

Scott K. Cushing

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EDUCATION:

- 2016-2018** **Dept. of Energy EERE Postdoctoral Fellow,**
Prof. Stephen Leone Group University of California, Berkeley, CA
Co-Appointment at Lawrence Berkeley National Laboratory
- 2011-2015** **Ph.D. in Physics, under Nick Wu and Alan Bristow**
West Virginia University, Morgantown, WV
- 2007-2011** **B.S in Physics, emphasis in Material Science and Chemistry**
West Virginia University, Morgantown, WV

POSITIONS:

- 2018-Present** **Assistant Professor of Chemistry**
September 2018 to Present, Caltech, Pasadena, CA
- 2016-Present** **Senior Research Advisor for Pacific Integrated (PI) Energy**
March 2016 to Present, San Diego, CA

SELECTED HONORS AND AWARDS:

- 2024** DARPA YFA Fellow
- 2024** Camille-Dreyfus Teacher Scholar
- 2023** KNI Wheatley Fellow
- 2023** Research Corp. Scialog Fellow
- 2023** Emerging Young Investigator for *ChemComm*
- 2022** W. M. Keck Foundation Award
- 2022** Shirley Malcom Prize for Excellence in Mentoring
- 2022** Cottrell Scholar
- 2022** Emerging Young Investigator for *Journal of Physical Chemistry C*
- 2021** Invited Committee Member for National Academy of Sciences “Interface of Chemistry and Quantum Information Science”
- 2021** Invited Panelist for National Academy of Science’s “Quantum Biology” Meeting
- 2021** (Early Career) Editor for *Electrochemical Society: Interface*
- 2020** Rose Hills Foundation Innovator
- 2020** Emerging Young Investigator for *Journal of Materials Chemistry*
- 2020** Emerging Young Investigator for *Journal of Chemical Physics*
- 2019** DOE Early Career Award
- 2019** AFOSR Young Investigator Program
- 2016** DOE EERE Postdoctoral Fellow
- 2015** Council of Graduate Schools, Top Scientific Thesis in United States and Canada
- 2015** *Nanotechnology* Top 10 Researcher Award
- 2014** ECS Energy and Technologies Division Top Graduate Student Award
- 2014** SPIE D. J. Lovell Award for Society’s Top Graduate Student.
- 2014** Ones to Watch List by *Photonics Spectra Magazine*
- 2011** NSF Graduate Research Fellowship

OUTREACH

- **Caltech – Connection:** Created program that connects Caltech graduate students with undergraduate students at local minority serving institutes (MSIs) to help with research, the transition to graduate school, and ultimately set up lifelong mentoring environments. The program currently includes an HBCU, and HSI, and four community colleges with 100 participants per year.
- **STEAM Video Series:** Helped develop program with West Virginia Public Broadcasting to better engage the public with cutting edge science.
- **Mental Health Community @ Caltech:** Responsible for organizing a supportive community around those that affiliate with or suffer from mental health issues.
- **NOGLSTP:** On scholarship and organizational committee for the National Organization for Gay and Lesbian Scientists and Technical Professionals
- **YouTube Series:** Helped start series dealing with invisible, mental, and visible disabilities in science.
- **Public podcasts** on solar energy research through PI Energy Podcast and disabilities on ChemTalk

SCIENTIFIC SERVICE

- **ECS: Interface:** Assistant Editor since 2022, started Student Division Award Perspective Section
- **ChemTalk Advisory Board** – Public charity non-profit, focused on STEM education, and the next generation of or STEM workforce through free lessons, materials, and podcasts.
- **ACS CATL Co-Organizer** – ACS Fall 2023 symposium section organizer
- **Electrochemical Society – EDT Solar Fuels:** Organization and chairing from 2015-present.
- **Chemistry-2021 Conference:** Advisory Board
- **ChemElectroChem:** Early Career Advisory Board
- **Invited talks** at GRC, ACS, SPIE, ECS, Pacific Chem, Telluride RSC, MRS, Analyticon
- **Journal referee** for Nature Materials, Nature Photonics, Nature Communications, Optical Materials Express, Journal of the American Chemical Society, Journal of Physical Chemistry C, Journal of Physical Chemistry Letters, Nano Letters, Elsevier. **Grant reviewer** for DOE, AFOSR, NSF, NIH.

