies National User Meeting, Santa Fe, NM, September 23, 2019
33. “Amplifying the prospects of upconverting nanoparticles,” Methods and Applications in Fluorescence (MAF), La Jolla, CA, August 20-24, 2019
34. “Tip-enhanced Raman and PL on 2D semiconductors: probing at length scales that matter,” Plenary Speaker, Ramanfest 2019, Oxford, UK, June 24, 2019
35. “Next-Generation Miniature Lasers,” Politechnico di Milano, Department of Physics, 2nd Intensive Course in Laser Physics and Applications, Milano, Italy, May 14, 2019
36. “Band Gaps, Bound Excitons, and Ultra-Bright UCNPs,” University of Victoria, SPIE Optics Seminar, Victoria, Canada, March 15, 2019
37. “Using Near-field Optics to Uncover Local Optoelectronic Properties in 2D Semiconductors,” Stevens Institute of Technology, Nanotechnology Seminar, Feb. 20, 2019
38. “Amplifying the prospects of upconverting nanoparticles with antennas, new compositions and (very) tiny lasers,” SPIE BIOS Photonics West, San Francisco, CA, Feb. 5, 2019

39. “From Non-Ideal Edges to Nanobubbles: Using Near-field Optics to Uncover Local Optoelectronic Properties in 2D Semiconductors”, Center for Nanoscale Materials (CNM) Seminar Series, Argonne National Lab, Dec. 12, 2018
40. “Nano-Optical Investigations of 2D Semiconductors at Length Scales That Matter,” SciX 2018, Atlanta, Georgia, Oct. 21-26, 2018
41. “Nano-optical Activation of Defect-bound Excitons in Monolayer WSe2: Towards Room-temperature 2D Single-photon Optoelectronics,” AVS 65th International Symposium & Exhibition, Long Beach, CA, Oct. 25, 2018
42. “From Non-Ideal Edges to Nanobubbles: Using Near-field Optics to Uncover Local Optoelectronic Properties in 2D Semiconductors”, International Conference On Raman Spectroscopy (ICORS), Jeju, South Korea, August 27-31, 2018
43. "Sharp meets flat: nano-optical interrogation of 2D semiconducting strongly-correlated materials", Sharp Meets Bright Workshop Series on Combining SPM with Light: TERS, TEPL and Photovoltaic Measurements, North Carolina Central University, April 25, 2018
44. “Probing nanomaterials at the length scales that matter,” University of Delaware, Department of Materials Science and Engineering Seminar, April 18, 2018
45. “Enhancing the prospects of upconverting nanoparticles with molecular antennas, new compositions and UCNP microlasers,” Keynote Lecture, UpCon-18, Valencia, Spain, April 5, 2018
46. “Nano-mapping the optoelectronic properties of 2D semiconductors at length scales that matter,” Brookhaven National Lab, March 1, 2018
47. “Amplifying Lanthanide Upconversion with Molecular Antenna Triplets,” University of Technology, Sydney (UTS), IBMD Research Week, Feb. 5, 2018
48. “Mapping optoelectronic properties at length scales that matter in 2D semiconductors,” CUNY Optics Seminar, New York, NY, Dec. 18 2017
49. “Nano-imaging and nanospectroscopy of 2D semiconductors at length scales that matter,” SPIE Optics + Photonics, San Diego, CA, August 2017
50. “Nano-mapping the optoelectronic properties of 2D semiconductors at length scales that matter,” META 2017, Incheon, South Korea, July 25-28, 2017
51. “Mapping optoelectronic properties at length scales that matter in 2D semiconductors,” SPP8, The 8th International Conference on Surface Plasmon Photonics, Taipei, Taiwan, May 22-26, 2017
52. “Enhancing lanthanide upconversion with molecular concentrators, micro pillars and energy-looping nanoparticle-based lasers,” MRS Spring Meeting, Phoenix , AZ, April 19, 2017
53. “Nano-optical investigations of 2D semiconductors at length scales that matter,” MRS Spring Meeting, Symposium *2D Materials—Macroscopic Perfection vs. Emerging Nanoscale Functionality,* Phoenix , AZ, April 2017
54. “Mapping the optoelectronic properties of 2D semiconductors at length scales that matter,” Advanced Light Source Seminar Series, Lawrence Berkeley National Lab, Berkeley, CA, March 1, 2017
55. “Visualizing optoelectronic properties of 2D materials at length scales that matter,” 63rd AVS International Symposium and Exhibition, Nashville, TN, Nov. 6-11, 2016
56. “Revealing Optical Properties of Reduced-Dimensionality Materials at Relevant Length Scales Using Nanospectroscopic Imaging,” NFO-14 School Tutorial, Hamamatsu City, Japan, September 4, 2016
57. “Speeding up X-Ray Detection” High-Energy and Ultrafast X-Ray Imaging Technologies and Applications Workshop, Santa Fe, New Mexico, Aug. 2-3, 2016
58. “Probing Low-dimensional Materials and Local Environments with Nano-light,” Center for Energy Efficient Electronics Science, Berkeley CA, July 19, 2016

