

CURRICULUM VITAE

William Esco (W. E.) Moerner
Harry S. Mosher Professor and Professor, by courtesy, of Applied Physics
Department of Chemistry and Biophysics Program
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Education

1975	B.S. Physics (Final Honors) B.S. Electrical Engineering (Final Honors) A.B. Mathematics (summa cum laude)	Washington University St. Louis, Missouri
1978	M.S. (Physics)	Cornell University Ithaca, New York
1982	Ph.D. (Physics)	Cornell University Ithaca, New York

Thesis Topic: Vibrational Relaxation Dynamics of an IR-Laser-Excited
Molecular Impurity Mode in Alkali Halide Lattices
Thesis Advisor: Professor A. J. Sievers

Academic Honors

1963-82	Grade Point Average of All A's (4.0)
1971-75	Alexander S. Langsdorf Engineering Fellow, Washington University
1975	Dean's Award for Unusually Exceptional Academic Achievement
1975	Ethan A. H. Shepley Award for Outstanding Achievement (university-wide)
1975-79	National Science Foundation Graduate Fellow

Career Summary

2016-	Affiliated Faculty Member, Stanford Neurosciences Institute
2014-	Faculty Fellow, Sarafan ChEM-H at Stanford
2011-2014	Chemistry Department Chair
2005-	Professor, by courtesy, of Applied Physics
2002-	Harry S. Mosher Professor of Chemistry
1998-	Professor of Chemistry Department of Chemistry Stanford University

Multidisciplinary education and research program on single-molecule spectroscopy, imaging, and quantum optics in solids, proteins, and liquids; single-molecule biophysics in cells; nanophotonics of metallic nanoantennas; and photoactive polymer materials with emphasis on photorefractive polymers. Major milestones include: first room-temperature single-molecule source of single photons, antibunching for a single CdSe/ZnSe nanocrystal, observation of nucleotide-dependent orientational flexibility of single kinesin motors bound to microtubules, single-pair FRET for a dual-GFP sensor of calcium ion concentrations, full characterization of the single-copy properties of DsRed fluorescent proteins, first analysis of diffusion of single MHCII transmembrane protein complexes in cells, discovery of a new class of single-molecule fluorophores and development of these for cellular imaging, direct measurement of local electromagnetic field enhancement for bowtie nanoantennas and their use in surface-enhanced Raman scattering and in enhancing single-molecule fluorescence, observation of single GFP fusions in bacteria acting as nanoscale, photoswitchable light sources to show super-resolved cellular structures, invention of a new trap for nanoscale objects and single biomolecules in solution, observation of specific ATP-induced conformational changes for a model substrate interacting with the chaperonin GroEL/ES, determination of ADP number distributions for single multi-subunit enzymes in solution, cellular imaging of huntingtin protein aggregates and behavior of signaling proteins in the Hedgehog pathway of the primary cilium, and demonstration of 3D superresolution imaging and tracking of single photoactivatable molecules, cellular structures, DNA loci in yeast chromatin, and cellular mRNA particles with a double-helix point-spread function microscope. Numerous studies of protein and oligonucleotide motions and distributions in *Caulobacter crescentus* beyond the diffraction limit. First method for correction of dipole-induced shifts in single-molecule localization imaging, analysis of the impact of orientation flexibility on this effect. Development of various pupil-plane phase modulation strategies to extract additional information from single-molecule images, and invention of TILT-3D super-resolution microscope for thick cells. Application of the ABEL trap to the analysis of photosynthetic antenna protein photodynamics, G-protein-coupled receptors, single fluorophores, single electron-transfer enzymes in solution, and direct detection of mobility and diffusion coefficient of single biomolecules. Trapping of single nanoscale objects without fluorescence. Correlative low-temperature single-molecule localizations to provide single-molecule annotations of cryo-electron tomography images. Applications of deep neural nets for phase retrieval and structured background estimation for single-molecule localization microscopy in 3D.

1995-1998 First Holder, Distinguished Chair in Physical Chemistry
 Professor of Chemistry
 Department of Chemistry and Biochemistry
 University of California San Diego

Multidisciplinary education and research program on single-molecule spectroscopy and quantum optics in solids, proteins, and liquids; single-molecule biophysics, near-field microscopy; and photoactive polymer materials with emphasis on photorefractive polymers. Major milestones include 3-D studies of single molecules diffusing in gels, observation of blinking and switching in single GFP molecules, pumping of single molecules with whispering gallery modes of microspheres, and beam fanning and self-pumped phase conjugation in new

extremely high gain photorefractive polymers. Research group included four postdoctoral research associates, three graduate students, and three undergraduates.

1994-95 Research Staff Member and Project Leader
IBM Almaden Research Center
San Jose, California

Multidisciplinary research program on single-molecule spectroscopy, near-field optics, and photorefractive (PR) polymers. Project leader for ARPA contract on PR polymers.

1993-1994 Visiting Guest Professor and IBM Research Staff Member
Laboratory for Physical Chemistry
ETH Zentrum (Swiss Federal Institute of Technology)
Zürich, Switzerland

Research program in single-molecule spectroscopy, spectral hole-burning, and near-field optics. Educated and supervised 4 Ph.D. students and two visiting scientists; lectured on single-molecule laser spectroscopy and photorefractive polymers. Major accomplishments included discovery and imaging of single molecules in Shpol'skii matrices and the first near-field single-molecule spectroscopy. Continued as consultant on IBM project on photorefractive polymer materials research and development.

1989-1993 Research Staff Member and Project Leader
IBM Almaden Research Center
San Jose, California

Multidisciplinary research program in Organic Optoelectronic Materials Department with two main thrust areas: (i) precision fundamental spectroscopy of defect centers in solids including single-molecule detection and spectroscopy, statistical fine structure, and spectral hole-burning, and (ii) optical and physical properties of nonlinear materials, including organic photorefractive polymeric materials.

Novel accomplishments:

Single-Molecule Spectroscopy and Spectral Hole-Burning:

Phase-sensitive, time-resolved study of ballistic phonon propagation in a solid; direct observation of spectral diffusion in a solid using a single-molecule probe; observation of lifetime-limited linewidths, dephasing, and nonlinear saturation for a single molecule; observation of hole-burning and spectral diffusion for a single molecule in a polymer; observation of photoinduced reaction kinetics for a single molecule; observation of photon antibunching for a single molecule in a solid; measurement of vibrationally dispersed fluorescence from a single molecule in a crystal and in a polymer; and magnetic resonance of a single molecular spin.

Organic Nonlinear Materials:

Intracavity second harmonic generation in an organic crystal; observation of photorefractivity in a polymer; demonstration of two-beam coupling in a photorefractive polymer; subsecond photorefractive response in a polymer; sensitization of a photorefractive polymer with C₆₀; development of photorefractive polymers with net gain

and efficiency sufficient to surpass some conventional inorganic crystals; and image storage in a photorefractive polymer.

1988-1989 Manager, Laser-Materials Interactions
 IBM Almaden Research Center
 San Jose, California

Managed Research Staff Members in Laser-Materials Interactions Project which concentrated on laser spectroscopy of solids and quantum optics. Continued research on statistical properties of inhomogeneously broadened lines and on mechanisms of the photorefractive effect in electro-optic crystals. Major accomplishment: first optical detection and spectroscopy of a single impurity molecule in a solid.

1981-1988 Research Staff Member
 IBM Almaden Research Center
 San Jose, California

Performed individual research on materials and mechanisms for frequency domain optical storage using high resolution, low temperature laser spectroscopy and photochemical and nonphotochemical hole-burning spectroscopy. Developed high sensitivity measurement techniques such as laser frequency modulation, optical normalization, and ultrasonic modulation to measure extremely small changes in optical absorption.

Novel accomplishments:

Photochemical hole burning at GaAs laser wavelengths, observation of high efficiency photochemistry for an infrared color center; observation of two-photon absorption for linear polyenes in crystals using cw lasers; detailed studies of hole-burning bottlenecks for organic and inorganic systems; use of the quantum-limited sensitivity of FM spectroscopy to measure the stimulated Raman gain in deuterium; use of high resolution ultrasonic modulation to detect photochemical holes; observation of photochemical hole production in 100 ns; complete analysis of coupled reading-writing constraints for single-photon hole-burning materials leading to the need for photon-gating; observation of photon-gated hole-burning in an organic system; development of photon-gating via a donor-acceptor electron transfer mechanism, which allowed fast (30 ns) hole formation in small focused laser spots; and observation of statistical fine structure in an inhomogeneously broadened spectral line.

1975-1981 Graduate Research Assistant and NSF Graduate Fellow
 Laboratory for Atomic and Solid State Physics,
 Cornell University, Ithaca, New York

Performed basic research on the vibrational relaxation dynamics of molecular impurities in alkali halides. Principal techniques included low temperature laser saturation, high resolution spectral hole burning, and coherent transient spectroscopy with CO₂ and PbSnTe diode lasers. Major accomplishments were the first measurements of T₁ and T₂ for ReO₄⁻ molecules in a variety of alkali halide hosts, and the discovery of persistent nonphotochemical spectral hole burning for a molecular vibrational mode in a crystalline lattice.

1972-1975 Research Assistant
 Department of Physics
 Washington University, St. Louis, Missouri

Performed experiments, computer simulations, and theory to develop more accurate formulae for the determination of ultrasonic propagation velocity and dispersion in composite resonators. Assisted in ultrasonic studies of the magnetoelastic properties of single crystal Co and Ni.

1970-1971 Statistical Computer Programmer
 Department of Biomedical Engineering
 University of Texas Medical School at San Antonio, Texas

Wrote and/or executed a large number of statistical analysis programs up to the complexity of factor analysis for comparative analysis of a large data base of measured taxa distributions in the Kuroshio Sea, under the mentorship of Dr. Richard G. Domey.

Honors and Awards

Co-recipient, Chemistry Biology Interface Division Horizon Prize from the Royal Society of Chemistry, 2021
Hall of Honor, Sigma Xi, The Scientific Research Honor Society, 2018
Wu Zheng Kai Chemistry Prize, Fudan University, 2018
Distinguished Eagle Scout Award, National Eagle Scout Association, 2017
Photonics Pioneer Award, Duke University Fitzpatrick Institute for Photonics, 2016
Distinguished Alumnus Award, Washington University, St. Louis, 2015
Julio Palmaz Award for Innovation in Healthcare and Biosciences, Biomed SA, 2015
Fellow, SPIE-The International Society for Optics and Photonics, 2015
Honorary Fellow, Royal Society of Chemistry, 2015
Nobel Prize in Chemistry, 2014
John Gamble Kirkwood Medal for Outstanding Achievement in Science, from Yale University and the New Haven Section of the American Chemical Society, 2013
Engineering Alumni Achievement Award, Washington University, 2013
Peter Debye Award in Physical Chemistry, 2013
Pittsburgh Spectroscopy Award, 2012
Irving Langmuir Prize in Chemical Physics, 2009
Wolf Prize in Chemistry, 2008
Member, National Academy of Sciences, 2007
Fellow, American Association for the Advancement of Science, 2004
Geoffrey Frew Fellow, Australian Academy of Sciences, 2003
Fellow, American Academy of Arts and Sciences, 2001
Earle K. Plyler Prize for Molecular Spectroscopy, American Physical Society, 2001
Robert Burns Woodward Visiting Professor, Department of Chemistry, Harvard University, 1997-1998
IBM Outstanding Technical Achievement Award for Single-Molecule Detection and Spectroscopy, November 22, 1992
Fellow, American Physical Society, November 16, 1992
Fellow, Optical Society of America, May 28, 1992

Senior Member, Institute of Electrical and Electronics Engineers, June 17, 1988
IBM Outstanding Technical Achievement Award (with R. M. Macfarlane and R. M. Shelby)
for Photon-Gated Spectral Hole-Burning, July 11, 1988
National Winner of the Roger I. Wilkinson Outstanding Young Electrical Engineer Award for
1984, from the electrical engineering honorary society, Eta Kappa Nu, April 22, 1985

Doctor Honoris Causa

University Aix Marseille, November 9, 2016
University of Chile, December 10, 2015

Honorary Professorships

Huazhong University of Science and Technology, Wuhan, China, November 2019
Moscow State Pedagogical University, Moscow, Russia, August 2018
Fudan University, Shanghai, China, July 2018