FUNDING:

External (PI): DOE Early Career Award, AFOSR Young Investigator Program, Cottrell Scholar, Camille-Dreyfus Teacher Scholar, W. M. Keck Foundation, Rose Hills Foundation Early Career Innovator, Baxter International, ACS PRF Doctoral New Investigator, DOE Quantum Chemistry and Materials (lead PI of 7 PI team across four institutions) / Funded Phase I and II, AFOSR DURIP, Scialog Fellow, DARPA Young Faculty Award

External (co-PI): DOE Liquid Sunlight Alliance, NSF RCN Quantum Biology, NIH-BIG, NSF-CDMSA, DOE ERFC Nanoparticle Solar Fuel Reactors (Team Lead)

Internal (PI): Chen Neuroscience Institute (2), Rosen Bioengineering Center Pilot Grant, Resnick Institute Small grant award, KNI Wheatley Fellow Award, Beckman Institute Pilot Center, RI² Innovation Grant, Broadcom Innovation Funds

Workforce Development: Preer Family Donation for Caltech Connection / WAVE programs, NSF MNTCH-START (Co-PI), DOE LISA-CHASE Student ACS Symposium, Kavounas Family Donation for Caltech Connection

PATENTS:

1. Distributable Time Resolved Fluorescence Sensing Using Temporally Correlated Single Photons
S. K. Cushing, N. Harper, B. P. Hickam, M. He, *Provisional Patent Submitted*, 5/11/2023
2. Laser Driven Ultrafast Impedance Spectrometer
S. K. Cushing, K. Pham, *Provisional Patent Submitted*, 12/23/2022
3. An Entangled, Continuous Wave, Photon Source That Can Replace a Pulsed Laser In Non-Destructive, Multiphoton Or Nonlinear Optical Devices
S. K. Cushing, M. He, S. Szoke, B. P. Hickam, *Patent Number: 2021/0165300*, 6/03/2021
4. Metal Halide Based Thermionic Energy Conversion Devices
S. K. Cushing, P. Layton, D. Keogh, *Application Number: 62632360*, 2/19/2019
5. High Absorption, photo induced resonance energy transfer electromagnetic energy collector
P. Layton, D. Keogh, **S. K. Cushing**, *Application Number: 62596531*, 12/8/2018

STUDENT THESES:

1. Measuring Charge Carrier and Structural Photodynamics at Solar Energy Material Surfaces Using Transient Extreme Ultraviolet Reflection Spectroscopy.
Jonathan Michelsen (2024)
2. Exploring How Entangled Photon Correlations Can Enhance Spectroscopy
Bryce Hickam (2023)
3. Entanglement-Enhanced Bioimaging and Sensing.
Manni He (2023)
4. Understanding the Origins of Photoexcited XUV Spectra
Isabel Klein (2022)
5. Entangled Photon Interferometry: Development of Photonic Systems Towards Quantum Spectroscopy
Szilard Szoke (2021)

PUBLICATIONS: [Google Scholar Profile](#); ~70 publications, cited ~10,000 times, h-index 35, i10-index=50

Since Caltech as a Principal Investigator[†]

Entangled Photon Spectroscopy:

1. Investigation of nanophotonic lithium niobate waveguides for on-chip evanescent wave sensing.
N. A. Harper, E. Y. Hwang, P. A. Kocheril, **S. K. Cushing[†]** *Optics Letters*, *Accepted*, (2024)
2. Experimental Upper Bounds for Resonance-Enhanced Entangled Two-Photon Absorption Cross Section of Indocyanine Green. M. He, B. P. Hickam, N. Harper, **S. K. Cushing[†]** (2024), *Journal of Chemical Physics* 160, 094305 (2024). doi.org/10.1063/5.0193311 (**Featured Article**)

