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APPOINTMENTS AND EXPERIENCE

Associate Professor, Washington University in St. Louis 2022 – present
Preston M. Green Department of Electrical and Systems Engineering
Affiliate of the Department of Biomedical Engineering;
the DBBS Biochemistry, Biophysics, and Structural Biology Program; and
the Institute of Materials Science & Engineering.
Member of the Center for Biomolecular Condensates and
the Center for Quantum Leaps.

Associate Chair of Academic Affairs, Washington University in St. Louis 2022 – present
Preston M. Green Department of Electrical and Systems Engineering

Assistant Professor, Washington University in St. Louis 2015 – 2022
Preston M. Green Department of Electrical and Systems Engineering

Postdoctoral Scholar, Stanford University School of Medicine 2014 – 2015
Department of Structural Biology
Molecular Imaging: Speckle-Modulating Optical Coherence Tomography
Research Advisor: Adam de la Zerda

Research Intern, Google[x] 2014
Mountain View, CA

Student Intern, Southwest Research Institute 2004, 2005
San Antonio, TX

EDUCATION

Ph.D. in Electrical Engineering, 4.0 GPA 2015
Stanford University
Engineering New Capabilities into Optical Microscopes: Toward Measuring the Three-Dimensional Position and Orientation of Single Molecules in Living Cells
Research Advisor: W. E. Moerner

M.S. in Electrical Engineering, 3.9 GPA 2010
Stanford University

B.S. with Honor in Electrical Engineering, 4.0 GPA 2008
California Institute of Technology
Quantitative Differential Phase Imaging and Phase Reconstruction
Research Advisor: Changhuei Yang

AWARDS AND RECOGNITIONS

Outstanding Faculty Award, *Washington University Graduate Student Senate*	2023
Senior Member, Class of 2021, *Optica, formerly OSA*	2021
Scialog: Advancing Bioimaging Fellow	2021
Excellence in Teaching Award, *Emerson Electric Co.*	2020
Outstanding Teaching Award, *Washington University Department of Electrical and Systems Engineering*	2020
Full Membership Inductee, *Sigma Xi, The Scientific Research Honor Society*	2020
National Science Foundation CAREER Award	2017-2022
Hiruma/Wagner Award, *16th Conference of Peace through Mind/Brain Science*	2016
Winner of 2015 After Image Photo Contest, *Optics & Photonics News*	2015
Second Place Poster Award, Gordon Research Conferences: Single-Molecule Approaches to Biology	2012
Stanford Bio-X Travel Award	2010, 2011
PicoQuant Young Investigator Award	2010
National Science Foundation Graduate Research Fellowship	2008
Newport-Spectra Physics Research Excellence Award	2008
Stanford Graduate Fellowship, 3Com Corporation Fellow	2008
Tau Beta Pi Fellow No. 762	2008
Graduation with Honor, California Institute of Technology	2008
Caltech Carnation Merit Award	2007
Caremark Rx Scholarship	2006, 2007
Tau Beta Pi Scholarship	2007
Inductee, *Tau Beta Pi, The Engineering Honor Society*	2007
Caltech Summer Undergraduate Research Fellowship, Rita A. and Φistein Skjellum Fellow	2006
Caltech Perpall Speaking Competition Finalist	2006
College Board National Advanced Placement Scholar	2004
MasterCard Alamo Bowl Scholarship	2004
National Merit Scholarship	2004

PUBLICATIONS (H-INDEX: 27, I10-INDEX: 42 VIA GOOGLE SCHOLAR, SEE ARTICLES AND METRICS HERE)

*equal contribution, [+]co-corresponding authors, †cover article, ‡editor's pick/hot paper

Refereed Publications

40.† W. Zhou, T. Wu, and **M. D. Lew**, "Fundamental Limits in Measuring the Anisotropic Rotational Diffusion of Single Molecules," *J. Phys. Chem. A* **128**, 5808 (2024). [Journal cover, Open Scholarship, Article, Data]

39. B. Sun, T. Ding, W. Zhou, T. S. Porter, and **M. D. Lew**, "Single-Molecule Orientation Imaging Reveals the Nano-Architecture of Amyloid Fibrils Undergoing Growth and Decay," *Nano Lett.* **24**, 7276 (2024). [The Source - Washington University, EurekAlert!, Open Scholarship, Article, Data]

38. M. R. King, K. M. Ruff, A. Z. Lin, A. Pant, M. Farag, J. M. Lalmansingh, T. Wu, M. J. Fossat, W. Ouyang, **M. D. Lew**, E. Lundberg, M. D. Vahey, and R. V. Pappu, "Macromolecular condensation organizes nucleolar sub-phases to set up a pH gradient," *Cell* **187**, 1889 (2024). [The Source - Washington University, EurekAlert!, Article]

37.† W. Zhou, C. L. O'Neill, T. Ding, O. Zhang, J. S. Rudra, and **M. D. Lew**, "Resolving the Nanoscale Structure of β-Sheet Peptide Self-Assemblies Using Single-Molecule Orientation–Localization Microscopy," *ACS Nano* **18**, 8798 (2024). [Journal cover, The Source - Washington University, EurekAlert!, Open Scholarship, Article]