Named Lectureships

Oliver Smithies Nobel Lecture, University of North Carolina, September 2020
Purdue College of Engineering Distinguished Lecture, Purdue University, February 2020
Physical Chemistry Student Select Lecture, University of Illinois at Urbana-Champaign,
December 2019
J. T. Donald Lecturer, Chemistry Department, McGill University, Montreal, Canada,
September, 2019
Jin Si Lecture, Fudan University, China, July 2018
Hermann Anton Haus Lecture, Massachusetts Institute of Technology, April 2018
Nelson Lecture, The University of Miami, April 2018
E. U. Condon Lecture, University of Colorado, Boulder, Colorado, February 2018
Munushian Lecture, Ming Hsieh Department of Electrical Engineering, Viterbi School of
Engineering, University of Southern California, February 2017
Morris Travers Memorial Lecture, Indian Institute of Science, Bangalore, January 2017
Andreas C. Albrecht Memorial Lecture, Department of Chemistry and Chemical Biology,
Cornell University, April 2016
Hightower Lecture, Department of Physics, Emory University, April 2016
Fred J. Robbins Memorial Lectures, Department of Chemistry, Pomona College, March
2016
Provost Lecture, Temple University, Philadelphia, Pennsylvania, March 2016
Wallace H. Coulter Lecture, Pittcon, Atlanta, Georgia, March 2016
Paul D. Gottlieb Lecture, Institute of Cellular and Molecular Biology, The University of
Texas at Austin, February 2016
Sir Ernst Chain Lecture, Imperial College of London, November 2015
Samuel I. Weissman Memorial Lectures, Department of Chemistry, Washington University,
St. Louis, Missouri, November 2015
Presidential Distinguished Lecture, The University of Texas Health Science Center at San
Antonio, September 2015
Presidential Distinguished Lecture, The University of Texas at San Antonio, September 2015
Paul C. Cross Lecture, Department of Chemistry, University of Washington, May 2015

George B. Kistiakowsky Lecturer, Department of Chemistry and Chemical Biology, Harvard University, March 2015
John Gamble Kirkwood Lecturer, Department of Chemistry, Yale University, September 2013
Walter Kauzmann Lecturer in Biophysical Chemistry, Princeton University, September 2013
E. K. C. Lee Lecturer, Department of Chemistry, University of California, Irvine, May 2013
Samuel Krimm Lecture in Biophysics, University of Michigan, April 2013
Ehrenfest Colloquium Lecturer (repeat), University of Leiden, The Netherlands, June 2012
Pittsburgh Conference Lecturer, Department of Chemistry, University of Pittsburgh, 2011
Leica Scientific Forum United Kingdom Lecturer, June 2011
Willis Flygare Memorial Lecturer, Department of Chemistry, University of Illinois at Urbana-Champaign, 2011
Joe L. Franklin Lecturer, Department of Chemistry, Rice University, 2010
William Lloyd Evans Lecturer, Department of Chemistry, The Ohio State University, 2009
Karl Friedrich Bonhoeffer Lecturer, Max Planck Institute for Biophysical Chemistry, Göttingen, Germany, 2009
Neil Gordon Frontiers in Chemistry Lecturer, Department of Chemistry, Wayne State University, 2009
A. S. Noyes Lecturer, Department of Chemistry and Biochemistry, University of Texas at Austin, 2009
DuPont-Marshall Lecturer, Department of Chemistry, University of Pennsylvania, 2008
Herbert H. King Lecturer, Department of Chemistry, Kansas State University, 2006
Edwin Yunker Lecturer, Department of Physics, Oregon State University, 2006
A. R. Gordon Distinguished Lecturer, Department of Chemistry, University of Toronto, 2006
Lecturer, Summer School on Visualization, Manipulation, and Modeling of Single Biomolecules, ENS Paris, France, 2005
Geoffrey Frew Fellowship Lecturer, Australian Academy of Sciences (University of Queensland, Australian National University, Swinburne Institute of Technology, University of Melbourne), 2003
International Invited Lecturer (Basel, Berne, Lausanne, Geneva): Conference Universitaire de Suisse Occidentale du 3ème Cycle en Chimie, 2003
Moses Gomberg Lecturer, Department of Chemistry, University of Michigan, 2001
William Draper Harkins Lecturer, Department of Chemistry, University of Chicago, 2001
Guest Lecturer in Frontiers in Spectroscopy, Ohio State University, 1999
Arthur D. Little Lecturer, Department of Chemistry, Massachusetts Institute of Technology, 1995
Ehrenfest Colloquium Lecturer, University of Leiden, The Netherlands, March 1994
Samuel M. McElvain Lecturer, Department of Chemistry, University of Wisconsin, 1993

Patents

U. S. Patent 4,614,116: "Phase Sensitive Ultrasonic Modulation Method for the Detection of Strain-Sensitive Spectral Features", September 30, 1986.
U. S. Patent 5,064,264: "Photorefractive Materials", November 12, 1991.
U. S. Patent 5,361,148: "Apparatus for Photorefractive Two-Beam Coupling," November 1, 1994.
U. S. Patent 5,460,907: "Photorefractive Materials", October 24, 1995.
U. S. Patent 5,607,799: "Optical Photorefractive Article," March 4, 1997.

- U. S. Patent 6,046,925: “Photochromic Fluorescent Proteins and Optical Memory Storage Devices Based on Fluorescent Proteins,” April 4, 2000.
- U. S. Patent 6,280,884: “Process for Photorefractive Index Grating Formation,” August 28, 2001.
- U. S. Patent 7,068,698 “Room-Temperature Source of Single Photons Based on a Single Molecule in a Condensed Matter Host,” June 27, 2006.
- U. S. Patent 8,057,655: “Sub-Micron Object Control Arrangement and Approach Therefor,” Nov. 15, 2011 (provisional application filed August 20, 2004).
- U. S. Patent 8,153,446 B2: “Fluorogenic Compounds Converted to Fluorophores by Photochemical or Chemical Means and Their Use in Biological Systems,” April 10, 2012 (provisional application filed May 23, 2008).
- U. S. Patent 8,693,742 B2: “Three-Dimensional Single-Molecule Fluorescence Imaging Beyond the Diffraction Limit Using a Double-Helix Point Spread Function,” April 8, 2014 (provisional application filed December 17, 2008).
- U. S. Patent 8,772,048 B2: “Fluorogenic Compounds Converted to Fluorophores by Photochemical or Chemical Means and Their Use in Biological Systems,” July 8, 2014 (provisional application filed May 23, 2008).
- U. S. Patent 9,075,010 B2: “Enhancement of Molecular Emission Using Optical-Antenna Structures,” July 7, 2015 (provisional application filed October 15, 2010).
- U. S. Patent 9,693,034 B2: “Apparatus and Method for Localizing Objects for Distance and/or in Three Dimensions Using a Spiral Point Spread Function,” June 27, 2017, Disclosure filed May 17, 2012 (provisional filed December 13, 2011).
- U. S. Patent 10,187,626 B2: “Apparatuses and Methods for Three-Dimensional Imaging of an Object,” Issued January 22, 2019 (provisional filed April 10, 2015).
- U. S. Patent 10,341,640 B2: “Multi-Wavelength Phase Mask,” Issued July 2, 2019.
- U. S. Patent 10,638,112 B2: “Apparatuses and Methods for Three-Dimensional Imaging of an Object” Issued April 28, 2020 (amendment filed January 17, 2019).
- U. S. Patent 10,791,318 B2: “Multi-Wavelength Phase Mask,” Issued September 29, 2020.

Application: “Firefly Luciferin Analogues, Methods of Making Firefly Luciferin Analogues, and Methods of Imaging,” Provisional filed March 10, 2009.

Additional published disclosures in optics, frequency domain optical storage, single-molecule applications, microscopy, and photorefractive materials.

Professional Societies and Positions

Boards:

Member, Advisory Board, Double Helix Optics, 2019-

Member, Board of Trustees of the Society for Science, 2018-

Member, Advisory Board, Institute of Atomic and Molecular Sciences (IAMS) of Academia Sinica, Taiwan, 2005-

Member, Scientific Advisory Board, Max-Planck Institute for Biochemistry Martinsried, 2019-2022

Member, Scientific Advisory Board, Welch Foundation, 2017-2021

Member, World Laureates Association, 2017-2018, 2020

Journals:

International Advisory Board, *Angewandte Chemie*, 2017-2020
Associate Editor, *Quarterly Reviews of Biophysics-Discovery* 2015-2016
Advisory Editor, *ChemPhysChem* 2004-2018
Advisory Editor, *Chemical Physics Letters* 1998-2016
Editorial Advisory Board, *Journal of Physical Chemistry* 2013-2015
Advisory Editor, *Single Molecules* 2000-2002

American Academy of Arts and Sciences

American Association for the Advancement of Science

American Chemical Society

Program Committee, Symposium on Optical Properties of Polymers, August 1996

Single-Molecule Symposium Organizer, Physical Chemistry Division, April 1997

Co-Editor, Special Issue of *Accounts of Chemical Research* on Single Molecules and Ions,
December 1996

American Physical Society

Chair, Herbert P. Broida Prize Committee 2000

Member, Earle K. Plyler Prize Committee 2001

Member, Irving Langmuir Prize Committee 2010

Symposium Organizer for Laser Science Topical Group, 1992 March Meeting

Symposium Organizer for Laser Science Topical Group, 1993 March Meeting

Institute of Electrical and Electronic Engineers, Lasers and Electro-Optics Society

Assistant Treasurer, 1988 Annual Meeting

Treasurer and Program Committee Member, 1989 Annual Meeting

Symposium Organizer, LEOS 1989 Annual Meeting on Optical Memory and
Storage

Materials Research Society

National Academy of Sciences

Optical Society of America

Chair, Fundamental and Applied Spectroscopy Technical Group, 1992-1994

General Chair and Founder, OSA Topical Conference on Persistent Spectral
Hole-Burning Science and Applications, 1991

Co-Editor, 2 Special Issues of J. Opt. Soc. America B on Persistent Spectral
Hole-Burning

Advisory Chair and Program Committee Member, Topical Meeting on Spectral
Hole-Burning and Luminescence, 1993-1994

Assistant Chair, Fundamental and Applied Spectroscopy Technical Group,
1992

Society of Photo-Optical Instrumentation Engineers

Program Co-Chair, Symposium on Organic Photorefractive Materials, 1996, 1997, 1998

Program Committee, 1999-2003

Conference on Quantum Electronics and Laser Science

Program Committee, 1992 and 1993

Conference on Lasers and Electro-Optics

Program Committee, 1999

International Conference on Hole-Burning and Single-Molecule Spectroscopies

Program Committee, 1996, 1999, 2003

Gordon Research Conference on Single-Molecule Approaches to Biology,
Co-Vice Chair, 2008; Co-Chair, 2010.

Task Forces and Major University Committees

Chairman, IBM Task Force on Frequency Domain Optical Storage, 1984.
Physics and Mechanisms Member, IBM Task Force on Holographic Optical Storage, 1986.
Co-Chair, Systems and Applications, IBM Optical Storage Initiative, 1988.
Member, Appointments and Promotions Committee, Division of Humanities and Sciences,
Stanford University, 2002-2004.
Member, Nanoinitiative Committee, Stanford University, Winter 2006
Member, NSF Center for Probing the Nanoscale Executive Committee, Fall 2007
Member, Stanford University Committee on Health and Safety, 2007-2008
Chair, Stanford University Committee on Health and Safety, 2008-2009, 2009-2010
Member, Stanford University Emergency Management Steering Committee, 2009-2010
Member, Advisory Board, Center for Biological Imaging at Stanford, 2010-2015
Member, Corporation Visiting Committee, Department of Chemistry, Massachusetts Institute
of Technology, 2013-2017.
Member, Review Panel, HHMI Janelia Research Campus, 2020

Study Panels and Governmental Committees

Member, NSF SBIR Study Panel, September, 1996.
Member, NIH Bioengineering Symposium Panel on Imaging at the Molecular and Cellular
Levels, February 27-28, 1998.
Co-Chair, Toward Molecular Scale Devices Subgroup, NSF Integrating Themes Workshop
for Physical Chemists, September 18-20, 1998, Keystone, Colorado.
Member, NIH Review Panel, November 1999; September 2000.
Member, FAMOS Update Panel, National Research Council, 1999-2002.
Member, NIH-NIGMS Workshop on Single Molecule Detection and Manipulation, 2000
Member, NSF-Intelligence Community Workshop on Approaches to Combat Terrorism, 2002.
Subgroup Chair, NIH-NIDA Workshop on Emerging Technologies: Analysis of Endogeneous
Biomaterials and Single-Molecule Studies, 2002.
Member, International Review Committee for the Institute of Atomic and Molecular Sciences
(IAMS) of Academia Sinica, Taiwan, 2003-2004
Member, NIH-BST Molecular Imaging Study Section, 2004.
Member, Pacific Northwest National Laboratory DOE-BES Review Panel, 2005.
Member, DOE Workshop on Single-Molecule Research in the New Millenium, 2005.
Session Chair: NIH Frontiers in Live Cell Imaging Conference, April 19-21, 2006
Member, NIH-NHGRI Study Section, July, 2006
Member, Board of Scientific Counselors, National Institute of Biomedical Imaging and
Bioengineering, 2010-2014