3. Visible and near-IR entangled photon generation and UV second harmonic generation with lithium niobate nanophotonic waveguides for on-chip spectroscopy. E. Hwang, N. Harper, R. Sekine, L. Ledezma, A. Marandi, **S. K. Cushing**[†] *Proceedings of SPIE LASE*, 1286907 (2024) <https://doi.org/10.1117/12.3000100>
4. Progress towards on-chip entangled photon spectroscopy and bioimaging. M. He, E. Hwang, N. Harper, **S. K. Cushing**[†] *Proceedings of SPIE OPTO*, 1289500 (2024) <https://doi.org/10.1117/12.2693025>
5. Highly efficient visible and near-IR photon pair generation with thin-film lithium niobate, N. Harper, E. Hwang, R. Sekine, L. Ledezma, C. Perez, A. Marandi, **S. K. Cushing**[†] *Optica Quantum* 2(2), 103-109 (2024), <https://doi.org/10.1364/OPTICAQ.507526>
6. Entangled Photon Correlations Allow a Continuous-Wave Laser Diode to Measure Single Photon, Time-Resolved Fluorescence, N. Harper, B. P. Hickam, M. He, **S. K. Cushing**[†], *Journal of Physical Chemistry Letters* 14 (2023), 5805. doi.org/10.1021/acs.jpcclett.3c01266
7. Advancing Chemistry and Quantum Information Science: An Assessment of Research Opportunities at the Interface of Chemistry and Quantum Information Science in the United States. **S. K. Cushing**, *Contributor to National Academies of Sciences, Engineering, and Medicine* (2023). <https://doi.org/10.17226/26850>.
8. Tunable and efficient ultraviolet generation in nanophotonic lithium niobate, E. Hwang, N. Harper, R. Sekine, L. Ledezma, A. Marandi, **S. K. Cushing**[†], *Optics Letters*, 48, 3917-3920 (2023). doi.org/10.1364/OL.491528. (**Highlighted by Optica**)
9. Single-Photon Scattering Can Account for the Discrepancies among Entangled Two-Photon Measurement Techniques, B. P. Hickam, M. He, N. Harper, S. Szoke, **S. K. Cushing**[†], *Journal of Physical Chemistry Letters* (2022) [10.1021/acs.jpcclett.2c00865](https://doi.org/10.1021/acs.jpcclett.2c00865)
10. *Quantum Science Concepts in Enhancing Sensing and Imaging Technologies: Applications for Biology*, edited by A. F. Johnson, S. M. Moss, A. Bremer, F. Sharples; **S.K. Cushing**[†] as a contributor, ISBN 978-0-309-46534-2 (2021), DOI [10.17226/26139](https://doi.org/10.17226/26139)
11. Designing High-Power, Octave Spanning Entangled Photon Sources for Quantum Spectroscopy S. Szoke, M. He, B. P. Hickam, **S. K. Cushing**[†], *Journal of Chemical Physics*, 154 (2021), 244201 (**Invited special issue on “Quantum Light”**)
12. Entangled Light-Matter Interactions and Spectroscopy, S. Szoke, H. Liu, B. P. Hickam, M. He, **S. K. Cushing**[†], *Journal of Materials Chemistry C*, 8 (2020), 10732. (**Invited Young Career Paper**)

Transient X-Ray Spectroscopy:

13. Dynamic Competition Between Orbital and Exchange Interactions Selectively Localizes Electrons and Holes Through Polarons. J. L. Mendes, H. J. Shin, J. Y. Seo, N. L. Lee, Y. J. Choi, J. B. Varley, **S. K. Cushing**[†], (2024) arxiv.org/abs/2411.00770