36.† J. Lu and **M. D. Lew**, "Single-molecule electrochemical imaging resolves the midpoint potentials of individual fluorophores on nanoporous antimony-doped tin oxide," *Chem. Sci.* **15**, 2037 (2024). [Journal cover, Article]

35. O. Zhang, Z. Guo, Y. He, T. Wu, M. D. Vahey, and **M. D. Lew**, "Six-dimensional single-molecule imaging with isotropic resolution using a multi-view reflector microscope," *Nat. Photon.* **17**, 179 (2023). [The Source - Washington University, Open Scholarship, Article]

34.‡ J. M. Jusuf and **M. D. Lew**, "Towards optimal point spread function design for resolving closely spaced emitters in three dimensions," *Opt. Express* **30**, 37154 (2022). [Article]

33. T. Wu, P. Lu, M. A. Rahman, X. Li, and **M. D. Lew**, "Deep-SMOLM: deep learning resolves the 3D orientations and 2D positions of overlapping single molecules with optimal nanoscale resolution," *Opt. Express* **30**, 36761 (2022). [McKelvey Engineering News, Article]

32. M. Shen, T. Ding, C. Tan, W. H. Rackers, D. Zhang, **M. D. Lew**, and B. Sadtler, "In Situ Imaging of Catalytic Reactions on Tungsten Oxide Nanowires Connects Surface–Ligand Redox Chemistry with Photocatalytic Activity," *Nano Lett.* **22**, 4694 (2022). [NSF-PAR, Article]

31. T. Wu, J. Lu, and **M. D. Lew**, "Dipole-spread-function engineering for simultaneously measuring the 3D orientations and 3D positions of fluorescent molecules," *Optica* **9**, 505 (2022). [The Source - Washington University, Article]

30. O. Zhang, W. Zhou, J. Lu, T. Wu, and **M. D. Lew**, "Resolving the three-dimensional rotational and translational dynamics of single molecules using radially and azimuthally polarized fluorescence," *Nano Lett.* **22**, 1024 (2022). [The Source - Washington University, Open Scholarship, Article]

29.† T. Ding and **M. D. Lew**, "Single-molecule localization microscopy of 3D orientation and anisotropic wobble using a polarized vortex point spread function," *J. Phys. Chem. B* **125**, 12718 (2021). [Journal cover, The Source - Washington University, EurekAlert!, Article]

28. M. Shen, T. Ding, W. H. Rackers, C. Tan, K. Mahmood, **M. D. Lew**, and B. Sadtler, "Single-molecule colocalization of redox reactions on semiconductor photocatalysts connects surface heterogeneity and charge-carrier separation in bismuth oxybromide," *J. Am. Chem. Soc.* **143**, 11393 (2021). [Article]

27.‡ O. Zhang and **M. D. Lew**, "Single-molecule orientation localization microscopy II: a performance comparison," *J. Opt. Soc. Am. A* **38**, 288 (2021). [Article]

26. O. Zhang and **M. D. Lew**, "Single-molecule orientation localization microscopy I: fundamental limits," *J. Opt. Soc. Am. A* **38**, 277 (2021). [Article]

25. H. Mazidi, T. Ding, A. Nehorai, and **M. D. Lew**, "Quantifying accuracy and heterogeneity in single-molecule super-resolution microscopy," *Nat. Commun.* **11**, 6353 (2020). [The Source - Washington University, EurekAlert!, Article]

24.†‡J. Lu, H. Mazidi, T. Ding, O. Zhang, and **M. D. Lew**, "Single-Molecule 3D Orientation Imaging Reveals Nanoscale Compositional Heterogeneity in Lipid Membranes," *Angew. Chem. Int. Ed.* **59**, 17572 (2020). [Journal cover, The Source - Washington University, The Analytical Scientist, EurekAlert!, Article]

23. O. Zhang and **M. D. Lew**, "Quantum limits for precisely estimating the orientation and wobble of dipole emitters," *Phys. Rev. Research* **2**, 033114 (2020). [Article]

22. M. Shen, T. Ding, J. Luo, C. Tan, K. Mahmood, Z. Wang, D. Zhang, R. Mishra, **M. D. Lew**, and B. Sadtler, "Competing Activation and Deactivation Mechanisms in Photodoped Bismuth Oxybromide Nanoplates Probed by Single-Molecule Fluorescence Imaging," *J. Phys. Chem. Lett.* **11**, 5219 (2020). [Article]

21. T. Ding*, T. Wu*, H. Mazidi, O. Zhang, and **M. D. Lew**, "Single-molecule orientation localization microscopy for resolving structural heterogeneities between amyloid fibrils," *Optica* **7**, 602 (2020). [OSA news release, The Source - Washington University, EurekAlert!, Photonics Media, Article]

20. M. Shen*, T. Ding*, S. T. Hartman, F. Wang, C. Krucylak, Z. Wang, C. Tan, B. Yin, R. Mishra, **M. D. Lew**$^{+}$, and B. Sadtler^{+}, "Nanoscale Colocalization of Fluorogenic Probes Reveals Role of Oxygen Vacancies in the Photocatalytic Activity of Tungsten Oxide Nanowires," *ACS Catal.* **10**, 2088 (2020). [Article]