Publications: William Esco (W. E.) Moerner

1. Richard G. Domey and William E. Moerner, "Cooperative Studies of the Kuroshio and Adjacent Regions, Part I: A Factor Analysis," *Indian J. Marine Sciences* **2**, 69 (1973).
2. H. I. Ringermacher, W. E. Moerner, and J. G. Miller, "Improved Transducer Correction for Standing Wave Ultrasonic Velocity Measurements," *J. Appl. Phys.* **45**, 549 (1974).
3. H. I. Ringermacher, W. E. Moerner, and J. G. Miller, "Two Transducer Formula for More Precise Determination of Ultrasonic Phase Velocity from Standing Wave Measurements," Proc. IEEE Ultrasonics Symposium, IEEE Cat. No. PD74CH0896-1SU, 555 (1974).
4. W. E. Moerner and J. G. Miller, "Ultrasonic Dispersion ($\Delta v/v$) Determined from Mechanical Resonance Frequency Shifts," Proc. IEEE Ultrasonics Symposium, IEEE Cat. No. PD74CH0896-1SU, 478 (1974).
5. V. E. Stubblefield, W. E. Moerner, P. A. Fedders, J. G. Miller, and D. I. Bolef, "Ultrasonic Determination of Magnetoelastic and Anisotropy Constants of Single Crystal Ni," Proc. IEEE Ultrasonics Symposium, IEEE Cat. No. PD74CH0896-1SU, 474 (1974).
6. L. H. Greene, R. T. Warner, W. E. Moerner, and A. J. Sievers, "Passive Mode Locking of a TEA CO₂ Laser with Matrix Isolated SF₆," Eleventh International Quantum Electronics Conference Digest of Technical Papers, IEEE Cat. No. PD80CH1561-O, 640 (1980).
7. A. R. Chraplyvy, W. E. Moerner, and A. J. Sievers, "High-Resolution Spectroscopy of Matrix-Isolated ReO₄⁻ Molecules," *Opt. Lett.* **6**, 254 (1981).
8. A. R. Chraplyvy, W. E. Moerner, and A. J. Sievers, "Infrared Hole Burning Spectroscopy of Matrix-Isolated ReO₄⁻ Molecules," *Opt. Lett.* **6**, 431 (1981).
9. W. E. Moerner, A. J. Sievers, and A. R. Chraplyvy, "Anharmonic Relaxation Times of Molecular Vibrational Modes in Alkali Halide Crystals," *Phys. Rev. Lett.* **47**, 1082 (1981).
10. W. E. Moerner, A. J. Sievers, R. H. Silsbee, A. R. Chraplyvy, and D. K. Lambert, "Persistent Holes in the Spectra of Localized Vibrational Modes in Crystalline Solids," *Phys. Rev. Lett.* **49**, 398 (1982).
11. W. E. Moerner, F. M. Schellenberg, and G. C. Bjorklund, "Photochemical Hole Burning at GaAs Laser Wavelengths," *Appl. Phys.* **B28**, 263 (1982).
12. M. D. Levenson, W. E. Moerner, and D. E. Horne, "FM Spectroscopy Detection of Stimulated Raman Gain," *Opt. Lett.* **8**, 108 (1983).
13. P. Pokrowsky, W. E. Moerner, F. Chu, and G. C. Bjorklund, "Reading and Writing of Photochemical Holes Using GaAlAs Diode Lasers," *Opt. Lett.* **8**, 280 (1983).
14. W. E. Moerner, A. R. Chraplyvy, A. J. Sievers, and R. H. Silsbee, "Persistent Nonphotochemical Spectral Hole Dynamics for an Infrared Vibrational Mode in Alkali Halide Crystals," *Phys. Rev.* **B28**, 7244 (1983).
15. P. Pokrowsky, W. E. Moerner, F. Chu, and G. C. Bjorklund, "Reading and Writing of Photochemical Holes Using GaAlAs Diode Lasers," *Proc. Soc. Photo-Opt. Instrum. Engineers* **382**, 202 (1983).
16. B. H. Schechtman, G. C. Bjorklund, and W. E. Moerner, "A Horse of a Different Color:

- Frequency Domain Optical Storage," IBM Research Report # RJ4128, 1983.
17. W. E. Moerner, "Organic Materials for Frequency Domain Optical Storage," Proc. Lasers '83, R. C. Powell, editor, (STS Press, McLean, Virginia, 1983), p. 489.
 18. W. E. Moerner, A. R. Chraplyvy, and A. J. Sievers, "Anharmonic Vibrational Relaxation Dynamics for a Molecular Impurity Mode in Alkali Halide Crystals," *Phys. Rev.* **B29**, 6694 (1984).
 19. A. L. Huston and W. E. Moerner, "Detection of Persistent Spectral Holes Using Ultrasonic Modulation," *J. Opt. Soc. Am. B: Opt. Phys.* **1**, 349 (1984).
 20. M. Romagnoli, W. E. Moerner, F. M. Schellenberg, M. D. Levenson, and G. C. Bjorklund, "Beyond the Bottleneck: Submicrosecond Hole-Burning in Phthalocyanine," *J. Opt. Soc. Am. B: Opt. Phys.* **1**, 341 (1984).
 21. W. E. Moerner, M. Gehrtz, and A. L. Huston, "Measurement of Quantum Efficiencies for Persistent Spectral Hole-Burning," *J. Phys. Chem.* **88**, 6459 (1984).
 22. W. E. Moerner, "The Spectroscopic Search for Single-Photon Materials," *Photonics Spectra* **19**, 59 (February 1985).
 23. H. W. H. Lee, A. L. Huston, M. Gehrtz, and W. E. Moerner, "Photochemical Hole-Burning in a Protonated Phthalocyanine with GaAlAs Diode Lasers," *Chem. Phys. Lett.* **114**, 491 (1985).
 24. W. E. Moerner and M. D. Levenson, "Can Single-Photon Processes Provide Useful Materials for Frequency Domain Optical Storage?" *J. Opt. Soc. Amer. B: Opt. Phys.* **2**, 915 (1985).
 25. W. E. Moerner, F. M. Schellenberg, G. C. Bjorklund, P. Kaipa, and F. Lüty, "High Efficiency Photochemical Hole-Burning for an Infrared Color Center," *Phys. Rev.* **B32**, 1270 (1985).
 26. M. Gehrtz, W. E. Moerner, and G. C. Bjorklund, "Shot-Noise Limited Detection in FM Spectroscopy by Optical Nulling of Residual Amplitude Modulation," IBM RJ#4678, 1985.
 27. H. W. H. Lee, M. Gehrtz, E. Marinero, and W. E. Moerner, "Two-Color, Photon-Gated Spectral Hole-Burning in an Organic Material," *Chem. Phys. Lett.* **118**, 611 (1985).
 28. W. E. Moerner, "Laser-Light-Induced Physical Processes in Optical Materials: Persistent Spectral Hole-Burning," *Proc. Soc. Photo-Opt. Instrum. Engr.* **541**, 60 (1985).
 29. W. E. Moerner, R. M. Macfarlane, and R. M. Shelby, "Photon-Gated Spectral Hole-Burning," *Physics/Optics News in 1985* *Optics News* **11** (12), 9 (1985).
 30. W. E. Moerner, "Molecular Electronics for Frequency Domain Optical Storage: Persistent Spectral Hole-Burning - A Review," *J. Molec. Elec.* **1**, 55 (1985).
 31. W. E. Moerner, P. Pokrowsky, F. M. Schellenberg, and G. C. Bjorklund, "Persistent Spectral Hole-Burning for R' Color Centers in LiF Crystals: Statics, Dynamics, and External Field Effects," *Phys. Rev.* **B33**, 5702 (1986).
 32. W. E. Moerner and A. L. Huston, "Phase-Sensitive Ultrasonic Modulation of Persistent Spectral Holes," *Appl. Phys. Lett.* **48**, 1181 (1986).

33. W. Lenth and W. E. Moerner, "Gated Spectral Hole-Burning for Frequency Domain Optical Recording," *Optics Commun.* **58**, 249 (1986).
34. W. E. Moerner, "Dynamical Hole-Burning Requirements for Frequency Domain Optical Storage," in Unconventional Photoactive Solids, Harvey Scher, editor, (Plenum, New York, 1988), pp. 41-51.
35. W. Lenth, R. M. Macfarlane, W. E. Moerner, F. M. Schellenberg, R. M. Shelby, and G. C. Bjorklund, "High-Density Frequency-Domain Optical Recording," *Proc. Soc. Photo-opt. Instrum. Engr.* **695**, 216 (1986).
36. A. J. Sievers and W. E. Moerner, "Persistent Infrared Spectral Hole-Burning for Impurity Vibrational Modes in Solids," Chapter 6 of Persistent Spectral Hole-Burning: Science and Applications, W. E. Moerner, editor, Topics in Current Physics Vol. 44 (Springer, Berlin, Heidelberg, 1988).
37. W. E. Moerner and A. L. Huston, "Phase-sensitive Detection of Persistent Spectral Holes Using Synchronous Ultrasonic Modulation Spectroscopy," *J. Opt. Soc. Am. B: Opt. Phys.* **3**, P210 (1986).
38. W. E. Moerner, T. P. Carter, and C. Bräuchle, "Fast Burning of Persistent Spectral Holes in Small Laser Spots Using Photon-Gated Materials," *Appl. Phys. Lett.* **50**, 430 (1987).
39. T. P. Carter, C. Bräuchle, V. Y. Lee, M. Manavi, and W. E. Moerner, "Photon-Gated Spectral Hole-Burning Via Donor-Acceptor Electron Transfer," *Opt. Lett.* **12**, 370 (1987).
40. T. P. Carter, C. Bräuchle, V. Y. Lee, M. Manavi, and W. E. Moerner, "Mechanism of Photon-Gated Persistent Spectral Hole-Burning in Metalloporphyrin/Halomethane Systems: Donor-Acceptor Electron Transfer," *J. Phys. Chem.* **91**, 3998 (1987).
41. W. E. Moerner, Sharon Moerner, and David Palmer, "FINDER – The Family INformation Database for Emergency Responders," Proceedings of the 6th Computer Networking Conference, American Radio Relay League, Redondo Beach, California, August 29, 1987, pp. 134-141. ISBN 0-87259-202-2.
42. W. E. Moerner, W. Lenth, and G. C. Bjorklund, "Frequency Domain Optical Storage and Other Applications of Persistent Spectral Hole-Burning," Chapter 7 of Persistent Spectral Hole-Burning: Science and Applications, W. E. Moerner, editor, Topics in Current Physics Vol. 44 (Springer, Berlin, Heidelberg, 1988).
43. W. E. Moerner, "Introduction to Persistent Spectral Hole-Burning: Science and Applications," Chapter 1 of Persistent Spectral Hole-Burning: Science and Applications, W. E. Moerner, editor, Topics in Current Physics Vol. 44 (Springer, Berlin, Heidelberg, 1988).
44. W. E. Moerner and T. P. Carter, "Statistical Fine Structure in Inhomogeneously Broadened Absorption Lines," *Phys. Rev. Lett.*, **59**, 2705 (1987).
45. W. E. Moerner and T. P. Carter, "Statistical Fine Structure in Inhomogeneously Broadened Absorption Lines in Solids," Advances in Laser Science III, AIP Conference Proceedings **172** (AIP, New York, 1988), p. 419.
46. T. P. Carter, M. Manavi, and W. E. Moerner, "Statistical Fine Structure in the Inhomogeneously Broadened Electronic Origin of Pentacene in p-Terphenyl," *J. Chem. Phys.* **89**, 1768 (1988).