14. Approaching the Lower Temporal Limit of Laser-Produced Plasma Sources for Table-Top Soft X-ray NEXAFS Measurements, D. Nimlos, A. Arellano, **S. K. Cushing**[†], (2024)
arxiv.org/abs/2409.02280
15. Oxidizing role of Cu co-catalysts in unassisted photocatalytic CO₂ reduction using p-GaN/Al₂O₃/Au/Cu heterostructures. M. Zoric, P. Basera, L. Palmer, A. Aitbekova, N. Powers-Riggs, H. Lim, W. Hu, A. T. Garcia-Esparza, H. Sarker, F. Abild-Pedersen, H. Atwater, **S. K. Cushing**[†], M. Bajdich, A. Cordones *ACS Nano* (2024), 18 19538
doi.org/10.1021/acsnano.4c02088
16. Coherent charge hopping suppresses photoexcited small polarons in ErFeO₃ by antiadiabatic formation mechanism. Y.-J. Kim, J. L. Mendes, Y. J. Choi, **S. K. Cushing**[†], *Science Advances* (2023), 10 (2023), DOI: 10.1126/sciadv.adk4282
17. Determining Quasi-Equilibrium Electron and Hole Distributions from Plasmonic Photocatalysts using Photomodulated X-ray Absorption Spectroscopy. L. D. Palmer, W. Lee, C. L. Dong, R.-S. Liu, N. Wu, **S. K. Cushing**[†] *ACS Nano* (2023), [doi/10.1021/acsnano.3c08181](https://doi.org/10.1021/acsnano.3c08181).
18. Time-resolved chemically selective spectroscopic investigation of the α -Fe₂O₃/Al redox reaction, J. S. Pelli Cresi, E. Principi, W. Lee, F. Bencivenga, D. De Angelis, L. Foglia, D. Garzella, G. Kurdi, M. Manfredda, N. Denys, A. Simoncig, **S. K. Cushing**[†], R. Mincigrucchi, C. Masciovecchio (2023), <https://doi.org/10.21203/rs.3.rs-3328823/v1>. *In Revision Nat. Comm.*
19. Direct confirmation of a pressure-induced electronic topological transition in cadmium, J. K. Hinton, D. Schacher, W. Lee, G. A. Smith, E. Siska, C. Park, P. B. Ellison, **S. K. Cushing**[†], C. Schwartz, K. V. Lawler, A. Salamat, *Physical Review B*. (2024, Just Accepted)
20. Measuring photoexcited electron and hole dynamics in ZnTe and modeling excited state core-valence effects in transient XUV reflection spectroscopy, H. Liu, J. M. Michelsen, J. L. Mendes, I. M. Klein, S. R. Bauers, J. M. Evans, Andriy Zakutayev, **S. K. Cushing**[†], *Journal of Physical Chemistry Letters* (2023), [10.1021/acs.jpcclett.2c03894](https://doi.org/10.1021/acs.jpcclett.2c03894)
21. Ab Initio Calculations of XUV Ground and Excited States for First-Row Transition Metal Oxides, I. M. Klein, A. Krotz, W. Lee, J. M. Michelsen, **S. K. Cushing**[†], *Journal of Physical Chemistry C* (2023), [10.1021/acs.jpcc.2c06548](https://doi.org/10.1021/acs.jpcc.2c06548) (**Invited Special Issue**)
22. Ab Initio Prediction of Excited State and Polaron Effects in Transient XUV Measurements of α -Fe₂O₃, I. M. Klein, H. Liu, D. Nimlos, A. Krotz, **S. K. Cushing**[†], *Journal of the American Chemical Society* (2022), 144, 12834.
23. Element-specific electronic and structural dynamics using transient X-ray spectroscopy, H. Liu, I. M. Klein, J. M. Michelsen, **S. K. Cushing**[†], *Chem*, 10 (2021), 2569-2584. (**Invited Perspective**)
24. Layer-Resolved Ultrafast XUV Measurement of Hole Transport in a Ni-TiO₂-Si Photoanode, **S. K. Cushing**[†], I. J. Porter, B. R. Lamoureux, A. Lee, B. M. Marsh, S. Szoke, M. E. Vaida, S. R. Leone, *Science Advances*, 6 (2020), eaay6650
25. Characterization of Carrier Cooling Bottleneck in Silicon Nanoparticles by Extreme Ultraviolet

(XUV) Transient Absorption Spectroscopy,
J. Porter, A. Lee, **S. K. Cushing**[†], H.-T. Chang, J. C. Ondry, A. P. Alivisatos, S. R. Leone, *J. Phys. Chem. C*, 125, 17 (2021), 9319–9329

26. Electron thermalization and relaxation in laser-heated nickel by few-femtosecond core-level transient absorption spectroscopy,
H.-T. Chang, A. Guggenmos, **S. K. Cushing**[†], Y. Cui, N. U. Din, S. R. Acharya, I. J. Porter, U. Kleineberg, V. Turkowski, T. S. Rahman, D. M. Neumark, S. R. Leone, *Physical Review B*, 103 (2020), 064305.
27. Transient extreme ultraviolet measurement of element-specific charge transfer dynamics in multiple-material junctions,
J. M. Michelsen, W. T. Denman, **S. K. Cushing**[†], *SPIE Photonics West*, 10926 (2019), 109262A.