19. H. Mazidi, E. S. King, O. Zhang, A. Nehorai, and **M. D. Lew**, "Dense Super-Resolution Imaging of Molecular Orientation via Joint Sparse Basis Deconvolution and Spatial Pooling," *2019 IEEE 16th International Symposium on Biomedical Imaging (ISBI 2019)*, 325 (2019). [Article]
18. O. Zhang and **M. D. Lew**, "Fundamental Limits on Measuring the Rotational Constraint of Single Molecules using Fluorescence Microscopy," *Phys. Rev. Lett.* **122**, 198301 (2019). [The Source - Washington University, Article]
17. H. Mazidi, J. Lu, A. Nehorai, and **M. D. Lew**, "Minimizing Structural Bias in Single-Molecule Super-Resolution Microscopy," *Sci. Rep.* **8**, 13133 (2018). [Article]
16.† D. Maji, J. Lu, P. Sarder, A. H. Schmieder, G. Cui, X. Yang, D. Pan, **M. D. Lew,** S. Achilefu, and G. M. Lanza, "Cellular Trafficking of Sn-2 Phosphatidylcholine Prodrugs Studied with Fluorescence Lifetime Imaging and Super-resolution Microscopy," *Prec. Nanomed.* **1**, 128 (2018). [Journal cover, Article]
15.† K. Spehar*, T. Ding*, Y. Sun, N. Kedia, J. Lu, G. R. Nehass, **M. D. Lew**⁺, and J. Bieschke⁺, "Super-resolution imaging of amyloid structures over extended times using transient binding of single thioflavin T molecules," *ChemBioChem* **19**, 1944 (2018). [Journal cover, The Source - Washington University, NSF Science360, Futurity, EurekAlert!, OSA News Release, Article]
14. O. Zhang, J. Lu, T. Ding, and **M. D. Lew**, "Imaging the three-dimensional orientation and rotational mobility of fluorescent emitters using the Tri-spot point spread function," *Appl. Phys. Lett.* **113**, 031103 (2018). [Article]
    Correction: *Appl. Phys. Lett.* **115**, 069901 (2019). [Article]
13. O. Liba, **M. D. Lew,** E. D. SoRelle, R. Dutta, D. Sen, D. M. Moshfeghi, S. Chu, and A. de la Zerda, "Speckle-modulating optical coherence tomography in living mice and humans," *Nat. Commun.* **8**, 15845 (2017).
    -- Featured in *Nat. Methods* **14**, 767 (2017): "Research Highlights: Methods in Brief."
12.† A. von Diezmann, M. Y. Lee, **M. D. Lew,** and W. E. Moerner, "Correcting field-dependent aberrations with nanoscale accuracy in three-dimensional single-molecule localization microscopy," *Optica* **2**, 985 (2015).
11. **M. D. Lew** and W. E. Moerner, "Azimuthal polarization filtering for accurate, precise, and robust single-molecule localization microscopy," *Nano Lett.* **14**, 6407 (2014).
10. A. S. Backer, M. P. Backlund, **M. D. Lew**, and W. E. Moerner, "Single-molecule orientation measurements with a quadrated pupil," *Opt. Lett.* **38**, 1521 (2013).
9.† **M. D. Lew***, M. P. Backlund*, and W. E. Moerner, "Rotational mobility of single molecules affects localization accuracy in super-resolution fluorescence microscopy," *Nano Lett.* **13**, 3967 (2013).
8. M. P. Backlund*, **M. D. Lew***, A. S. Backer, S. J. Sahl, G. Grover, A. Agrawal, R. Piestun, and W. E. Moerner, "Simultaneous, accurate measurement of the 3D position and orientation of single molecules," *Proc. Natl. Acad. Sci. USA* **109**, 19087 (2012).
    -- Featured in *Nat. Methods* **10**, 13 (2013): "Research Highlights: Methods in Brief."
7.† H-L. D. Lee*, S. J. Sahl*, **M. D. Lew**, and W. E. Moerner, "The double-helix microscope super-resolves extended biological structures by localizing single blinking molecules in three dimensions with nanoscale precision," *Appl. Phys. Lett.* **100**, 153701 (2012).
6. **M. D. Lew***, S. F. Lee*, J. L. Ptacin, M. K. Lee, R. J. Twieg, L. Shapiro, and W. E. Moerner, "Three-dimensional superresolution colocalization of intracellular protein superstructures and the cell surface in live *Caulobacter crescentus*," *Proc. Natl. Acad. Sci. USA* **108**, E1102 (2011).
5. **M. D. Lew**, S. F. Lee, M. Badieirostami, and W. E. Moerner, "Corkscrew point spread function for far-field three-dimensional nanoscale localization of pointlike objects," *Opt. Lett.* **36**, 202 (2011).
4. M. Badieirostami, **M. D. Lew**, M. A. Thompson, and W. E. Moerner, "Three-dimensional localization precision of the double-helix point spread function versus astigmatism and biplane," *Appl. Phys. Lett.* **97**, 161103 (2010).
3. M. A. Thompson*, **M. D. Lew***, M. Badieirostami, and W. E. Moerner, "Localizing and tracking single nanoscale emitters in three dimensions with high spatiotemporal resolution using a double-helix point spread function," *Nano Lett.* **10**, 211 (2010).
2. X. Cui, **M. Lew**, and C. Yang, "Quantitative differential interference contrast microscopy based on structured-aperture interference," *Appl. Phys. Lett.* **93**, 091113 (2008).