47. T. P. Carter, D. E. Horne, and W. E. Moerner, "Pseudo-Stark Effect and FM/Stark Double-Modulation Spectroscopy for the Detection of Statistical Fine Structure in Alexandrite," *Chem. Phys. Lett.* **151**, 102 (1988).
48. W. E. Moerner and David Palmer, "ARES/Data: A Packet-Radio Database for Emergency Communications," Proceedings of the 7th Computer Networking Conference, American Radio Relay League, Columbia, Maryland, October 1, 1988, pp. 141-144. ISBN 0-87259-213-8
49. L. Kador, T. P. Carter, and W. E. Moerner, "FM-Stark Double-Modulation Spectroscopy for the Detection of Weak Spectral Features in Solids," Proc. IEEE Lasers and Electro-Optics Society Annual Meeting, IEEE Cat. No. 88CH 2683-1, pp. 246-248 (1988).
50. W. E. Moerner and L. Kador, "Optical Detection and Spectroscopy of Single Molecules in a Solid," *Phys. Rev. Lett.* **62**, 2535 (1989).
51. L. Kador, D. E. Horne, and W. E. Moerner, "Optical Detection and Probing of Single Dopant Molecules of Pentacene in a p-Terphenyl Host Crystal by Means of Absorption Spectroscopy," **Feature Article**, *J. Phys. Chem.* **94**, 1237 (1990).
52. W. E. Moerner and L. Kador, "Finding a Single Molecule in a Haystack: Optical Detection and Spectroscopy of Single Absorbers in Solids," *Analyt. Chem.* **61**, A1217-A1223 (1989).
53. W. E. Moerner, "Photon-Gated Persistent Spectral Hole-Burning," Proceedings of the International Symposium on Optical Memory 1989, *Japan J. Appl. Phys.* **28** (Suppl. 28-3), 221 (1989).
54. W. E. Moerner, Sharon Moerner, and David Palmer, "ARES/Data Update: A Packet Radio Database for Emergency Communications with Conference Bridge," Proceedings of the 8th Computer Networking Conference, American Radio Relay League, Colorado Springs, Colorado, October 7, 1989, pp. 134-143. ISBN 0-87259-251-0.
55. W. E. Moerner, L. Kador, and W. P. Ambrose, "Ultrasensitive Laser Spectroscopy in Solids: Optical Detection of a Single Dopant Molecule," Proc. IEEE Lasers and Electro-Optics Society Annual Meeting, IEEE Cat. No. 89CH2641-9, p. 260 (1989).
56. W. E. Moerner, L. Kador, and W. P. Ambrose, "Ultrasensitive Laser Spectroscopy in Solids: Single-Molecule Detection," Proceedings of the Fourth International Conference on Unconventional Photoactive Solids, The Almaden Symposium, *Molec. Cryst. Liq. Cryst.* **183**, 47 (1990).
57. W. E. Moerner, "Persistent Spectral Hole-Burning: Photon-Gating and Fundamental Statistical Limits," in Polymers for Microelectronics, Science, and Technology, Y. Tabata, I. Mita, and S. Nonogaki, editors (Kodansha Scientific and VCH Publishers, 1990), pp. 465-479.
58. W. P. Ambrose and W. E. Moerner, "Temperature Dependence of Photon-Gated Persistent Spectral Hole-Burning for the meso-tetra-p-tolyl-Zn-tetrabenzoporphyrin/Chloroform System in poly(Methylmethacrylate)", *Chem. Phys.* **144**, 71 (1990).
59. S. Ducharme, W. P. Risk, W. E. Moerner, V. Y. Lee, R. J. Twieg, and G. C. Bjorklund, "Intracavity Frequency Doubling of a Nd: YAG Laser with an Organic Nonlinear Optical Crystal," *Appl. Phys. Lett.* **57**, 537 (1990).
60. W. E. Moerner, "Ultrasensitive Laser Spectroscopy in Solids: Statistical Fine Structure and

- Single-Molecule Detection," *New J. Chem.* **15**, 199-208 (1991).
61. W. P. Ambrose and W. E. Moerner, "Phase-Sensitive Optical Detection of Ballistic Phonon Heat Pulses Using Frequency-Modulation Spectroscopy and Persistent Spectral Holes," *Phys. Rev.* **B43**, 1743 (1990).
 62. G. C. Bjorklund, S. Ducharme, D. Jungbauer, W. E. Moerner, J. D. Swalen, R. Twieg, C. G. Willson, and D. Yoon, "Organic Nonlinear Optical Materials for Frequency Doubling, Modulation, and Switching," in Proceedings of "Symposium on Optics and Electronics for Organic Materials," Annual Meeting of Society of Fiber Science and Technology, Tokyo, Japan, July 11-12, 1990.
 63. G. C. Bjorklund, S. Ducharme, W. Fleming, D. Jungbauer, W. E. Moerner, J. D. Swalen, R. Twieg, C. G. Willson, and D. Yoon, "Applications of Organic Second Order Nonlinear Optical Materials," Ch. 13 of *Materials for Nonlinear Optics: Chemical Perspectives*, S. R. Marder, J. E. Sohn, and G. D. Stucky, eds. ACS Symposium Series 455, 216 (1991).
 64. J. D. Swalen, G. C. Bjorklund, S. Ducharme, W. Fleming, S. Herminghaus, D. Jungbauer, W. E. Moerner, B. A. Smith, R. Twieg, D. Yoon, and G. Willson, "Organic Nonlinear Optical Materials and Their Device Applications for Frequency Doubling, Modulation, and Switching," *Proc. Soc. Photo-Opt. Instrum. Engr. NLO III* **1337**, 2 (1990).
 65. W. E. Moerner, "Organic Optoelectronic Materials," in Proceedings of the 23rd IBM Computer Science Symposium, Gotemba, Japan, *Challenges to Novel Computing*, H. Asio and S. Amari, eds. (Mita, Tokyo, 1990), pp. 153-170.
 66. W. E. Moerner, Sharon Moerner, and David Palmer, "ARES/Data – A Packet Database for Emergency and Public Service Communications," *QST Magazine* **74** (12), 75 (December 1990).
 67. W. P. Ambrose and W. E. Moerner, "Fluorescence Spectroscopy and Spectral Diffusion of Single Impurity Molecules in a Crystal," *Nature* **349**, 225-227 (1991).
 68. W. E. Moerner and W. P. Ambrose, "Comment on 'Single Pentacene Molecules Detected by Fluorescence Excitation in a p-Terphenyl Crystal,'" *Phys. Rev. Lett.* **66**, 1376 (1991).
 69. S. Ducharme, J. C. Scott, R. J. Twieg, and W. E. Moerner, "Observation of the Photorefractive Effect in a Polymer," *Phys. Rev. Lett.* **66**, 1846 (1991).
 70. W. E. Moerner and W. P. Ambrose, "Finding a Single Molecule in a Haystack: Laser Spectroscopy of Solids from \sqrt{N} to $N = 1$," *Proc. Soc. Photo-Opt. Instrum. Engr.* **1435**, 244 (1991).
 71. W. P. Ambrose, T. Basché, and W. E. Moerner, "Detection and Spectroscopy of Single Pentacene Molecules in a p-Terphenyl Crystal by Means of Fluorescence Excitation," *J. Chem. Phys.* **95**, 7150 (1991).
 72. J. C. Scott, S. Ducharme, R. J. Twieg, and W. E. Moerner, "The Photorefractive Effect in Non-Linear Polymers Doped with Charge Transport Agents," *Polym. Preprints* **32**, 107 (1991).
 73. J. D. Swalen, W. Fleming, M. Jurich, W. E. Moerner, B. A. Smith, S. Herminghaus, and G. C. Bjorklund, "Optical Waveguiding in Poled NLO Polymers," *Mat. Res. Soc. Symp. Proc.* **228**, 101 (1992).

74. S. Ducharme, J. C. Scott, R. J. Twieg, and W. E. Moerner, "Reply to 'Comment on Observation of the Photorefractive Effect in a Polymer,'" *Phys. Rev. Lett.* **67**, 2589 (1991).
75. W. E. Moerner, C. Walsh, J. C. Scott, S. Ducharme, D. M. Burland, G. C. Bjorklund, and R. J. Twieg, "Photorefractivity in Doped Nonlinear Organic Polymers," *Proc. Soc. Photo-Opt. Instrum. Engr. NLO IV* **1560**, 278 (1991).
76. W. P. Ambrose, Th. Basché, and W. E. Moerner, "Single Molecule Spectral Diffusion in a Solid Detected Via Fluorescence Spectroscopy," *J. Lumin.* **53**, 62 (1992).
77. Th. Basché and W. E. Moerner, "Optical Modification of a Single Impurity Molecule in a Solid," *Nature* **335**, 355 (1992).
78. Th. Basché, W. P. Ambrose, and W. E. Moerner, "Optical Spectra and Kinetics of Single Impurity Molecules in a Polymer: Spectral Diffusion and Persistent Spectral Hole-Burning," *J. Opt. Soc. Amer. B* **9**, 829 (1992).
79. C. A. Walsh and W. E. Moerner, "Two-Beam Coupling Measurements of Grating Phase in a Photorefractive Polymer," *J. Opt. Soc. Amer. B* **9**, 1642 (1992) (Special Issue on Photorefractive Materials, Effects, and Devices).
80. J. D. Swalen, G. C. Bjorklund, W. Fleming, S. Herminghaus, D. Jungbauer, M. Jurich, W. E. Moerner, B. Reck, B. A. Smith, R. Twieg, C. G. Willson, and R. Zentel, "Poled Epoxy Polymers for Optoelectronics," in *Organic Molecules for Nonlinear Optics and Photonics*, J. Messier et al. (eds.) (Kluwer Academic, Amsterdam, 1991) pp. 433-445.
81. J. C. Scott, L. Pautmeier, and W. E. Moerner, "Photoconductivity Studies of Photorefractive Polymers," *J. Opt. Soc. Am. B* **9**, 2059 (1992).
82. W. E. Moerner, C. A. Walsh, S. M. Silence, R. J. Twieg, T. J. Matray, J. C. Scott, V. Y. Lee, R. D. Miller, F. Hache, D. M. Burland, and G. C. Bjorklund, "Nonlinear Optical Properties of Organic Photorefractive Polymers," *Proc. Mat. Res. Soc.* **277**, 121 (1992).
83. J. C. Scott, L. Th. Pautmeier, W. E. Moerner, C. A. Walsh, S. M. Silence, T. J. Matray, and R. J. Twieg, "Photoconductivity of Photorefractive Polymers," *Proc. Mat. Res. Soc.* **277**, 135 (1992).
84. S. M. Silence, C. A. Walsh, J. C. Scott, T. J. Matray, R. J. Twieg, G. C. Bjorklund, F. Hache, and W. E. Moerner, "Sub-Second Grating Growth in a Photorefractive Polymer," *Opt. Lett.* **17**, 1107 (1992).
85. J. C. Scott, L. Th. Pautmeier, and W. E. Moerner, "Photoconduction and Photorefraction in Molecularly Doped Polymers," *Synth. Met.* **54**, 9 (1992).
86. Th. Basché, W. E. Moerner, M. Orrit, and H. Talon, "Photon Antibunching in the Fluorescence of a Single Dye Molecule Trapped in a Solid," *Phys. Rev. Lett.* **69**, 1516 (1992).
87. S. M. Silence, C. A. Walsh, J. C. Scott, and W. E. Moerner, "C₆₀ Sensitization of a Photorefractive Polymer," *Appl. Phys. Lett.* **61**, 2967 (1992).
88. W. E. Moerner, "Quantum Optics of a Single Molecule in a Solid," *Optics News in 1992*, *Opt. and Photon. News* **3**, 21 (1992).
89. J. D. Swalen, G. C. Bjorklund, W. W. Fleming, M. Jurich, W. E. Moerner, A. Skumanich, B. A. Smith, and J. I. Thackara, "Polymeric Electro-Optic Phase Modulator," *Nonl. Opt.* **6**,