Ultrafast Electron and Battery Spectroscopy:

28. Direct observation of Rh and La dopant positions in SrTiO₃ nanoparticles with atomic-scale electron microscopy. J. T. Mulvey, R. P. Prasad, Z. Chen, L. Palmer, B. Layne, K. Watanabe, M. Xu, A. Talin, X. Pan, A. Kudo, **S. K. Cushing**[†], S. Ardo, J. P. Patterson (2024)
29. Laser-driven ultrafast impedance spectroscopy for measuring complex ion hopping processes, K. H. Pham, **S. K. Cushing**[†] *Review of Scientific Instruments*, 95 (2024)
<https://doi.org/10.1063/5.0182323>
30. Many-body phonon-ion conduction in solid electrolyte driven by THz modes, K. H. Pham, K. Gordiz, J. M. Michelsen, H. Liu, D. Vivona, Y. Shao-Horn, A. Henry, K. A. See, **S. K. Cushing**[†] (2024), <https://arxiv.org/abs/2305.01632>.
31. Ultrafast Formation of Charge Transfer Trions at Molecular-Doped 2D MoS₂ Interfaces. Y. Jinga, K. Liangb, N. S. Muira, H. Zhou, Z. Lib, J. M. Palasza, J. Sorbiea, C. Wanga, **S. K. Cushing**[†], C. P. Kubiak, Z. Sofer, S. Li, W. Xiong. *Angew. Chem. Int. Ed. Engl.* (2024)
DOI:10.1002/anie.202405123
32. Using Electron Energy-Loss Spectroscopy to Measure Nanoscale Electronic and Vibrational Dynamics in a TEM, Y.-J. Kim, L. D. Palmer, W. Lee, N. J. Heller, **S. K. Cushing**[†], *Journal Chemical Physics*, 159 (2023), 050901 (**Cover Article**)
33. Molecular hot spots in surface-enhanced Raman scattering,
M. Li*, **S. K. Cushing**^{*†}, G. Zhou, N. Wu, *Nanoscale*, 12 (2020), 22036 (**2020 Hot Paper**)
34. Plasmonic hot carriers skip out in femtoseconds,
S. K. Cushing[†], *Nature Photonics*, 11 (2017), 745
-Invited News and Views

Not as a Principal Investigator

*two bolded names indicate shared first authorship

Transient X-Ray Spectroscopy:

35. Differentiating Photoexcited Carrier and Phonon Dynamics in the Δ , L, and Γ Valleys of Si(100) with Transient Extreme Ultraviolet Spectroscopy,

- S. K. Cushing**, A. Lee, I. J. Porter, L. M. Carneiro, M. Zürich, H.-T. Chang, S. R. Leone, *Journal of Physical Chemistry C*, 123 (2019), 3343-3352.
36. Retrieval of the complex-valued refractive index of germanium near the M4,5 absorption edge, C. J. Kaplan, P. M. Kraus, E. M. Gullikson, L. J. Borja, **S. K. Cushing**, M. Zürich, H.T. Chang, D. M. Neumark, S. R. Leone, *Journal of the Optical Society of America B*, 36 (2019), 1716-1720.
37. Hot Phonon and Carrier Relaxation in Si(100) Determined by Transient Extreme Ultraviolet Spectroscopy,
S. K. Cushing, M. Zürich, P. M. Kraus, L. M. Carneiro, A. Lee, H.-T. Chang, C. J. Kaplan, S. R. Leone, *Structural Dynamics*, 5 (2018), 054302.
- Featured Article
38. Photoexcited Small Polaron Formation in Goethite (α -FeOOH) Nanorods Probed by Transient Extreme Ultraviolet Spectroscopy,
I. J. Porter, **S. K. Cushing**, L. M. Carneiro, A. Lee, J. C. Ondry, J. C. Dahl, H. T. Chang, A. P. Alivisatos, S. R. Leone, *Journal of Physical Chemistry Letters*, 9 (2018), 4120-4124.
39. The Ultrafast X-ray Spectroscopic Revolution in Chemical Dynamics,
P. M. Kraus, M. Zürich, **S. K. Cushing**, D. M. Neumark, S. R. Leone, *Nature Reviews Chemistry*, 2 (2018), 82.
- Invited Review
40. Femtosecond tracking of carrier relaxation in Germanium with extreme ultraviolet transient reflectivity,
C. J. Kaplan, P. M. Krauss, A. D. Ross, M. Zürich, **S. K. Cushing**, M. F. Jager, H.T. Chang, E. M. Gullikson, D. M. Neumark, S. R. Leone, *Physical Review B*, 97 (2018), 205202.
41. Excitation wavelength dependent small polaron trapping of photoexcited carriers in α -Fe₂O₃,
L. M. Carneiro*, **S. K. Cushing***, C. Liu, Y. Su, P. Yang, A. P. Alivisatos, S. R. Leone, *Nature Materials* 16 (2017), 819.
42. Direct and simultaneous observation of ultrafast electron and hole dynamics in germanium,
M. Zürich, H.-T. Chang, L. J. Borja, P. M. Kraus, **S. K. Cushing**, A. Gandman, C. J. Kaplan, M. H. Oh, J. S. Prell, D. Prendergast, C. D. Pemmaraju, D. M. Neumark, S. R. Leone, *Nature Communications* 8 (2017), 15734.
43. Ultrafast carrier thermalization and trapping in silicon-germanium alloy probed by extreme ultraviolet transient absorption spectroscopy,
M. Zürich, H.-T. Chang, P. M. Kraus, **S. K. Cushing**, L. J. Borja, A. Gandman, C. J. Kaplan, M. H. Oh, J. S. Prell, D. Prendergast, C. D. Pemmaraju, D. M. Neumark, S. R. Leone, *Structural Dynamics*, 4 (2017), 044029.
44. Measuring the Surface Photovoltage of a Schottky Barrier Under Intense Light Conditions: Zn/p-Si(100) by Laser Time-Resolved Extreme Ultraviolet Photoelectron Spectroscopy,
B. M. Marsh, M. E. Vaida, **S. K. Cushing**, B. R. Lamoureux, S. R. Leone, *Journal of Physical Chemistry C*, 121 (2017) 21904.
45. Valley-dependent carrier and lattice dynamics in silicon measured by transient XUV spectroscopy,
S. K. Cushing, L. M. Carneiro, M. Zürich, P. M. Kraus, C. J. Kaplan, H. T. Chang, S. R. Leone,