1. **M. Lew**, X. Cui, X. Heng, and C. Yang, "Interference of a four-hole aperture for on-chip quantitative two-dimensional differential phase imaging," *Opt. Lett.* **32**, 2963 (2007).

Review Articles and Book Chapters

5. T. Wu and **M. D. Lew**, "Dipole-Spread Function Engineering for Six-Dimensional Super-Resolution Microscopy," in Coded Optical Imaging (ed. J. Liang), 207 (Springer, 2024). [Chapter]
4. **M. D. Lew**, "Computational Modelling Enables Robust Multidimensional Nanoscopy," in Computational Modeling: From Chemistry to Materials to Biology (eds. K. Wüthrich, B. Weckhuysen, L. Rongy, and A. De Wit), 189 (World Scientific, 2021). [Article]
3. **M. D. Lew**, S. F. Lee, M. A. Thompson, H-L. D. Lee, and W. E. Moerner, "Single-molecule photocontrol and nanoscopy," in Far-Field Optical Nanoscopy (eds. P. Tinnefeld, C. Eggeling, and S. W. Hell) **14**, 87 (Springer-Verlag, 2015).
2. M. P. Backlund, **M. D. Lew**, A. S. Backer, S. J. Sahl, and W. E. Moerner, "The role of molecular dipole orientation in single-molecule fluorescence microscopy and implications for super-resolution imaging," *ChemPhysChem* **15**, 587 (2014).
1. M. A. Thompson, **M. D. Lew**, and W. E. Moerner, "Extending microscopic resolution with single-molecule imaging and active control," *Annu. Rev. Biophys.* **41**, 321 (2012).

Other Publications

20. E. Eshelman, M. Willis, C. Foreman, J. Michels, A. Cerrud, L. Schattner, G. Singh, D. Van Hoesen, W. Medina, T. Carlson, and **M. D. Lew**, "PERISCOPE: Detecting and Mapping Organic Compounds in the Near Subsurface," *2024 IEEE Aerospace Conference,* 1 (2024). doi:10.1109/AERO58975.2024.10521317
19. T. Wu, W. Zhou, J. S. Rudra, R. V. Pappu, and **M. D. Lew**, "6D single-fluorogen orientation-localization microscopy for elucidating the architecture of beta-sheet assemblies and biomolecular condensates," *Proc. SPIE* **12853**, 1285302 (2024).
18. **M. D. Lew**, "Can a Computer Help Make a Better Camera?" *NewScience*, 6 (Summer 2022).
17. J. S. Biteen, **M. D. Lew**, and K. A. Willets, "Tribute to W. E. Moerner," *J. Phys. Chem. B* **126**, 1157 (2022).
16. T. Ding and **M. D. Lew**, "Elucidating the nanoscale architecture of amyloid aggregates using a polarized donut point spread function," *Microsc. Microanal.* **27 (S1)**, 1428 (2021).
15. T. Wu, J. Lu, and **M. D. Lew**, "pixOL: pixel-wise point spread function engineering for measuring the 3D orientation and 3D location of dipole-like emitters," *Microsc. Microanal.* **27 (S1)**, 858 (2021).
14. T. Wu, T. Ding, H. Mazidi, O. Zhang, and **M. D. Lew**, "A computationally-efficient bound for the variance of measuring the orientation of single molecules," *Proc. SPIE* **11246**, 1124616 (2020).
13. H. Mazidi, T. Ding, A. Nehorai, and **M. D. Lew**, "Measuring localization confidence for quantifying accuracy and heterogeneity in single-molecule super-resolution microscopy," *Proc. SPIE* **11246**, 1124611 (2020).
12. O. Zhang and **M. D. Lew**, "Fundamental limits of measuring single-molecule rotational mobility," *Proc. SPIE* **10884**, 1088412 (2019).
11. T. Ding, K. Spehar, J. Bieschke, and **M. D. Lew**, "Long-term, super-resolution imaging of amyloid structures using transient amyloid binding microscopy," *Proc. SPIE* **10884**, 108840J (2019).
10. O. Liba, **M. D. Lew,** E. D. SoRelle, R. Dutta, D. Sen, D. M. Moshfeghi, S. Chu, and A. de la Zerda, "Speckle-modulation for speckle reduction in optical coherence tomography," *Proc. SPIE* **10483**, 104832D (2018).
9. H. Mazidi, A. Nehorai, and **M. D. Lew**, "A robust statistical estimation (RoSE) algorithm jointly recovers the 3D location and intensity of single molecules accurately and precisely," *Proc. SPIE* **10500**, 105000E (2018).
8. O. Zhang, T. Ding, J. Lu, H. Mazidi, and **M. D. Lew**, "Measuring 3D molecular orientation and rotational mobility using a Tri-spot point spread function," *Proc. SPIE* **10500**, 105000B (2018).
7. A. S. Backer, M. P. Backlund, **M. D. Lew**, A. R. Diezmann, S. J. Sahl, and W. E. Moerner, "Single-molecule orientation measurements with a quadrated pupil," *Proc. SPIE* **8950**, 89500L (2014).