- 205 (1993).
90. W. E. Moerner and Th. Basché (**invited review**), "Optical Spectroscopy of Single Impurity Molecules in Solids," *Angew. Chem.* **105**, 537 (1993); *Angew. Chem. Int. Ed. Engl.* **32**, 457 (1993).
 91. P. Tchénio, A. B. Myers, and W. E. Moerner, "Dispersed Fluorescence Spectra of Single Molecules of Pentacene in p-Terphenyl," *J. Phys. Chem. Lett.* **97**, 2491 (1993).
 92. M. C. J. M. Donckers, S. M. Silence, C. A. Walsh, F. Hache, D. M. Burland, W. E. Moerner, and R. J. Twieg, "Net Two-Beam-Coupling Gain in a Polymeric Photorefractive Material," *Opt. Lett.* **18**, 1044 (1993).
 93. J. Köhler, J. A. J. M. Disselhorst, M. C. J. M. Donckers, E. J. J. Groenen, J. Schmidt, and W. E. Moerner, "Magnetic Resonance of a Single Molecular Spin," *Nature* **363**, 242 (1993).
 94. J. D. Swalen, G. C. Bjorklund, W. Fleming, R. Hung, M. Jurich, V. Y. Lee, R. D. Miller, W. E. Moerner, D. Y. Morichiere, A. Skumanich, and B. A. Smith, "NLO Polymeric Waveguide Electro-Optic Phase Modulator," *Proc. Soc. Photo-Opt. Instrum. Engr. NLO V* **1775**, 369 (1992).
 95. S. M. Silence, F. Hache, M. Donckers, C. A. Walsh, D. M. Burland, G. C. Bjorklund, R. J. Twieg, and W. E. Moerner, "Nonlinear Optical Properties of Photorefractive Polymers", *Proc. Soc. Photo-Opt. Instrum. Engr.* **1852**, 253 (1993).
 96. P. Tchénio, A. B. Myers, and W. E. Moerner, "Optical Studies of Single Terrylene Molecules in Polyethylene," *J. Lumin.* **56**, 1 (1993).
 97. S. M. Silence, J. C. Scott, F. Hache, E. J. Ginsburg, P. K. Jenkner, R. D. Miller, R. J. Twieg, and W. E. Moerner, "Poly(silane)-Based High Mobility Photorefractive Polymers," *J. Opt. Soc. Am. B* **10**, 2306 (1993).
 98. S. M. Silence, M. C. J. M. Donckers, C. A. Walsh, D. M. Burland, R. J. Twieg, and W. E. Moerner, "Optical Properties of Poly(N-Vinylcarbazole)-Based Guest-Host Photorefractive Polymer Systems," *Appl. Opt.* **33**, 2218 (1993).
 99. W. E. Moerner, S. M. Silence, F. Hache, and G. C. Bjorklund, "Orientationally Enhanced Photorefractive Effect in Polymers," *J. Opt. Soc. Am. B* **11**, 320-330 (1993).
 100. W. E. Moerner and Scott M. Silence, "Polymeric Photorefractive Materials," *Chem. Revs.* **94**, 127 (1994).
 101. B. A. Smith, M. Jurich, W. E. Moerner, W. Volksen, M. E. Best, J. D. Swalen, and G. C. Bjorklund, "Lightwave Transmission of Multiple Television Signals Using a Polyimide Electro-Optic Phase Modulator," *Proc. Soc. Photo-Opt. Instrum. Engr. NLO VI* **2025**, 499 (1993).
 102. P. Tchénio, A. B. Myers, and W. E. Moerner, "Vibrational Analysis of Dispersed Fluorescence from Single Molecules of Terrylene in Polyethylene," *Chem. Phys. Lett.* **213**, 325 (1993).
 103. W. E. Moerner, "Optical Detection of the Magnetic Resonance of a Single Molecular Spin," *Physics News in 1993*, (American Institute of Physics, New York, 1994), p. 28.
 104. W. E. Moerner, "Optical Detection of the Magnetic Resonance of a Single Molecular

- Spin," *Optics News* in 1993, *Opt. and Photon. News* **4**, 35(1993).
105. A. B. Myers, P. Tchénio, and W. E. Moerner, "Vibronic Spectroscopy of Single Molecules: Exploring Electronic-Vibrational Frequency Correlations Within an Inhomogeneous Distribution," *J. Lumin.* **58**, 161 (1994).
 106. W. E. Moerner, "Fundamentals of Single-Molecule Spectroscopy in Solids," *J. Lumin.* **60&61**, 997 (1993).
 107. S. M. Silence, M. C. J. M. Donckers, C. A. Walsh, D. M. Burland, W. E. Moerner, and R. J. Twieg, "Electric-Field Dependent Nonphotorefractive Gratings in a Nonlinear Photoconducting Polymer," *Appl. Phys. Lett.* **64**, 712 (1994).
 108. G. C. Bjorklund, D. M. Burland, M. C. J. M. Donckers, E. Ginsburg, F. Hache, P. Jenkner, R. D. Miller, W. E. Moerner, J. C. Scott, S. M. Silence, R. J. Twieg, and C. A. Walsh, "Photorefractive Polymers Achieve Net Gain, High Diffraction Efficiency, and High Speed," *Optics News* in 1993, *Opt. and Photon. News* **4**, 42 (1993).
 109. T. Plakhotnik, W. E. Moerner, T. Irngartinger, and W. E. Moerner, "Single-Molecule Spectroscopy in Shpol'skii Matrices," *Chimia* **48**, 31 (1994).
 110. W. E. Moerner, "Examining Nanoenvironments in Solids on the Scale of a Single, Isolated Impurity Molecule," (**Invited General Article**) *Science* **265**, 46 (1994).
 111. W. E. Moerner, T. Plakhotnik, T. Irngartinger, M. Croci, V. Palm, and U. P. Wild, "Optical Probing of Single Molecules of Terrylene in a Shpol'skii Matrix: A Two-State Single-Molecule Switch," (**R. Kopelman Festschrift**) *J. Phys. Chem.* **98**, 7382 (1994).
 112. W. E. Moerner, "Book Review of Introduction to Photorefractive Nonlinear Optics by P. Yeh," *Phys. Today* (January 1994) p. 45.
 113. W. E. Moerner, S. M. Silence, G. C. Bjorklund, D. M. Burland, R. D. Miller, J. J. Stankus, and R. J. Twieg, "Photorefractive Polymers," *Polym. Preprints* **35**, 93 (1994).
 114. A. B. Myers, P. Tchénio, M. Z. Zgierski, and W. E. Moerner, "Vibronic Spectroscopy of Individual Molecules in Solids," (**Feature Article**) *J. Phys. Chem.* **98**, 10377 (1994).
 115. S. M. Silence, R. J. Twieg, G. C. Bjorklund, and W. E. Moerner, "Quasinondestructive Readout in a Photorefractive Polymer," *Phys. Rev. Lett.* **73**, 2047 (1994).
 116. S. M. Silence, G. C. Bjorklund, and W. E. Moerner, "Optical Trap Activation in a Photorefractive Polymer," *Opt. Lett.* **19**, 1822 (1994).
 117. S. M. Silence, J. C. Scott, J. J. Stankus, W. E. Moerner, C. R. Moylan, G. C. Bjorklund, and R. J. Twieg, "Photorefractive Polymers Based on Dual-Function Dopants," *J. Phys. Chem.* **99**, 4096 (1995).
 118. J. J. Stankus, S. M. Silence, W. E. Moerner, and G. C. Bjorklund, "Electric Field Switchable Stratified Volume Holograms in Photorefractive Polymers," *Opt. Lett.* **19**, 1480 (1994).
 119. T. Plakhotnik, W. E. Moerner, V. Palm, and U. P. Wild, "Single Molecule Spectroscopy: Maximum Emission Rate and Saturation Intensity," *Opt. Commun.* **114**, 83 (1995).
 120. W. E. Moerner, T. Plakhotnik, T. Irngartinger, U. P. Wild, D. W. Pohl, and B. Hecht, "Near-Field Optical Spectroscopy of Individual Molecules in Solids," *Phys. Rev. Lett.* **73**,

- 2764 (1994).
121. D. M. Burland, G. C. Bjorklund, W. E. Moerner, S. M. Silence, and J. J. Stankus, "Photorefractive Polymers-A Status Report," *Pure & Appl. Chem.* **67**, 33 (1995).
 122. D. Y. Kim, W. E. Torruellas, J. Kang, C. Bosshard, G. I. Stegeman, P. Vidakovic, J. Zyss, W. E. Moerner, R. Twieg, and G. Bjorklund, "Second-Order Cascading as the Origin of Large Third-Order Effects in Organic Single-Crystal-Core Fibers," *Opt. Lett.* **19**, 868 (1994).
 123. J. J. Stankus, S. M. Silence, R. J. Twieg, D. M. Burland, R. D. Miller, J. C. Scott, W. E. Moerner, and G. C. Bjorklund, "Recent Progress in Photorefractive Polymers: Materials and Structures," *Proc. Soc. Photo-Opt. Instrum. Engr.* **2285**, 204 (1994).
 124. W. E. Moerner, "Polymers Scale New Heights," *Nature* **371**, 475 (1994).
 125. S. M. Silence, D. M. Burland, and W. E. Moerner, "Photorefractive Polymers," Chapter 5 of Photorefractive Effects and Materials, David D. Nolte, Ed. (Kluwer Academic, Boston, 1995), pp. 265-309.
 126. W. E. Moerner and N. Peyghambarian, "Advances in Photorefractive Polymers: Plastics for Holography and Optical Processing," *Opt. Photon. News* **6**, 24 (March 1995).
 127. A. B. Myers, P. Tchénio, and W. E. Moerner, "Dynamics and Vibrational Spectra of Individual Molecules in Polymer Glasses," *Proc. Soc. Photo-Opt. Instrum. Engr.* **2385**, 103 (1995).
 128. W. E. Moerner, "Optical Spectroscopy of Individual Molecules Trapped in Solids," in *Atomic Physics 14, AIP Conf. Proc.* **323**, D. J. Wineland, C. E. Wieman, and S. J. Smith, eds. (AIP Press, New York, 1995), pp. 467-486.
 129. C. Poga, D. M. Burland, T. Hanemann, Y. Jia, C. R. Moylan, J. J. Stankus, R. J. Twieg, and W. E. Moerner, "Photorefractivity in New Organic Polymeric Materials," *Proc. Soc. Photo-Opt. Instrum. Engr.* **2526**, 82 (1995).
 130. W. E. Moerner, D. M. Burland, C. R. Moylan, and R. J. Twieg, "Mechanisms of Photorefractivity in Polymer Composites," *Polym. Preprints* **37**, 129 (1996).
 131. W. E. Moerner, "Probing Nanoenvironments in Solids and Quantum Optics Using Individual Impurity Molecules," Proceedings of Today Symposium 1995 on Frontiers in Laser Physics and Spectroscopy, *Prog. Crystal Growth and Charact.* **33**, 11 (1996).
 132. P. M. Lundquist, C. Poga, R. G. DeVoe, Y. Jia, W. E. Moerner, M.-P. Bernal, H. Coufal, R. K. Grygier, J. A. Hoffnagle, C. M. Jefferson, R. M. Macfarlane, R. M. Shelby, and G. T. Sincerbox, "Holographic Digital Data Storage in a Photorefractive Polymer," *Opt. Lett.* **21**, 890 (1996).
 133. J. L. Skinner and W. E. Moerner, "Structure and Dynamics in Solids as Probed by Optical Spectroscopy," **Invited Article for the Physical Chemistry Centennial Issue** of *J. Phys. Chem.* **100**, 13251-13262 (1996).
 134. W. E. Moerner, "Physical Principles and Methods of Single-Molecule Spectroscopy in Solids," Chapter 1 of Single-Molecule Optical Detection, Imaging, and Spectroscopy, Th. Basche, W. E. Moerner, M. Orrit, and U. P. Wild, eds. (VCH, Munich, 1997).
 135. W. E. Moerner, "High-Resolution Optical Spectroscopy of Single Molecules in Solids,"

Invited Article for Special Issue on Single-Molecule Detection and Manipulation,
Accounts Chem. Res. **29**, 563 (1996).