CLEO: Applications and Technology, ATH3C-5 (2017).

Plasmonics:

46. Plasmonic hot carriers skip out in femtoseconds,
S. K. Cushing, *Nature Photonics*, 11 (2017), 745
-Invited News and Views
47. Tunable Nonthermal Distribution of Hot Electrons in a Semiconductor Injected from a Plasmonic Gold Nanostructure,
S. K. Cushing, C. J. Chen, C. L. Dong, X. T. Kong, A. O. Govorov, R. S. Liu, N. Wu, *ACS Nano*, 12 (2018), 7117.
48. Progress and Perspectives of Plasmon-Enhanced Solar Energy Conversion,
S. K. Cushing and N. Wu, *Journal Physical Chemistry Letters*, 7 (2016), 666-675.
- Invited Perspective, Journal Front Cover
49. Distinguishing surface effects of gold nanoparticles from plasmonic effect on photoelectrochemical water splitting by hematite,
J. Li, **S. K. Cushing**, D. Chu, P. Zheng, J. Bright, C. Castle, A. Manivannan, N. Q. Wu, *Journal of Materials Research*, 31 (2016), 1608-1615.
50. Investigation of Plasmonic Effect in Air-processed PbS/CdS Core-shell Quantum Dot based Solar Cells
B. A. Gonfa, M. R. Kim, P. Zheng, **S. K. Cushing**, Q. Qiao, N. Wu, M. A. El Khakani and D. Ma, *Journal of Materials Chemistry A*, 4 (2016), 13071-13080.
51. Plasmon-induced resonance energy transfer for solar energy conversion,
J. Li*, **S. K. Cushing***, F. Meng, T. R. Senty, A. D. Bristow, N. Wu, *Nature Photonics*, 9 (2015), 601-607.
- Featured at Ars Technica
52. Theoretical maximum efficiency of solar energy conversion in plasmonic metal-semiconductor heterojunctions,
S. K. Cushing, A. D. Bristow, N. Wu, *Phys. Chem. Chem. Physics*, 17 (2015), 30010-30022.
53. Controlling Plasmon-Induced Resonance Energy Transfer and Hot Electron Injection Processes in Metal@TiO₂ Core-Shell Nanoparticles,
S. K. Cushing, J. Li, J. Bright, B. Yost, P. Zheng, A. D. Bristow, N. Wu, *Journal Physical Chemistry C*, 119 (2015), 16239–16244.
54. Above and Below Band Edge Light Recovery with Plasmonics,
S. K. Cushing, J. Li, A. D. Bristow, N. Q. Wu, *SPIE Proceedings Photonic West*, (2015), 935811.
- Green Photonics Best Paper Award
55. Solar Hydrogen Generation by a CdS-Au-TiO₂ Sandwich Nanorod Array Enhanced with Au Nanoparticle as Electron Relay and Plasmonic Photosensitizer,
J. Li*, **S. K. Cushing***, P. Zheng, T. Senty, F. Meng, A. D. Bristow, A. Manivannan, N. Q. Wu, *Journal of the American Chemical Society*, 136 (2014), 8438–8449.