6. **M. D. Lew***, A. R. S. von Diezmann*, and W. E. Moerner, "Easy-DHPSF open-source software for three-dimensional localization of single molecules with precision beyond the optical diffraction limit," *Protocol Exchange* (2013). DOI: 10.1038/protex.2013.026
5. M. P. Backlund*, **M. D. Lew***, A. S. Backer, S. J. Sahl, G. Grover, A. Agrawal, R. Piestun, and W. E. Moerner, "The double-helix point spread function enables precise and accurate measurement of 3D single-molecule localization and orientation," *Proc. SPIE* **8590**, 85900L (2013).
4. **M. D. Lew**, M. A. Thompson, M. Badieirostami, and W. E. Moerner, "*In vivo* three-dimensional superresolution fluorescence tracking using a double-helix point spread function," *Proc. SPIE* **7571**, 75710Z (2010).
3. **M. Lew**, X. Cui, X. Heng, and C. Yang, "Two-dimensional differential interference contrast microscopy based on four-hole variation of Young's interference," *Proc. SPIE* **6859**, 685916 (2008).
2. X. Cui, **M. Lew**, X. Heng, and C. Yang, "On-chip differential interference contrast (DIC) phase imager and beam profiler based on Young's interference," *Proc. SPIE* **6441**, 64411F (2007).
1. **M. Lew**, X. Cui, and C. Yang, "Measuring the phase of light," *Caltech Undergraduate Research Journal* **6**, 18 (2007).

PATENTS

7. **M. D. Lew** and T. Wu inventors. Washington University, assignee. "Pixel-Wise Point Spread Function Engineering Systems and Methods," United States Patent 11994470 B2 (2024). [USPTO PDF, Global Dossier]
6. **M. D. Lew**, A. Nehorai, and H. Mazidisharfabadi, inventors. Washington University, assignee. "Methods for Quantifying and Enhancing Accuracy in Microscopy Using Measures of Localization Confidence," United States Patent 11300515 B2 (2022). [USPTO PDF, Global Dossier]
5. **M. D. Lew** and O. Zhang, inventors. Washington University, assignee. "Multi-View Reflector (MVR) Microscope for Imaging the 3D Position and 3D Orientation of Dipole-Like Emitters," International Patent Application PCT/US2021/063071 (2021). [Global Dossier]
4. **M. D. Lew**, T. Wu, and T. Ding, inventors. Washington University, assignee. "Systems and Methods for Performing Optical Imaging Using Duo-Spot Point Spread Functions," International Patent Application PCT/US2021/018235 (2021). [Global Dossier]
3. O. Zhang and **M. D. Lew**, inventors. Washington University, assignee. "Systems and methods for performing optical imaging using a tri-spot point spread function (PSF)," United States Patent 10761419 B2 (2020). [USPTO PDF, Global Dossier]
2. **M. D. Lew** and W. E. Moerner, inventors. The Board of Trustees of the Leland Stanford Junior University, assignee. "Apparatus and method for localizing objects for distance and/or in three dimensions using a spiral point spread function," United States Patent 9693034 B2 (2017). [USPTO PDF, Global Dossier]
1. O. Liba, **M. D. Lew**, E. D. SoRelle, and A. de la Zerda, inventors. The Board of Trustees of the Leland Stanford Junior University, assignee. "Methods and Apparatus for Speckle-Free Optical Coherence Imaging," United States Patent Application 15/768708 and International Patent Application PCT/US2016/057656 (2016).

ORAL PRESENTATIONS

Invited

36. "Microscopy in the 21st Century – Blinking Molecules, Bending Light, and Rapid Computation," *2024 Lawrence Jasper Lecture, Osher Lifelong Learning Institute*, St. Louis, MO, April 2024.
35. "6D Single-Fluorogen Microscopy for Visualizing Biomolecular Condensates," *Mini Symposium of the Center for Biomolecular Condensates, Washington University*, St. Louis, MO, March 2024.
34. "6D Single-Molecule Orientation-Localization Microscopy: Fundamental Limits for Visualizing the Dynamic Organization of Biomolecule," *Quantum Sensing and Information Processing for Biomedical Applications, APS March Meeting 2024*, Minneapolis, MN, March 2024.