136. W. E. Moerner and P. M. Barbara, "Editorial: Single Molecules and Atoms," *Accounts Chem. Res.* **29**, 561 (1996).
137. A. Grunnet-Jepsen, C. L. Thompson, R. J. Twieg, and W. E. Moerner, "Photorefractive Properties of Low-Glass-Transition-Temperature Polymer Composites," *Proc. Amer. Chem. Soc. Division of Polymeric Materials* **75**, 175 (1996).
138. R. M. Dickson, D. J. Norris, Y.-L. Tzeng, and W. E. Moerner, "Three-Dimensional Imaging of Single Molecules Solvated in Pores of Poly(acrylamide) Gels," *Science* **274**, 966 (1996).
139. W. E. Moerner, A. Grunnet-Jepsen, C. L. Thompson, and R. J. Twieg, "Mechanisms of Photorefractivity in Polymer Composites," *Proc. SPIE* **2850**, 2 (1996).
140. R. M. Dickson, D. J. Norris, Y.-L. Tzeng, R. Sakowicz, L. S. B. Goldstein, and W. E. Moerner, "Single Molecules Solvated in Pores of Poly(acrylamide) Gels," *Mol. Cryst. Liq. Cryst.* **291**, 31 (1996).
141. A. Grunnet-Jepsen, C. L. Thompson, R. J. Twieg, and W. E. Moerner, "Amplified Scattering in a High Gain Photorefractive Polymer," *J. Opt. Soc. Am. B.* **15**, 901 (1998).
142. W. E. Moerner, R. M. Dickson, and D. J. Norris, "Single-Molecule Nanophotonics in Solids," *Mats. Sci. and Engr.* **B48**, 169 (1997).
143. W. E. Moerner, A. Grunnet-Jepsen, and C. L. Thompson, "Photorefractive Polymers", **Invited Review**, *Annual Review of Materials Science* **27**, 585-623 (1997).
144. A. Grunnet-Jepsen, C. L. Thompson, R. J. Twieg, and W. E. Moerner, "High Performance Photorefractive Polymer with Improved Stability," *Appl. Phys. Lett.* **70**, 1515 (1997).
145. W. E. Moerner, R. M. Dickson, and D. J. Norris, "Single-Molecule Spectroscopy and Quantum Optics in Solids," **Invited Review**, *Advances in Atomic, Molecular and Optical Physics*, Vol. **38**, 193-236 (1997).
146. Th. Basche, W. E. Moerner, M. Orrit, and U. P. Wild, eds., Single-Molecule Optical Detection, Imaging, and Spectroscopy (VCH, Munich, 1997).
147. A. Grunnet-Jepsen, C. L. Thompson, and W. E. Moerner, "Measurement of Spatial Phase-Shift in High-Gain Photorefractive Materials," *Opt. Lett.* **22**, 874 (1997).
148. A. Grunnet-Jepsen, C. L. Thompson, and W. E. Moerner, "Spontaneous oscillation and self-pumped phase conjugation in a photorefractive polymer amplifier," *Science* **277**, 549 (1997).
149. A. Grunnet-Jepsen, C. L. Thompson, and W. E. Moerner, "Systematics of two-wave mixing in a photorefractive polymer," *J. Opt. Soc. Am. B* **15**, 905-913 (1998).
150. A. Grunnet-Jepsen, C. L. Thompson, and W. E. Moerner, "Gain enhancement by moving gratings in a photorefractive polymer," *Opt. Commun.* **145**, 145-149 (1998).
151. A. Grunnet-Jepsen, C. L. Thompson, and W. E. Moerner, "Optical Limiting in a Photorefractive Polymer", *Proc. Materials Research Society*, Symposium S, **479**, 199 (1997).

152. R. M. Dickson, A. B. Cubitt, R. Y. Tsien, and W. E. Moerner, "On/Off Blinking and Switching Behavior of Single Green Fluorescent Protein Molecules," *Nature* **388**, 355 (1997).
153. D. J. Norris, M. Kuwata-Gonokami, and W. E. Moerner, "Excitation of a Single Molecule on the Surface of a Spherical Microcavity," *Appl. Phys. Lett.* **71**, 297 (1997).
154. W. E. Moerner, **Invited Perspective**, "Those Blinking Single Molecules," *Science* **277**, 1059 (1997).
155. A. Grunnet-Jepsen, C. L. Thompson, R. J. Twieg, K. Belfield, M. S. Bratcher, and W. E. Moerner, "Large Gain Photorefractive Polymers," *Proc. Soc. Photo-Opt. Instrum. Engr.* **3144**, 216-226 (1997).
156. W. E. Moerner, A. Grunnet-Jepsen, C. L. Thompson, M. S. Bratcher, and R. J. Twieg, "Recent Advances in Photorefractive Polymer Materials," *Proc. Soc. Photo-Opt. Instrum. Engr.* **3147**, 84-94 (1997).
157. A. Grunnet-Jepsen, D. Wright, B. Smith, M. S. Bratcher, M. S. DeClue, J. S. Siegel, and W. E. Moerner, "Spectroscopic Determination of Trap Density in C₆₀-Sensitized Photorefractive Polymers," *Chem. Phys. Lett.* **291**, 553-561 (1998).
158. S. Kummer, R. M. Dickson, and W. E. Moerner, "Probing Single Molecules in Polyacrylamide Gels," *Proc. Soc. Photo-Opt. Instrum. Engr.* **3273**, 165-173 (1998).
159. W. E. Moerner, M. A. Diaz-Garcia, D. Wright, B. R. Smith, J. Casperson, M. S. Bratcher, M. S. DeClue, J. S. Siegel, and R. J. Twieg, "Fast and Efficient Photorefractivity in Polymer Composites," *Polym. Preprints* **39**, 980 (1998).
160. M. S. Bratcher, M. S. DeClue, A. Grunnet-Jepsen, D. Wright, B. Smith, W. E. Moerner, and J. S. Siegel, "Synthesis of Fully-Functional Photorefractive Polymers with Net Gain: Design Strategy Amenable to Combinatorial Optimization," *J. Amer. Chem. Soc.* **120**, 9680-9681 (1998).
161. R. M. Dickson, D. J. Norris, and W. E. Moerner, "Simultaneous Imaging of Individual Molecules Aligned Both Parallel and Perpendicular to the Optic Axis," *Phys. Rev. Lett.* **81**, 5322-5325 (1998).
162. D. Wright, M. A. Diaz-Garcia, J. D. Casperson, M. DeClue, and W. E. Moerner, "High Speed Photorefractive Polymer Composites," *Appl. Phys. Lett.* **73**, 1490-1492 (1998).
163. D. Wright, A. Grunnet-Jepsen, M. A. Diaz-Garcia, J. D. Casperson, B. Smith, M. S. Bratcher, M. S. DeClue, J. S. Siegel, W. E. Moerner, and R. J. Twieg, "Trapping Studies on Photorefractive Polymers," *Proc. Soc. Photo-Opt. Instrum. Engr.* **3471**, 60-71 (1998).
164. M. B. Klein, G. D. Bacher, A. Grunnet-Jepsen, D. Wright, and W. E. Moerner, "Homodyne Detection of Ultrasonic Surface Displacements Using Two-Wave Mixing in Photorefractive Polymers," *Opt. Commun.* **162**, 79-84 (1999).
165. W. E. Moerner, E. J. G. Peterman, S. Basselet, S. Kummer, and R. M. Dickson, "Optical Methods for Exploring Dynamics of Single Copies of Green Fluorescent Protein," *Cytometry* **36**, 232-238 (1999).
166. W. E. Moerner and M. Orrit, "Illuminating Single Molecules in Condensed Matter," **Invited Article**, *Science* **283**, 1670-1676 (1999).

167. M. A. Díaz-García, D. Wright, J. D. Casperson, B. Smith, E. Glazer, W. E. Moerner, L. I. Sukhomlinova, and R. J. Twieg, "Photorefractive Properties of Poly(N-Vinyl Carbazole)-Based Composites for High Speed Applications," *Chem. Mater.* **11**, 1784-1791 (1999).
168. W. E. Moerner, A. Grunnet-Jepsen, D. Wright, J. D. Casperson, M. S. DeClue, J. S. Siegel, and R. J. Twieg, "Understanding Photorefractivity in High-Performance Polymer Composites," *OSA Trends in Optics and Photonics* Volume **27**, Advances in Photorefractive Materials, Effects, and Devices, P. E. Andersen, P. M. Johansen, H. C. Pedersen, P. M. Petersen, and M. Saffman, Eds. (Optical Society of America, Washington, DC, 1999), pp. 164-172.
169. R. J. Twieg, M. He, L. Sukhomlinova, F. You, W. E. Moerner, M. A. Diaz-Garcia, D. Wright, J. D. Casperson, R. Wortmann, C. Glania, P. Kraemer, K. Lukaszuk, R. Matschiner, K. D. Singer, V. Ostoverkhov, and R. Petschek, "Design and Optimization of Chromophores for Liquid Crystal and Photorefractive Applications," *Proc. Mater. Res. Soc.* **561**, 119-130 (1999).
170. E. J. G. Peterman, S. Brasselet, and W. E. Moerner, "The Fluorescence Dynamics of Single Molecules of Green Fluorescent Protein," *J. Phys. Chem.* **A103**, 10553-10560 (1999).
171. S. Brasselet, E. J. G. Peterman, A. Miyawaki, and W. E. Moerner, "Single-Molecule Fluorescence Resonant Energy Transfer in Calcium-Concentration-Dependent Cameleon," *J. Phys. Chem. B* **104**, 3676-3682 (2000).
172. P. Schwille, S. Kummer, A. A. Heikal, W. E. Moerner, and W. W. Webb, "Fluorescence Correlation Spectroscopy Reveals Fast Optical Excitation-Driven Intermolecular Dynamics of Yellow Fluorescent Proteins," *Proc. Nat. Acad. Sci. USA* **97**, 151-156 (2000).
173. S. Brasselet and W. E. Moerner, "Fluorescence Behavior of Single-Molecule pH Sensors," *Single Molecules* **1**, 15-21 (Inaugural issue, 2000).
174. A. Goonesekera, D. Wright, and W. E. Moerner, "Image Amplification and Novelty Filtering in a Photorefractive Polymer," *Appl. Phys. Lett.* **76**, 3358-3360 (2000).
175. W. E. Moerner, "Photorefractive Polymers," in Encyclopedia of Materials: Science and Technology, Ed. D. D. Nolte; Senior Eds.: K.H. Jürgen Buschow, Robert W. Cahn, Merton C. Flemings, Bernhard Ilshner, Edward J. Kramer, Subhash Mahajan (Elsevier Science Ltd., Oxford, 2001) pp. 6961-6969.
176. B. Lounis and W. E. Moerner, "Single Photons on Demand from a Single Molecule at Room Temperature," *Nature* **407**, 491-493(2000).
177. W. E. Moerner, "Thirteen Years of Single-Molecule Spectroscopy in Physical Chemistry and Biophysics," in Single-Molecule Spectroscopy: Nobel Conference Lectures, R. Rigler, M. Orrit, Th. Basche, Editors, Springer Series in Chemical Physics, Volume 67 (Springer-Verlag, Heidelberg, 2001), pp. 32-61.
178. M. A. Diaz-Garcia, D. Wright, J. D. Casperson, B. Smith, El Glazer, W. E. Moerner, L. I. Sukhomlinova, and R. J. Twieg, "High Speed PVK-Based Photorefractive Polymer Composites," *Nonlinear Optics* **25**, 189-194 (2000).
179. B. Lounis, H. A. Bechtel, D. Gerion, P. Alivisatos, and W. E. Moerner, "Photon Antibunching in Single Quantum Dot Fluorescence," *Chem. Phys. Lett.* **329**, 399-404

- (2000).
180. H. Sosa, E. J. G. Peterman, W. E. Moerner, and L. S. B. Goldstein, "ADP-Induced Rocking of the Kinesin Motor Domain Revealed by Single-Molecule Fluorescence Polarization Microscopy," *Nature Struct. Biol.* **8**, 540-544 (2001).
 181. D. Wright, U. Gubler, M. B. Klein, and W. E. Moerner, "Photorefractive Polymers for Laser-Based Ultrasound Detection," *Proc. Soc. Photo-Opt. Instrum. Engr.* **4104**, 110-117 (2000).
 182. B. Lounis, J. Deich, F. I. Rosell, S. G. Boxer, and W. E. Moerner, "Photophysics of DsRed, a Red Fluorescent Protein, from the Ensemble to the Single-Molecule Level," *J. Phys. Chem. B* **105**, 5048-5054 (2001).
 183. M. He, R. J. Twieg, U. Gubler, D. Wright, and W. E. Moerner, "Synthesis and Properties of Some Composite Organic Photorefractive Materials," *Polym. Preprints* **42**, 510-511 (2001).
 184. E. J. G. Peterman, H. Sosa, L. S. B. Goldstein, and W. E. Moerner, "Polarized Fluorescence Microscopy of Individual and Many Kinesin Motors Bound to Microtubules," *Biophys. J.* **81**, 2851-2863 (2001).
 185. M. F. Paige, E. J. Bjerneld, and W. E. Moerner, "A Comparison of Through-the-Objective Total Internal Reflection Microscopy and Epi-fluorescence Microscopy for Single-Molecule Fluorescence Imaging," *Single Molecules* **2**, 191-201 (2001).
 186. D. Wright, U. Gubler, S. Sadhukhan, W. E. Moerner, M. He, R. J. Twieg, M. DeClue, and J. Siegel, "Organic Photorefractive Material Design Strategies," *Proc. Soc. Photo-Opt. Instrum. Engr.* **4462**, 125-138 (2001).
 187. W. E. Moerner, "A Dozen Years of Single-Molecule Spectroscopy in Physics, Chemistry, and Biophysics, (**Invited Feature Article**)," *J. Phys. Chem. B* **106**, 910-927 (2002).
 188. U. Gubler, D. Wright, W. E. Moerner, and M. B. Klein, "Photochromic Polymers for the Optical Homodyne Detection of Ultrasonic Surface Displacements," *Opt. Lett.* **27**, 354-356 (2002).
 189. D. Wright, U. Gubler, Y. Roh, W. E. Moerner, M. He, and R. J. Twieg, "A High Performance Photorefractive Polymer Composite with 2-dicyanomethylene-3-cyano-2,5-dihydrofuran Chromophore," *Appl. Phys. Lett.* **79**, 4274-4276 (2001).
 190. U. Gubler, M. He, D. Wright, Y. Roh, R. J. Twieg, and W. E. Moerner, "Monolithic Photorefractive Organic Glasses with Large Coupling Gain and Strong Beam Fanning," *Adv. Mater.* **14**, 313-317 (2002).
 191. M. F. Paige, D. P. Fromm, and W. E. Moerner, "Biomolecular Applications of Single-Molecule Measurements: Kinetics and Dynamics of a Single Enzyme Reaction," *Proc. Soc. Photo-Opt. Instrum. Engr.* **4634**, 92-103 (2002).
 192. O. Ostroverkhova, D. Wright, U. Gubler, W. E. Moerner, M. He, A. Sastre-Santos, R. J. Twieg, "Recent Advances in the Understanding and Development of Photorefractive Polymers and Glasses," *Adv. Func. Mater.* **12**, 621-629 (2002).
 193. N. B. Bowden, K. A. Willets, W. E. Moerner, and R. M. Waymouth, "Synthesis of Fluorescently-Labeled Polymers and Their Use in Single-Molecule Imaging,"