56. Plasmon-induced photonic and energy transfer enhancement of solar water splitting by a hematite nanorod array,
J. Li*, **S. K. Cushing***, P. Zheng, F. Meng, D. Chu, N. Q. Wu, *Nature Communications*, 4 (2013), 2651.
57. Asymmetric silver “nanocarrot” structures: solution synthesis and their asymmetric plasmonic resonances, H. Liang, D. Rossouw, H. Zhao, **S. K. Cushing**, H. Shi, A. Korinek, H. Xu, F. Rosei, W. Wang, N. Q. Wu, G. A. Botton, D. Ma, *Journal of the American Chemical Society*, 135 (2013), 9616-9619.
58. Ag@Cu₂O core-shell nanoparticles as visible-light plasmonic photocatalysts,
J. Li*, **S. K. Cushing***, J. Bright, F. Meng, T. R. Senty, P. Zheng, A. D. Bristow, N. Q. Wu, *ACS Catalysis*, 3(2013), 47-51
59. Photocatalytic activity enhanced by plasmonic resonant energy transfer from metal to semiconductor,
S. K. Cushing, J. Li, F. Meng, T. R. Senty, S. Suri, M. Zhi, M. Li, A. D. Bristow, N. Q. Wu, *Journal of the American Chemical Society*, 134 (2012), 15033–15041.
60. Size-dependent energy transfer between CdSe/ZnS quantum dots and gold nanoparticles,
M. Li, **S. K. Cushing**, Q. Wang, X. Shi, L. A. Hornak, Z. Hong, N. Q. Wu, *The Journal of Physical Chemistry Letters*, 2 (2011), 2125–2129.
61. Origin of localized surface plasmon resonances in thin silver film over nanosphere patterns,
S. K. Cushing, L. A. Hornak, J. Lankford, Y. Liu, N. Q. Wu, *Applied Physics A*, 103 (2011), 955-958.

Semiconductor Photocatalysis:

62. Effects of Defects on Photocatalytic Activity of Hydrogen-Treated Titanium Oxide Nanobelts,
S. K. Cushing, F. Meng, J. Zhang, B. Ding, C. K. Chen, C. J. Chen, R. S. Liu, A. D. Bristow, J. Bright, P. Zheng, and N. Wu, *ACS Catalysis*, 7 (2017), 1742-1748.
63. Inverting Transient Absorption Data to Determine Transfer Rates in Quantum Dot–TiO₂ Heterostructures, **T. R. Senty***, **S. K. Cushing***, C. Wang, C. Matranga, A. D. Bristow, *Journal of Physical Chemistry C*, 119 (2015), 6337–6343.
64. Enhancement of Solar Hydrogen Generation by Synergistic Interaction of La₂Ti₂O₇ Photocatalyst with Plasmonic Gold Nanoparticles and Reduced Graphene Oxide Nanosheets,
F. Meng, **S. K. Cushing**, J. Li, S. Hao, N. Wu, *ACS Catalysis*, 5 (2015), 1949-1955.
65. Investigation of band gap narrowing in nitrogen-doped La₂Ti₂O₇ with transient absorption spectroscopy,
B. T. Yost, **S. K. Cushing**, F. Meng, J. Bright, D. A. Bas, N. Q. Wu and A. D. Bristow, *Physical Chemistry Chemical Physics*, 17 (2015), 31039-31043.
66. Band gap narrowing in nitrogen-doped La₂Ti₂O₇ predicated by density-functional theory calculation,
J. Zhang, W. Dang, Z. Ao, **S. K. Cushing**, N. Q. Wu, *Physical Chemistry Chemical Physics*, 17 (2015), 8994-9000.