33. “6D single-fluorogen orientation-localization microscopy for elucidating the architecture of beta-sheet assemblies and biomolecular condensates,” *High-Speed Biomedical Imaging and Spectroscopy IX, SPIE Photonics West*, San Francisco, CA, January 2024.
32. “Single-fluorogen imaging reveals the nanoscale structure of beta-sheet assemblies and biomolecular condensates,” *SERMACS 2023*, Durham, NC, October 2023.
31. “Single-Molecule Imaging of Fluorogenic Probes Reveals Inhomogeneous Molecular Organization in Biomolecular Condensates,” *Inaugural Symposium of the Center for Biomolecular Condensates, Washington University*, St. Louis, MO, October 2022.
30. “Single-Molecule Orientation Localization Microscopy: Visualizing Molecular Organization at the Nanoscale,” *San Francisco State University Physics & Astronomy Colloquium*, online, April 2022.
29. “Single-Molecule Orientation Localization Microscopy: Visualizing Molecular Organization at the Nanoscale,” *MIT Modern Optics and Spectroscopy Seminar*, online, April 2022.
28. “Single-Molecule Orientation Localization Microscopy: Visualizing Molecular Rotational Dynamics at the Nanoscale,” *SERMACS 2021*, Birmingham, AL, November 2021.
27. “Single-Molecule Orientation Localization Microscopy: Engineering Imaging Systems to Visualize Molecular Dynamics at the Nanoscale,” *Hong Kong University of Science and Technology Physics Seminar*, online, July 2021.
26. “Visualizing Enzyme Activity in Lipid Membranes, One Molecule at a Time,” *Probing Chemical Reactions by Single-Molecule Spectroscopy*, virtual conference, June 2021.
25. “Toward Visualizing the Dynamic Organization of Amyloid Aggregates using Single-Molecule Orientation Localization Microscopy,” *Knight Alzheimer Disease Research Center Seminar*, online, January 2021.
24. “Single-Molecule Orientation Localization Microscopy for Visualizing Lipid Nanodomains and the Organization of Amyloid Aggregates,” *University of Minnesota Biophysics Seminar*, online, October 2020.
23. “Quantifying and Maximizing Imaging Accuracy in Single-Molecule Super-Resolution Microscopy,” *2020 IEEE 17th International Symposium on Biomedical Imaging (ISBI 2020)*, virtual conference, April 2020.
22. “Computational Modeling Enables Robust Multidimensional Nanoscopy,” *25th Solvay Conference on Chemistry*, Brussels, Belgium, October 2019.
21. “Single Molecules and Point Spread Function Engineering for Visualizing Amyloid Protein Dynamics at the Nanoscale,” *Imaging Sciences Pathway Retreat 2019*, St. Louis, MO, June 2019.
20. “Visualizing Amyloid Protein Dynamics at the Nanoscale,” *5th Annual Meeting of the Biophysical Society of Canada*, Mississauga, ON, May 2019.
19. “Single-Molecule Orientation Spectroscopy,” *Rice University Spectroscopic Imaging Workshop*, Houston, TX, December 2018.
18. “Towards Optimal Imaging of Single-Molecule Rotational Dynamics at the Nanoscale,” *Gordon Research Conference: Single-Molecule Approaches to Biology*, West Dover, VT, July 2018.
17. “Computational Optics for Multidimensional Nanoscale Imaging of Single Fluorescent Molecules,” *Stanford Optical Society Seminar*, Stanford, CA, June 2018.
16. “Elucidating the Functions of Molecular Machines in Living Cells,” *Washington University School of Engineering & Applied Science National Council Meeting*, St. Louis, MO, April 2018.
15. “Single-Molecule Probes and Computational Optics for Imaging Activity at the Nanoscale,” *Siteman Cancer Center Oncologic Imaging Research Forum*, St. Louis, MO, February 2018.
14. “Computational Optics for Imaging Nanoscale Single-Molecule Dynamics,” *Washington University in St. Louis Chemistry Seminar*, St. Louis, MO, March 2017.
13. “Single molecules and computational optics for nanoscale biological imaging,” *Washington University in St. Louis Optical Radiology Seminar*, St. Louis, MO, October 2016.
12. “Single molecules and computational optics for nanoscale biological imaging,” *Washington University in St. Louis Biochemistry and Molecular Biophysics Seminar*, St. Louis, MO, March 2016.
11. “Single molecules and computational optics for nanoscale imaging of living cells,” *The Sixteenth Conference of Peace through Mind Brain Science*, Hamamatsu City, Japan, February 2016.
10. “Single molecules and computational optics for nanoscale imaging of living cells,” *Washington University in St. Louis Biomedical Engineering Seminar*, St. Louis, MO, February 2016.

9. “Accurate 3D nanoscale imaging of dipole-like emitters,” *Laser Science 2015*, San Jose, CA, October 2015.
8. “Accurate nanoscale imaging of dipole-like emitters,” *Stefan W. Hell group retreat*, Ringberg Castle, Kreuth, Germany, January 2015.
7. “Engineering new capabilities into optical microscopes: towards measuring the 3D position and orientation of biomolecules within living cells,” *Washington University in St. Louis Electrical and Systems Engineering Seminar*, St. Louis, MO, April 2014.
6. “Beyond the clear pupil: engineering new capabilities into optical microscopes,” *Washington University in St. Louis Electrical and Systems Engineering Seminar*, St. Louis, MO, March 2014.
5. “Beyond the clear pupil: engineering new capabilities into optical microscopes,” *Duke University Electrical and Computer Engineering Seminar*, Durham, NC, March 2014.
4. “Beyond the clear pupil: engineering new capabilities into optical microscopes,” *IBM Research Almaden ARC Angels Student Seminar Series*, San Jose, CA, February 2014.
3. “Superresolution far-field optical microscopy: turning mountains into points,” *Spectra-Physics company seminar*, Santa Clara, CA, November 2011.
2. “Three-dimensional superresolution fluorescence microscopy using a double-helix point spread function,” *Arizona State University Center for Biological Physics Graduate Seminar*, Tempe, AZ, November 2011.
1. “In vivo three-dimensional superresolution fluorescence tracking using a double-helix point spread function,” S*PIE Photonics West BiOS (Biomedical Optics)*, San Francisco, CA, January 2010.

