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P. James Schuck is an Associate Professor of Mechanical Engineering at Columbia University. He earned his B.A. in Physics at UC Berkeley and his Ph.D. in Applied Physics at Yale University. Jim then did his postdoctoral studies with Prof. W. E. Moerner at Stanford University, studying optical nanoantennas and single-molecule spectroscopy. The Schuck group aims to characterize, understand and control nanoscale light-matter interactions, with a primary focus on sensing, engineering and exploiting novel optoelectronic phenomena emerging from nanostructures and interfaces. This offers unprecedented opportunities for developing innovative devices that rely on the dynamic manipulation of single photons and charge carriers. We are continuously developing new spectroscopic methods that provide unique access to optical, electrical, and structural properties at relevant length scales in real environments encountered in energy and biological applications. Current research interests include the investigation and applications of 2D materials and upconverting nanoparticles (UCNPs).

Select Publications:

1. Angel Fernandez-Bravo, PJS*, *et al.*, "Continuous-Wave Upconverting Nanoparticle Microlasers," ***Nature Nanotech.*** 13, 572 (2018)
2. D. Garfield, Nicholas Borys, PJS*, *et. al.*, "Enrichment of molecular antenna triplets amplifies upconverting nanoparticle emission," ***Nature Photonics*** 12, 402 (2018)
3. B. Tian, PJS*, *et al*., "Low irradiance multiphoton imaging with alloyed lanthanide nanocrystals," ***Nature Commun.*** 9, 3082 (2018)
4. A. Pickel, *et al*., "Apparent self-heating of individual upconverting nanoparticle thermometers," ***Nature Commun.*** 9, 4907 (2018)
5. K. Yao, N.J. Borys, PJS*, *et al.*, "Optically discriminating carrier-induced quasiparticle band gap and exciton energy renormalization in monolayer MoS_2," ***Physical Review Letters*** 119, 087401 (2017)
6. N.J. Borys, PJS*, *et. al.*, "Anomalous Above-Gap Photoexcitations and Optical Signatures of Localized Charge Puddles in Monolayer Molybdenum Disulfide," ***ACS Nano*** 11, 2115 (2017)
7. E. S. Barnard, PJS*, *et al*., "Three-Dimensional Lifetime Tomography Reveals How $CdCl_2$ Improves Recombination Throughout CdTe Solar Cells*," **Advanced Materials*** 29, 1603801 (2017)
8. 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)
9. D. J. Gargas, PJS*, *et al.*, "Engineering bright sub-10-nm upconverting nanocrystals for single-molecule imaging," ***Nature Nanotech.*** 9, 300, (2014).

10. P. James Schuck***,** *et al*., "Life Beyond Diffraction: Opening New Routes to Materials Characterization with Next-Generation Optical Near-Field Probes," Invited Review Article, ***Advanced Functional Materials*** 23, 2539 (2013)
11. P. James Schuck*****, "Nanoimaging: Hot Electrons Go Through the Barrier," ***Nature Nanotech.*** 8, 799 (2013)
12. W. Bao, PJS*****, *et al.*, "Mapping local charge recombination heterogeneity by multidimensional nanospectroscopic imaging," ***Science*** 338, 1317 (2012)
13. H. Choo, *et al*., "Nanofocusing in a metal-insulator-metal gap plasmon waveguide with a three-dimensional linear taper," ***Nature Photonics*** 6, 837 (2012)
14. A. McLeod, PJS*****, *et al.*, "Nonperturbative visualization of nanoscale plasmonic field distributions via photon localization microscopy," ***Phys. Rev. Lett.*** 106, 037402 (2011), "Editor's Suggestion"
15. A. Weber-Bargioni, PJS*****, *et al.*, "Hyperspectral Nanoscale Imaging on Dielectric Substrates with Coaxial Optical Antenna Scan Probes," ***Nano Lett.***, 11, 1201 (2011)
16. Z. Zhang, PJS*****, *et al.*, "Manipulating Nano-scale Light Fields with the Asymmetric Bowtie nano-Colorsorter," ***Nano Lett.,*** 9, 4505 (2009)
17. S.W. Wu, PJS*****, *et al*., "Non-blinking and photostable upconverted luminescence from single lanthanide-doped nanocrystals," ***PNAS*** 106, 10917 (2009)
18. P. J. Schuck, *et al*., "Improving the mismatch between light and nanoscale objects with gold bowtie nanoantennas," ***Phys. Rev. Lett.*** 94, 017402 (2005).