59. "Locally probing materials and environments with nano-light," META '16 Conference, Malaga, Spain, July 26, 2016
60. "Upconverting Nanoparticles: Near-Ideal (Single-Molecule) Probes for Deep-Tissue Imaging, Sensing, and Manipulation," Glenn T. Seaborg Center Seminar, Lawrence Berkeley National Lab, June 15, 2016
61. "Optical Nanospectroscopic Imaging at Length Scales That Matter," Department of Chemical Engineering and Materials Science Colloquium, University of Minnesota, Minneapolis, MN, May 3, 2016
62. "Life Beyond Diffraction: Locally probing materials and environments with nano-light," North Carolina State University, Department of Physics Colloquium, April 11, 2016
63. "Probing 2D materials at length scales that matter," MRS Spring Meeting, Phoenix , AZ, March 28-April 1, 2016
64. "Probing local environments with (nano)light," Stanford University, Materials Sciences Colloquium, Stanford, CA, March 11, 2016
65. "Nano-optical spectroscopic imaging of two-dimensional transition metal dichalcogenides," TERS 5, Osaka University, Osaka, Japan, October 29-30, 2015
66. "Locally Probing Materials and Environments with Nanolight," Department of Chemistry Seminar, Beijing Institute of Technology, Oct. 21, 2015
67. "Pushing Near-Field Polarizations In Plane", Kavli Program on Plasmonic Nanogaps and Circuits, Kavli Institute for Theoretical Physics China, Oct. 15, 2015
68. "A polarizing situation," Chinese Academy of Science, Institute of Physics, Oct. 14, 2015
69. "Optical Nanospectroscopic Imaging at Length Scales That Matter," Department of Physics Colloquium, Georgia State University, Atlanta, Georgia, September 1, 2015
70. "Probing 2D materials at length scales that matter," SPIE Optics + Photonics, San Diego, CA, August 9-13, 2015
71. "Nano-optical spectroscopic imaging of monolayer MoS2," META '15, New York City, NY, August 4-7, 2015
72. "Probing and controlling nanoscale optical polarization and its effects on local light-matter interactions," Workshop on Optical Polarization Conversion in the Near Field, University of Exeter, June 25-26, 2015
73. "Probing local environments with (nano)light," Life Sciences Division, LBNL, Divisional Seminar, Berkeley, CA, Feb. 17, 2015
74. "Optical Nanospectroscopic Imaging of 2D Materials at Relevant Length Scales," Pioneers in Photonic Nanostructures and Nanophotonics Workshop, Seoul, South Korea, December 4-5, 2014
75. "Advances in Nano-Optical Probing of Novel Materials at the Molecular Foundry", Korea Research Institute of Chemical Technologies (KRICT) R&D Forum on Nanospectroscopy and Nanoimaging, KRICT, DaeJeon, South Korea, December 2nd, 2014.
76. "Life Beyond Diffraction: Optical Nanospectroscopic Imaging at Length Scales that Matter," Condensed Matter Physics Seminar, Department of Physics, UC Davis, Davis CA, Nov. 20, 2014
77. "Optical Nanospectroscopic Imaging at Length Scales That Matter," Condensed Matter Physics Seminar, Department of Physics, Washington University St. Louis, St. Louis MO, Sept. 15, 2014
78. "Nano-Optical Scan Probes: Opening Doors to Previously-Inaccessible Parameter Spaces," CLEO:2014, San Jose, CA, June 8-13, 2014
79. "Upconverting Nanocrystals for Deep Brain Probing," Sensor Technologies for the Nervous System Symposium, UCSD and Kavli Institute for Brain and Mind, June 4, 2014