Contributed

25. “Simultaneous single-molecule orientation imaging of absorption and emission dipoles,” *Gordon Research Conferences: Single Molecule Approaches to Biology*, Newry, ME, July 2024 (poster).
24. “A multi-view reflector microscope visualizes six-dimensional single-molecule translational and rotational dynamics with isotropic nanoscale resolution,” *67th Biophysical Society Annual Meeting*, San Diego, CA, February 2023 (poster).
23. “Visualizing the nanoscale architecture of amyloid aggregates using amyloidophilic probes and a polarized vortex microscope,” *66th Biophysical Society Annual Meeting*, San Francisco, CA, February 2022 (poster).
22. “Single-molecule imaging of the electron transfer pathways within single electroactive bacteria,” *2021 NA-ISMET*, Los Angeles, CA, November 2021.
21. “Imaging Chemical Environments and Amyloid Architectures using Single-Molecule Orientation-Localization Microscopy,” *OSA Imaging and Applied Optics Congress*, virtual conference, July 2021.
20. “Robustly Detecting Imaging Model Mismatches and Reconstruction Artifacts in Single-Molecule Localization Microscopy,” *OSA Imaging and Applied Optics Congress*, virtual conference, July 2021.
19. “Visualizing Membrane Composition and Amyloid Aggregate Organization using Single-Molecule 3D Orientation Imaging,” *Focus on Microscopy 2021 (FOM 2021)*, virtual conference, March 2021.
18. “Quantifying Localization Accuracy in Single-Molecule Super-Resolution Microscopy,” *Quantitative Bioimaging Conference (QBI 2020)*, Oxford, UK, January 2020.
17. “Single-Molecule Super-Resolution Imaging of Molecular Orientation using a Tri-Spot Point Spread Function,” *OSA Imaging and Applied Optics*, Munich, Germany, June 2019.
16. “Fundamental Limits on Imaging the Orientational Dynamics of Dipole-Like Emitters,” *OSA Imaging and Applied Optics*, Munich, Germany, June 2019.
15. “Computational Optics for Multidimensional Nanoscale Imaging of Single Fluorescent Molecules,” *Gordon Research Conferences: Image Science*, Easton, MA, June 2018 (poster).
14. “Computational Nanoscopy for Multidimensional Imaging of Single Fluorescent Molecules,” *Gordon Research Conferences: Image Science*, Easton, MA, June 2016 (poster).
13. “An azimuthal polarizer assures localization accuracy in single-molecule super-resolution fluorescence microscopy,” *OSA CLEO: 2015*, San Jose, CA, May 2015.

12. “Optical methods for measuring single-molecule orientation and position: implications for super-resolution microscopy,” *OSA Frontiers in Optics (FiO)*, Orlando, FL, October 2013 (postdeadline).
11. “Measuring the 3D position and orientation of single molecules simultaneously and accurately with the double helix microscope,” *OSA CLEO: 2013*, San Jose, CA, June 2013.
10. “The double-helix microscope simultaneously measures single-molecule orientation and 3D position, reducing dipole-induced localization errors,” *Understanding Cell Behavior through Single Cell and Single Molecule Biology: Conference on Quantitative Bioimaging*, Albuquerque, NM, January 2013.
9. “The double-helix microscope simultaneously measures single-molecule orientation and 3D position, reducing dipole-induced localization errors,” *Gordon Research Conferences: Single-Molecule Approaches to Biology*, West Dover, VT, July 2012 (2nd place poster award).
8. “Superresolution double-helix microscopy resolves extended biological superstructures in 3D within bacterial and mammalian cells,” *Stanford Molecular Biophysics Seminar*, Stanford, CA, April 2012.
7. “Super-resolution 3D co-localization of protein superstructures and the cellular surface in live *Caulobacter crescentus*,” *OSA FiO*, San Jose, CA, October 2011.
6. “Super-resolution 3D co-localization of protein superstructures and the cellular surface in live *Caulobacter crescentus*,” *International OSA Network of Students-North America 3 (IONS-NA3)*, Stanford, CA, October 2011.
5. “Three-dimensional super-resolution imaging with a corkscrew point spread function,” *OSA Novel Techniques in Microscopy*, Monterey, CA, April 2011.
4. “Three-dimensional super-resolution co-localization of intracellular protein superstructures and the cell membrane in live *Caulobacter crescentus*,” *3rd Annual Center for Biological Imaging at Stanford Symposium*, Stanford, CA, March 2011.
3. “Three-dimensional superresolution imaging of single emitters using a double-helix point spread function,” *Picoquant 16th Annual Workshop on Single Molecule Spectroscopy and Ultrasensitive Analysis in the Life Sciences*, Berlin, Germany, September 2010.
2. “Localization precision of three-dimensional superresolution fluorescence imaging using a double-helix point spread function,” *OSA Computational Optical Sensing and Imaging*, San Jose, CA, October 2009.
1. “Two-dimensional differential interference contrast microscopy based on four-hole variation of Young's interference,” *SPIE Photonics West BiOS*, San Jose, CA, January 2008.