- Macromolecules* **35**, 8122-8125 (2002).
194. M. Vrljic, S. Y. Nishimura, S. Brasselet, W. E. Moerner, and H. M. McConnell, "Translational Diffusion of Individual Class II MHC Membrane Proteins in Cells," *Biophys. J.* **83**, 2681-2692 (2002).
 195. W. E. Moerner, "Single-Molecule Optical Spectroscopy of Autofluorescent Proteins," **Invited Review**, *J. Chem. Phys.* **117**, 10925-10937 (2002).
 196. M. He, R. J. Twieg, U. Gubler, D. Wright, and W. E. Moerner, "Synthesis and Photorefractive Properties of Multifunctional Glasses," *Chem. Mater.* **15**, 1156-1164 (2003).
 197. M. He, R. Twieg, U. Gubler, D. Wright, and W. E. Moerner, "Synthesis and Properties of Glassy Organic Multifunctional Photorefractive Materials," *Opt. Mater.* **21**, 353-357 (2002).
 198. M. He, R. J. Twieg, O. Ostroverkhova, U. Gubler, D. Wright, W. E. Moerner, "Dicyanomethylenedihydrofuran photorefractive materials," *Proc. Soc. Photo-Opt. Instrum. Engr.* **4802**, 9-20 (2002).
 199. O. Ostroverkhova, M. He, R. J. Twieg, W. E. Moerner, "High Performance Photorefractive Organic Glasses: Understanding Mechanisms and Limitations," *Proc. Soc. Photo-Opt. Instrum. Engr.* **4802**, 21-32 (2002).
 200. W. E. Moerner and D. P. Fromm, "Methods of Single-Molecule Fluorescence Spectroscopy and Microscopy," **Invited Review**, *Rev. Sci. Instrum.* **74**, 3597-3619 (2003).
 201. K. A. Willets, O. Ostroverkhova, M. He, R. J. Twieg, and W. E. Moerner, "New Fluorophores for Single-Molecule Spectroscopy," *J. Amer. Chem. Soc.* **125**, 1174-1175 (2003) (10.1021/ja029100q, 11 January 2003).
 202. O. Ostroverkhova, W. E. Moerner, "High-Performance Photorefractive Organic Glass with Near-Infrared Sensitivity," *Appl. Phys. Lett.* **82**, 3602-3604 (2003).
 203. O. Ostroverkhova, M. He, R. J. Twieg, and W. E. Moerner, "Role of Temperature in Controlling Performance of Organic Photorefractive Glasses," *ChemPhysChem* **4**, 732-744 (2003).
 204. J. Hwang, M. M. Fejer, and W. E. Moerner, "Exploring Novel Methods of Interferometric Detection of Ultrasmall Phase Shifts," *Proc. SPIE* **4962**, 110-120 (2003).
 205. D. Wright, U. Gubler, W. E. Moerner, M. DeClue, and J. S. Siegel, "Photorefractive Properties of Poly(siloxane)-triarylamine-Based Composites for High Speed Applications," *J. Phys. Chem. B* **107**, 4732-4737 (2003) (10.1021/jp027456i).
 206. W. E. Moerner, "Optical Measurements of Single Molecules in Cells," *Trends Analyt. Chem.* **22**, 544-548 (2003).
 207. Z. Chen, M. Asaro, O. Ostroverkhova, W. E. Moerner, M. He, and R. J. Twieg, "Self-trapping of light in a photorefractive organic glass," *Opt. Lett.* **28**, 1-3 (2003).
 208. Ellen M. Judd, Kathleen R. Ryan, W. E. Moerner, Lucy Shapiro, Harley H. McAdams, "Fluorescence bleaching reveals asymmetric compartment formation prior to cell division in *Caulobacter*," *Proc. Nat. Acad. Sci. (USA)* **100**, 8235-8240 (2003).

209. K. A. Willets, O. Ostroverkhova, S. Hess, M. He, R. J. Twieg, and W. E. Moerner, "Novel Fluorophores for Single-Molecule Imaging," *Proc. SPIE* **5222**, 150-157 (2003).
210. E. Thrush, O. Levi, W. Ha, G. Carey, L. J. Cook, J. Deich, S. J. Smith, W. E. Moerner, and J. S. Harris, Jr., "Integrated Semiconductor Vertical-Cavity Surface-Emitting Lasers and PIN Photodetectors for Bio-Medical Fluorescence Sensing," *IEEE J. Quant. Electr.* **40**, 491-498 (2004).
211. E. J. G. Peterman, H. Sosa, and W. E. Moerner, "Single-Molecule Fluorescence Spectroscopy and Microscopy of Biomolecular Motors," **Invited Review**, *Ann. Rev. Phys. Chem.* **55**, 79-96 (2004).
212. O. Ostroverkhova and W. E. Moerner, "Organic Photorefractives: Mechanisms, Materials, and Applications," **Invited Review**, *Chem. Revs.* **104**, 3267-3314 (2004).
213. E. Thrush, O. Levi, L. J. Cook, J. Deich, A. Kurtz, S. J. Smith, W. E. Moerner, and J. S. Harris Jr., "Monolithically integrated semiconductor fluorescence sensor for microfluidic applications," *Sensors and Actuators B: Chemical* **105**, 393-399 (2005).
214. J. Matteo, D. P. Fromm, Y. Yuen, P. J. Schuck, W. E. Moerner, and L. Hesselink, "Spectral Analysis of Strongly Enhanced Visible Light Transmission Through Single C-Shaped Nano-Apertures," *Appl. Phys. Lett.* **85**, 648-650 (2004).
215. J. Deich, E. M. Judd, H. H. McAdams, and W. E. Moerner, "Visualization of the Movement of Single Histidine Kinase Molecules in Live *Caulobacter* cells," *Proc. Nat. Acad. Sci. (USA)* **101**, 15921-15926 (2004) (published online Nov. 2, 2004, 10.1073/pnas.0404200101).
216. M. Vrljic, S. Y. Nishimura, W. E. Moerner, and H. M. McConnell, "Cholesterol depletion suppresses the translational diffusion of class II MHC proteins in the plasma membrane," *Biophys. J.* **88**, 334-347 (2005).
217. K. A. Willets, P. Callis, and W. E. Moerner, "Experimental and Theoretical Investigations of Environmentally Sensitive Single-Molecule Fluorophores," (**G. J. Small Festschrift**) *J. Phys. Chem. B* **108**, 10465-10473 (2004) (published online 17 April 2004, 10.1021/jp049684d).
218. E. Thrush, O. Levi, W. Ha, G. Carey, L. J. Cook, J. Deich, S. J. Smith, W. E. Moerner and J. S. Harris, Jr., "Laser background rejection optimization in integrated optoelectronic fluorescence sensor," *Proceedings of μ TAS* **1**, 363-366 (2003).
219. D. P. Fromm, A. Sundaramurthy, P. J. Schuck, G. Kino, and W. E. Moerner, "Gap-Dependent Optical Coupling of Single 'Bowtie' Nanoantennas Resonant in the Visible," *Nano Lett.* **4**, 957-961 (2004) (published online March 25, 2004, 10.1021/nl049951r).
220. W. E. Moerner, "Single-Photon Sources Based on Single Molecules in Solids," *New Journal of Physics* **6**, 88-109 (2004).
221. K. A. Willets, R. J. Twieg, and W. E. Moerner, "Single-Molecule Magic," *OEMagazine* **4**, 13-15 (2004).
222. 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, appearing March 2007).

223. S. Y. Kim, A. N. Semyonov, R. J. Twieg, A. L. Horwich, J. Frydman, and W. E. Moerner, "Probing the Sequence of Conformational Changes in the Molecular Chaperonin GroEL with Fluorescence Spectroscopy," *J. Phys. Chem. B* **109**, 24517-24525 (2005).
224. K. A. Willets, S. Y. Nishimura, P. J. Schuck, R. J. Twieg, and W. E. Moerner, "Nonlinear Optical Chromophores as Nanoscale Emitters for Single-Molecule Spectroscopy," **Invited Review**, *Accounts Chem. Res.* **38**, 549-556 (2005) (published online 28 Jan 2005).
225. P. J. Schuck, D. P. Fromm, A. Sundaramurthy, G. S. Kino, and W. E. Moerner, "Improving the Mismatch Between Light and Nanoscale Objects with Gold Bowtie Nanoantennas," *Phys. Rev. Lett.* **94**, 017402 (2005).
226. A. E. Cohen and W. E. Moerner, "A Method for Trapping and Manipulating Nanoscale Objects in Solution," *Appl. Phys. Lett.* **86**, 093109 (2005).
227. P. J. Schuck, K. A. Willets, D. P. Fromm, R. J. Twieg, and W. E. Moerner, "A Novel Fluorophore for Single-Molecule Two-Photon-Excited Fluorescence," *Chem. Phys.* **318**, 7-11 (2005).
228. K. Mauring, J. Deich, F. I. Rosell, T. B. McAnaney, W. E. Moerner, and S. G. Boxer, "Enhancement of the Blue Fluorescent Protein's Fluorescence by High Pressure or Low Temperature," *J. Phys. Chem. B* **109**, 12976-12981 (2005).
229. R. Twieg, H. Wang, Z. Lu, S. Y. Kim, S. Lord, S. Nishimura, P. J. Schuck, K. A. Willets, and W. E. Moerner, "Synthesis, Properties and Applications of Dicyanomethylenedihydrofuran (DCDHF) Single-Molecule Fluorophores," *Nonlinear Optics, Quantum Optics* **34**, 241-246 (2005).
230. M. Asaro, M. Sheldon, Z. Chen, O. Ostroverkhova, and W. E. Moerner, "Soliton-induced Waveguides in an Organic Photorefractive Glass," *Opt. Lett.* **30**, 519-521 (2005).
231. A. E. Cohen and W. E. Moerner, "The Anti-Brownian Electrophoretic Trap (ABEL Trap): Fabrication and Software," *Proc. SPIE* **5699**, 296-305 (2005).
232. E. M. Judd, L. R. Comolli, J. C. Chen, K. H. Downing, W. E. Moerner, and H. H. McAdams, "Distinct Constrictive Processes, Separated in Time and Space, Divide *Caulobacter* Inner and Outer Membranes," *J. Bacteriol.* **187**, 6874-6882 (2005).
233. S. Y. Nishimura, M. Vrljic, L. O. Klein, H. M. McConnell, and W. E. Moerner, "Cholesterol depletion induces solid-like regions in the plasma membrane," *Biophys. J.* **90**, 927-938 (2006).
234. A. E. Cohen and W. E. Moerner, "An All-Glass Microfluidic Cell for the ABEL Trap: Fabrication and Modeling," *Proc. SPIE* **5930**, 59300S-1-S-8 (2005).
235. A. Sundaramurthy, K. B. Crozier, G. S. Kino, D. P. Fromm, P. J. Schuck, and W. E. Moerner, "Field enhancement and gap-dependent resonance in a system of two opposing tip-to-tip Au nanotriangles," *Phys. Rev. B* **72**, 165409-1-6 (2005).
236. D. P. Fromm, A. Sundaramurthy, A. Kinkhabwala, P. J. Schuck, G. S. Kino, and W. E. Moerner, "Exploring the Chemical Enhancement for Surface-Enhanced Raman Scattering with Au Bowtie Nanoantennas," *J. Chem. Phys. Commun.* **124**, 061101 (2006).
237. A. Sundaramurthy*, P. J. Schuck*, N. R. Conley, D. P. Fromm, G. S. Kino, and W. E. Moerner, "Toward Nanometer-scale Optical Photolithography: Utilizing the Near-Field of