80. "Plasmonically-enhanced hot electrons break through the barrier," 5th International Conference on Metamaterials, Photonic Crystals, and Plasmonics (META 2014), Singapore, May 20-23, 2014
81. "Optical Nanospectroscopic Imaging at Length Scales that Matter," Symposium KK: Resonant Optics – Fundamentals and Applications, MRS 2014 Spring Meeting, San Francisco, CA, April 21-25, 2014
82. "Sub-surface minority carrier lifetime mapping in photovoltaic materials," 2014 APS March Meeting, Denver, CO, March 3-7, 2014
83. "Life beyond diffraction: optical nanospectroscopic imaging at length scales that matter," 11th Advanced Imaging Methods Workshop, Berkeley, CA, Jan. 29-31, 2014
84. "Visualizing Material Properties at Length Scales that Matter," Advanced Biosciences Seminar, Santa Clara University, Jan. 17th, 2014
85. "Plasmonically-Enhanced Solar-Matched Photocatalytic Water Splitting using GaN Surface States," Physics of Quantum Electronics (PQE), Snowbird, UT, Jan. 6th, 2014

Service: Conference Organization, Community and Academic Activities

- Chair and Organizer of the 2023 Gordon Research Conference on UCNPs
- International Advisory Committee Member, NFO-16, Victoria, British Columbia, Canada, August 2022
- Organizing Committee Member, TERS 2022, Paris, France
- Editorial Board Member, *Advanced Optical Materials*, Wiley, 2013-2019
- California State Senate Expert Panelist and Speaker, California State Senate Select Committee Hearing, Senate Select Committee on Emerging Technology: Biotechnology and Green Energy Jobs, *A Mindful Approach to the BRAIN Initiative*, UCSD, La Jolla, CA, Oct. 4, 2013
- Chair and Co-organizer, *Sharp Meets Bright* Workshop Series: Combining SPM with Light, Columbia University, Sept. 27, 2019
- Co-Organizer and Co-chair; MRS Symposium EP12 "Emerging Materials for Plasmonics, Metamaterials and Metasurfaces"; Spring 2019 MRS Meeting
- Program Committee Member, Plasmonics in Biology and Medicine XVI at SPIE-BIOS, Feb. 2-7, 2019
- International Advisory Committee Member, NFO-15, Troyes, France, August 2018
- Co-Organizer and Co-Chair, TERS6, The 6th International Conference on Tip-Enhanced Raman Spectroscopy, to be held in Gaithersburg, Md, August 2017
- Co-Organizer and Co-Chair; AAAS 2015 Meeting, Symposium "Correlating Properties of Nano-Building Blocks Via Hyperspectral Nano-Optical Imaging," San Jose, CA; Feb. 15, 2015
- Organizing Committee Member, NFO-14, Hamamatsu City, Japan, 2016
- Organizing Committee Member; Joint NSRC Workshop 2015 "Big, Deep, and Smart Data Analytics in Materials Imaging"
- Co-Organizer and Co-Chair; 13th International Conference on Near-Field Optics, Nanophotonics and Related Techniques (NFO 13); Salt Lake City, Utah; Aug. 31 – Sept. 4 2014
- Co-chair and Co-organizer, "Flatter and Faster: 2D Materials Workshop" at the 2015 Molecular Foundry Users Meeting
- Co-Organizer and Co-chair; MRS Symposium "Enabling Metamaterials: From Science to Innovation"; Fall 2013 MRS Meeting