TEACHING EXPERIENCE

	Semester (Number enrolled)
ESE 105 (undergraduate), Co-Developer and Co-Instructor Introduction to Electrical and Systems Engineering	Fall ’18 (36), ’19 (67), ’20 (76), ’21 (83) ’22 (93), ’23 (66)
ESE 582 (graduate), Developer and Instructor Fundamentals and Applications of Modern Optical Imaging	Fall ’15 (18), Spring ’17 (15), ’18 (28), ’19 (12), ’20 (18), ’21 (23), ’22 (15), ’24 (21)
ESE 330 (undergraduate), Instructor Engineering Electromagnetics Principles	Fall ’16 (37)
EE 134 (undergraduate), Developer and Guest Lecturer Introduction to Photonics (taught by Audrey K. Bowden) Stanford University	2012
EE 20 and EE 113 (undergraduate), Teaching Assistant Electronics Laboratory (taught by Dimitrios Antsos), Feedback and Control Circuits (taught by Glen George) California Institute of Technology	2006 – 2008

Other Professional Activities

Editorial Boards

Early Career Board, *Chemical and Biomedical Imaging* 2024 – present

Associate Editor, *Biological Imaging* 2020 – present

Editorial Board, *Scientific Reports* 2019 – present

Guest Editor, W. E. Moerner Festschrift, *J. Phys. Chem. B* 2022

Conference Leadership

Session Leader, "Single Molecules and Phase" 2022
65th Welch Conference on Chemical Research, "Molecules and Sculpted Light"
Post Oak Hotel, Houston, TX

Symposium Organizer, "Frontiers in Fluorescence Lifetime and Super-resolution Imaging of Biological Structures and Dynamics" 2021
Microscopy & Microanalysis (M&M), virtual conference

Program Committee, Stanford University Photonics Retreat (SUPR) 2015 2015
Asilomar Conference Grounds, Pacific Grove, CA

Program Committee, SUPR 2014 2014
Marconi Conference Center, Marshall, CA

Program Chair, SUPR 5 2013
DoubleTree Hotel Sonoma Wine Country, Rohnert Park, CA

Program Committee, SUPR 2012 2012
Asilomar Conference Grounds, Pacific Grove, CA

Program Committee, International OSA Network of Students (IONS) North America-3 2012
Stanford University

Peer Reviewer (Funding Agencies)

National Institutes of Health (Molecular and Cellular Sciences and Technologies Review Branch (MCST), Enabling Bioanalytical and Imaging Technologies (EBIT))
National Science Foundation (Division of Electrical, Communications and Cyber Systems)
Department of Energy (Basic Energy Sciences)

Peer Reviewer (Journals, with number of verified reviews) ResearcherID D-6270-2012

(13) Nature Communications
(10) Optics Express
(9) Journal of the Optical Society of America A
(7) Biomedical Optics Express
(7) Optics Letters
(6) Applied Physics Letters
(4) Nature Methods
(4) Biophysical Journal
(4) Chemical Science
(3) Nature Structural & Molecular Biology
(3) Scientific Reports
(2) IEEE Transactions on Computational Imaging
(2) Applied Optics
(2) Biological Imaging
(2) The Journal of Chemical Physics
(1) Optica
(1) IEEE Access
(1) Journal of Physical Chemistry Letters
(1) Neurobiology of Disease

Service to Washington University in St. Louis

Faculty Assembly Advisory Committee — 2023 – present
McKelvey School of Engineering

Washington University Doctoral Council — 2022 – present
Office of the Provost

Undergraduate Curriculum Committee — 2021 – present
Department of Electrical and Systems Engineering

Washington University Laser Safety Advisory Committee — 2018 – present
Environmental Health and Safety

PhD Admissions Committee, Imaging Science PhD Program — 2018 – present
McKelvey School of Engineering

Curriculum Committee, Imaging Science PhD Program — 2017 – present
McKelvey School of Engineering

Faculty Search Committee — 2016, 2017, 2020-present
Department of Electrical and Systems Engineering

Research Advisory Committee — 2021
McKelvey School of Engineering

PhD Admissions Committee, Department of Electrical and Systems Engineering — 2017 – 2021

Department Chair Search Committee, Electrical and Systems Engineering — 2018
School of Engineering & Applied Science

Service to Optica (formerly OSA)

Faculty Advisor, Washington University SPECTRA — 2021 – present
A student chapter of Optica and SPIE

Chair, Molecular Probes and Nanobio-Optics Technical Group — 2017 – 2019

Co-President, Stanford Optical Society, Student Chapter of OSA and SPIE — 2013 – 2014
Stanford University
-- Recipient of The Optical Society's 2014 Student Chapter Excellence Award

Service to Tau Beta Pi

Faculty Advisor, Missouri Gamma Chapter — 2020 – 2024
Washington University in St. Louis

President, California Beta Chapter — 2007 – 2008
California Institute of Technology

Service to IEEE

Vice Chair, Caltech Chapter — 2007 – 2008
California Institute of Technology

Community Outreach

- Portal to the Public, Saint Louis Science Center — 2016 – present
- LEGO Microscopes, Washington University SPECTRA — 2016

Professional Society Memberships

Biophysical Society	2022 – 2023
Microanalysis Society	2021
IEEE Engineering in Medicine and Biology Society	2020
Sigma Xi, The Scientific Research Honor Society	2020 – present
American Association for the Advancement of Science	2017 – present
American Chemical Society	2015 – present
Optica, formerly OSA	2008 – present
SPIE	2007 – present
Tau Beta Pi, The Engineering Honor Society	2007 – present