67. Solar hydrogen generation by nanoscale p-n junction of p-type molybdenum disulfide/n-type nitrogen-doped reduced graphene oxide,
F. Meng, J. Li, **S. K. Cushing**, M. Zhi, N. Q. Wu, *Journal of the American Chemical Society*, 135 (2013), 10286-10289.
68. Photocatalytic hydrogen generation enhanced by band gap narrowing and improved charge carrier mobility in AgTaO₃ by compensated co-doping,
M. Li, J. Zhang, W. Dang, **S. K. Cushing**, D. Guo, N. Q. Wu, P. Yin, *Physical Chemistry Chemical Physics*, 15 (2013), 16220-16226.
69. Photocatalytic water oxidation by hematite/reduced graphene oxide composites,
F. Meng, J. Li, **S. K. Cushing**, J. Bright, M. Zhi, J. Rowley, Z. Hong, A. Manivannan, A. D. Bristow, N. Q. Wu, *ACS Catalysis*, 3 (2013), 746.

Plasmonic Sensors:

70. A Surface-Enhanced Raman Scattering Sensor Integrated with Battery-Controlled Fluidic Device for Capture and Detection of Trace Small Molecules
Q. Zhou, G. Meng, P. Zheng, **S. K. Cushing**, N. Wu, Q. Huang, C. Zhu, Z. Zhang, Z. Wang, *Scientific Reports*, 5 (2015), 1-10.
71. A Gold Nanohole Array Based Surface-Enhanced Raman Scattering (SERS) Biosensor for Detection of Ag(I) and Mercury(II) in Human Saliva,
P. Zheng, M. Li, R. Jurevic, **S. K. Cushing**, Y. Liu, N. Wu, *Nanoscale*, 7 (2015), 11005-11012.
- **“Hot Article” List Nanotechnology**
72. Tailoring plasmonic properties of gold nanohole arrays for surface-enhanced Raman scattering,
P. Zheng, **S. K. Cushing**, S. Suri, N. Wu, *Physical Chemistry Chemical Physics*, 17 (2015), 21211-21219. - **Invited Theme Issue Article**
73. Plasmon-enhanced optical sensors: a review,
M. Li, **S. K. Cushing**, N. Q. Wu, *Analyst*, 140 (2014), 386-406.
- **Invited Critical Review**
74. Three-dimensional hierarchical plasmonic nano-architecture enhanced surface-enhanced Raman scattering immuno-sensor for cancer biomarker detection in blood plasma,
M. Li, **S. K. Cushing**, J. Zhang, S. Suri, R. Evans, W. P. Petros, L. F. Gibson, D. Ma, Y. Liu, and N. Q. Wu, *ACS Nano*, 7 (2013), 4967-4976.
75. Plasmonic nanorice antenna on triangle nano-array for surface-enhanced Raman scattering detection of hepatitis B virus DNA,
M. Li, **S. K. Cushing**, H. Liang, S. Suri, D. Ma, N. Q. Wu, *Analytical Chemistry*, 85 (2013), 2072.
76. Shape-dependent surface-enhanced Raman scattering in gold-Raman-probe-silica sandwiched nanoparticles for biocompatible applications,
M. Li, **S. K. Cushing**, J. Zhang, J. Lankford, Z. P. Aguilar, D. Ma, N. Q. Wu, *Nanotechnology*, 23 (2012), 115501.
- **Nanotechnology: Best of 2012 Selection**
- **Nanotechnology Weekly by VerticalNews**

77. Electrodeposition of Poly(phenylene oxide) Nanoscale Patterns with Nanosphere Lithography, J. Kang, H. Li, **S. K. Cushing**, J. Wang, and N. Wu, *ECS Trans.*, 19 (2009), 159.

Fluorescence Mechanisms:

78. Excitation Wavelength Dependent Fluorescence of Graphene Oxide Controlled by Strain, **S. K. Cushing**, W. Ding, G. Chen, C. Wang, F. Yang, F. Huang, and N. Wu, *Nanoscale*, 9 (2017), 2240-2245
79. Origin of strong excitation wavelength dependent fluorescence of graphene oxide, **S. K. Cushing**, J. Li, F. Huang, N. Q. Wu, *ACS Nano*, 8 (2014), 1002-1013.
80. Photoluminescence spectroscopy of YVO₄:Eu³⁺ nanoparticles with aromatic linker molecules: A precursor to biomedical functionalization, T. R. Senty, M. Yalamanchi, Y. Zhang, **S. K. Cushing**, M. S. Seehra, X. Shi, A. D. Bristow, *Journal of Applied Physics*, 115 (2014), 163107.
81. Fingerprinting photoluminescence of functional groups in graphene oxide, M. Li, **S. K. Cushing**, X. Zhou, S. Guo and N. Q. Wu, *Journal of Materials Chemistry*, 22 (2012), 23374-23379.