- Program Committee; SPIE Photonics West: Synthesis and Photonics of Nanoscale Materials, 2012-present
- Co-organizer and Co-chair, "Advances and Innovations in Energy Storage," Molecular Foundry/NCEM Users Meeting, October 2012
- Session Chair, SPP5 – The 5th International Conference on Surface Plasmon Photonics, Busan, Korea, May 15-20, 2011
- Chair, "Resonant Optical Antennas" symposium session, MRS Fall Meeting, Boston, MA 2010
- Chair, "Nanophotonic Materials" session, SPIE Optics + Photonics Conference, San Diego, CA, August 2010
- Co-organizer and Co-chair, "Harvesting and Manipulating Light at the Nanoscale workshop," Molecular Foundry/NCEM Users Meeting, October 2010.
- Co-organizer and Co-chair, "Harvesting and Manipulating Light at the Nanoscale workshop," Molecular Foundry/ALS Users Meeting, October 2009
- Co-organizer, "Optical Properties of Nanostructures" Focus Sessions for the Division of Materials Physics, American Physical Society March Meeting, 2009
  · Chair, "Optical Properties of Nanostructures IV: Optical Antennas and Plasmonics" Focus Session, American Physical Society March Meeting, March 18, 2009
- Co-organizer and Co-chair, "Nanophotonics and Nanoplasmonics Break-out Workshop," Molecular Foundry/ALS Users Meeting, October 2007
- Co-organizer and Co-chair, "Applications of Nanophotonics Break-out Workshop," Molecular Foundry, NCEM Users Meeting, October 2008

- DOE Panel Reviewer, *Nanoscale Science Research Centers* (NSRCs) Triennial Review, June 2019
- Member of the American Physical Society (APS), Optical Society of America (OSA), the Materials Research Society (MRS), and the American Chemical Society (ACS)
- Proposal Reviewer for: Department of Energy (DOE), The Office of Basic Energy Sciences (BES); National Institutes of Health (NIH) NINDS; State of Arizona, Science Foundation Arizona (SFAz); Research Corporation
- Reviewer for many journals including *Science*, *Nature, Nature Nanotechnology*, *Nature Physics*, *Nature Commun*., *Advanced Materials, Advanced Optical Materials, Advanced Functional Materials, JACS, Physical Review Letters, Applied Physics Letters, Optics Letters, Nano Letters, Optics Express, ACS Nano, Optics Communications, Journal of Microscopy, Physical Chemistry Chemical Physics, Journal of Physical Chemistry, Journal of Physical Chemistry Letters, New Journal of Physics, IEEE Photonics Technical Letters*

Columbia University, School of Engineering and Applied Science (SEAS), and Department Service:

- Co-Director, Columbia University Master of Science in Quantum Science and Technology, 2023-
- *Executive Committee Member* and *Center Theme Leader*, Programmable Quantum Materials (Pro-QM), DOE Energy Frontier Research Center, 2018-present
  -Responsible for co-leading the Pro-QM effort on Multimodal, Multiscale Quantum Materials Characterization ("Theme B"), including yearly evaluation of new and existing research efforts and leading "Theme B" proposal writing for original and successful renewal grants.
- Director of Graduate Studies, Mechanical Engineering Department 2022-2023

    - Led PhD program admissions process, 2023
    - Led MS program admissions process, 2023
- SEAS, Ad Hoc Tenure Review Committee, 2022
- SEAS Task Force to Showcase Engineering Majors, Department Rep., 2019
- SEAS, Ad Hoc Tenure Review Committee, 2019
- Department Lead, MS Program Admissions, 2020-2023
- Mechanical Engineering Seminar Series Organizer, 2018-2021
- Mechanical Engineering Graduate Committee, 2017-
- Mechanical Engineering Executive Committee, 2017-

Berkeley Lab Service:

- Member, LBNL Executive Committee tasked with organizing approaches to the BRAIN initiative, 2013-present.
    - Lab representative at State Senate Select Hearing, Oct. 4th, 2013
- Standing Member, Molecular Foundry Division Staff Committee, 2016-present
- Member, Molecular Foundry Division Awards Committee, 2016-present
- Service on Multiple Other LBNL Committees: Materials Science Division Technical Staff Committee, 2010-present; Molecular Foundry Director Search Committee, 2011-2013; Multiple Molecular Foundry Staff and Scientist Search Committees; Multiple MSD Career Review Ad Hoc Committees
- LBNL site lead for the UC Biophotonics Alliance; 2010-present

- LBNL Video Glossary, invited contribution of "Plasmon" definition
- "In Conversation with…" Seminar Series Speaker, July 2009
- Design of online laser safety course, with LBNL laser safety officer Ken Barat and MSD safety officer Rick Kelly
- MSD EH&S committee alternate, May 2006-2017
- Frequent Molecular Foundry tour guide, 2006-2017