- Bowtie Optical Nanoantennas,” *Nano Lett.* **6**, 355-360 (2006) (web release 9 Feb 2006) (*equal contributions).
238. J. Hwang, M. M. Fejer, and W. E. Moerner, ”Scanning Interferometric Microscopy for the Detection of Ultrasmall Phase Shifts in Condensed Matter,” *Phys. Rev. A Rapid Commun.* **73**, 021802R (2006).
 239. A. E. Cohen and W. E. Moerner, ”Suppressing Brownian Motion of Individual Biomolecules in Solution,” *Proc. Nat. Acad. Sci. (USA)* **103**, 4362-4365 (2006).
 240. S. Y. Nishimura, S. J. Lord, L. O. Klein, K. A. Willets, M. He, Z. Lu, R. J. Twieg, and W. E. Moerner, ”Diffusion of Lipid-Like Single-Molecule Fluorophores in the Cell Membrane,” *J. Phys. Chem. B* **110**, 8151-8157 (2006).
 241. C. A. Werley and W. E. Moerner, ”Single-Molecule Nanoprobes Explore Defects in Spin-Grown Crystals,” **R. J. Silbey Festschrift**, *J. Phys. Chem. B* **110**, 18939- 18944 (2006), web release date 19 April 2006.
 242. M. Vrljic, S. Y. Nishimura, and W. E. Moerner, ”Single-Molecule Tracking,” Chapter 14 in *Methods in Molecular Biology, Vol. 398: Lipid Rafts*, Thomas. J. McIntosh, Ed. (Humana Press, Totwa, NJ, 2009), pp. 193-219.
 243. S. Y. Kim, Z. Gitai, A. Kinkhabwala, L. Shapiro, and W. E. Moerner, ”Single Molecules of the Bacterial Actin MreB Undergo Directed Treadmilling Motion in *Caulobacter crescentus*,” *Proc. Nat. Acad. Sci. (USA)* **103**, 10929-10934 (2006).
 244. W. E. Moerner, P. J. Schuck, D. P. Fromm, A. Kinkhabwala, S. J. Lord, S. Y. Nishimura, K. A. Willets, A. Sundaramurthy, G. Kino, M. He, Z. Lu, R. J. Twieg, ”Nanophotonics and Single Molecules,” Chapter 1 of *Single Molecules and Nanotechnology*, R. Rigler and H. Vogel, Eds. (Springer-Verlag, Berlin, Heidelberg, 2008), pp. 1-24.
 245. C. von Borczyskowski, J. Koehler, W. E. Moerner, M. Orrit, and J. Wrachtrup, ”Single-Molecule Electron Spin Resonance,” *Appl. Magn. Reson.* (special issue honoring George Feher) **31**, 665-676 (2007).
 246. W. E. Moerner, ”Single-Molecule Mountains Yield Nanoscale Cell Images,” *Nature Methods* **3**, 781-782 (2006).
 247. G. T. Gavranovic, S. Csihony, N. B. Bowden, C. J. Hawker, R. M. Waymouth, W. E. Moerner, G. G. Fuller, ”Well-Controlled Living Polymerization of Perylene-Labeled Polyisoprenes and Their Use in Single-Molecule Imaging,” *Macromolecules* **39**, 8121-8127 (2006).
 248. H. Wang, Z. Lu, S. J. Lord, K. A. Willets, J. A. Bertke, S. D. Bunge, W. E. Moerner, R. J. Twieg, ”The Influence of Tetrahydroquinoline Rings in Dicyanomethylenedihydrofuran (DCDHF) Single-Molecule Fluorophores,” *Tetrahedron* **63**, 103-114 (2007).
 249. Z. Lu, S. J. Lord, H. Wang, W. E. Moerner, and R. J. Twieg, ”A Long-Wavelength Analog of PRODAN: Synthesis and Properties of Anthradan, a Fluorophore with a 2,6-Donor-Acceptor Anthracene Structure,” *J. Org. Chem.* **71**, 9651-9657 (2006).
 250. A. E. Cohen and W. E. Moerner, ”Internal Mechanical Response of a Polymer in Solution,” *Phys. Rev. Lett.* **98**, 116001-(1-4) (2007).
 251. A. E. Cohen and W. E. Moerner, ”Principal-Components Analysis of Shape Fluctuations

- of Single DNA Molecules,” *Proc. Nat. Acad. Sci. (USA)* **104**, 12622-12627 (2007).
252. W. E. Moerner, “New Directions in Single-Molecule Imaging and Analysis,” Invited Perspective, *Proc. Nat. Acad. Sci. (USA)* **104**, 12596-12602 (2007); Erratum *Proc. Nat. Acad. Sci. (USA)* **104**, 15584 (2007).
253. H. Wang, Z. Lu, S. J. Lord, W. E. Moerner, and R. J. Twieg, “Modifications of DCDHF Single-Molecule Fluorophores to Impart Water Solubility,” *Tet. Lett.* **48**, 3471-3474 (2007).
254. N. R. Conley, A. Kurtz Pomerantz, H. Wang, R. J. Twieg, and W. E. Moerner, “Bulk and Single-Molecule Characterization of an Improved Molecular Beacon Utilizing H-Dimer Excitonic Behavior,” *J. Phys. Chem. B Letters* **111**, 7929-7931 (Web release 21 July 2007).
255. S. J. Lord, Z. Lu, H. Wang, K. A. Willets, P. J. Schuck, H. D. Lee, S. Y. Nishimura, R. J. Twieg, and W. E. Moerner, “Photophysical Properties of Acene DCDHF Fluorophores: Long-Wavelength Single-Molecule Emitters Designed for Cellular Imaging,” *J. Phys. Chem. A* **111**, 8934-8941 (2007).
256. F. Jäckel, A. Kinkhabwala, and W. E. Moerner, “Gold bowtie nanoantennas for surface-enhanced Raman scattering under controlled electrochemical potential,” *Chem. Phys. Lett.* **446**, 339-343 (2007).
257. J. Hwang and W. E. Moerner, “Interferometry of a Single Nanoparticle Using the Gouy Phase of a Focused Laser Beam,” *Opt. Commun.* **280**, 487-491 (published online, Sept. 4, 2007).
258. H-L. Lee, E. A. Dubikovskaya, H. Hwang, A. N. Semyonov, H. Wang, L. R. Jones, R. J. Twieg, W. E. Moerner, and P. A. Wender, “Single-Molecule Motions of Oligoarginine Transporter Conjugates on the Plasma Membrane of CHO Cells,” *J. Amer. Chem. Soc.* **130**, 9364-9370 (published online, June 26, 2008).
259. A. E. Cohen and W. E. Moerner, “Controlling Brownian motion of single protein molecules and single fluorophores in aqueous buffer,” *Optics Express* **16**, 6941-6956 (2008).
260. S. J. Lord, N. R. Conley, H.-L. D. Lee, R. Samuel, Na Liu, R. J. Twieg, and W. E. Moerner, “A Photoactivatable Push-Pull Fluorophore for Single-Molecule Imaging in Live Cells,” *J. Amer. Chem. Soc.* **130**, 9204-9205 (published online, June 24, 2008).
261. G. R. Bowman, L. R. Comolli, J. Zhu, M. Eckart, M. Koenig, K. H. Downing, W. E. Moerner, T. Earnest, L. Shapiro, “A polymeric protein anchors the chromosomal origin/ParB complex at a bacterial cell pole,” *Cell* **134**, 945-955 (2008).
262. N. R. Conley, J. S. Biteen, and W. E. Moerner, “Cy3-Cy5 Covalent Heterodimers for Single-Molecule Photoswitching,” *J. Phys. Chem. B Lett.* **112**, 11878-11880 (published online, 28 August 2008).
263. Y. Jiang, Q. Wang, A. E. Cohen, N. Douglas, J. Frydman, and W. E. Moerner, “Hardware-based anti-Brownian electrokinetic trap (ABEL trap) for single molecules: Control loop simulations and application to ATP binding stoichiometry in multi-subunit enzymes,” *Proc. SPIE* **7038**, 703807 (2008).
264. W. E. Moerner, “Single-Molecule Optical Spectroscopy and Imaging: From Early Steps to

- Recent Advances,” in Single Molecule Spectroscopy in Chemistry, Physics and Biology: Nobel Symposium 138, Springer Series in Chemical Physics Vol. 96, A. Gräslund, R. Rigler, J. Widengren, Eds. (Springer-Verlag, Berlin, 2009), pp. 25-60.
265. S. J. Lord, N. R. Conley, H.-L. D. Lee, S. Y. Nishimura, A. K. Pomerantz, K. A. Willets, Z. Lu, H. Wang, N. Liu, R. Samuel, R. Weber, A. Semyonov, M. He, R. J. Twieg, and W. E. Moerner, “DCDHF Fluorophores for Single-Molecule Imaging in Cells,” *Chem Phys Chem* 10th Anniversary Issue **10**, 55-65 (2009).
 266. A. K. Pomerantz, W. E. Moerner, and E. T. Kool, “Visualization of Long Human Telomere Mimics by Single-Molecule Fluorescence Imaging,” *J. Phys. Chem. B Lett.* **112**, 13184-13187 (2008), published online 26 September 2008.
 267. J. S. Biteen, M. A. Thompson, N. K. Tselentis, G. R. Bowman, L. Shapiro, W. E. Moerner, “Superresolution Imaging in Live *Caulobacter Crescentus* Cells Using Photoswitchable EYFP,” *Nature Meth.* **5**, 947-949 (2008), published online 15 September 2008.
 268. Z. Lu, N. Liu, S. J. Lord, S. D. Bunge, W. E. Moerner, and R. J. Twieg, “Bright-Red Single-Molecule Emitters: Synthesis and Properties of Environmentally Sensitive Dicyanomethylenedihydrofuran (DCDHF) Fluorophores with Bisaromatic Conjugation,” *Chem. Mater.* **21**, 797-810 (2009).
 269. S. R. P. Pavani*, M. A. Thompson*, J. S. Biteen, S. J. Lord, N. Liu, R. J. Twieg, R. Piestun, and W. E. Moerner, (*equal contributions), "Three-Dimensional Single-Molecule Fluorescence Imaging Beyond the Diffraction Limit Using a Double-Helix Point Spread Function," *Proc. Nat. Acad. Sci. (USA)* **106**, 2995-2999 (2009), published online 11 February 2009.
 270. J. K. Lee, F. Jäckel, W. E. Moerner, and Z. Bao, “Micron-sized DNA-Single Fluorophore-DNA Supramolecule: Synthesis and Single-Molecule Characterization,” *Small* **5**, 2418-2423 (2009), published online June 10, 2009.
 271. R. Won and W. E. Moerner, “Eyes on Super-resolution,” *Nature Photonics* **3**, 368-369 (2009).
 272. A. Kinkhabwala, Z. Yu, S. Fan, Y. Avlasevich, K. Müllen, and W. E. Moerner, “Large Single-Molecule Fluorescence Enhancements Produced by a Bowtie Nanoantenna,” *Nature Photonics* **3**, 654-657 (2009), published online, October 18, 2009.
 273. K. Rivoire, A. Kinkhabwala, F. Hatami, W. T. Masselink, Y. Avlasevich, K. Müllen, W.E. Moerner, and Jelena Vuckovic, "Lithographic Positioning of Fluorescent Molecules on High-Q Photonic Crystal Cavities," *Appl. Phys. Lett.* **95**, 123113-1-3 (2009).
 274. M. Orrit and W. E. Moerner, “High Resolution Single-Molecule Spectroscopy in Condensed Matter,” Chapter 12 of Physics and Chemistry at Low Temperatures, L. Khriachtchev, Ed. (Pan Stanford Publishing, Singapore, 2011), pp. 381-417.
 275. S. J. Lord, H-L. D. Lee, R. Samuel, R. Weber, N. Liu, N. R. Conley, M. A. Thompson, R. J. Twieg, and W. E. Moerner, “Azido Push–Pull Fluorogens Photoactivate to Produce Bright Fluorescent Labels,” *J. Phys. Chem. B* **114**, 14157-14167 (2010), **Michael R. Wasielewski Festschrift**, published online October 27, 2009.
 276. S. J. Lord, N. R. Conley, H-L. D. Lee, N. Liu, R. Samuel, R. J. Twieg, and W. E. Moerner, “Photoactivatable DCDHF Fluorophores for Single-Molecule Imaging,” *Proc. SPIE* **7190**,

- 719013 (2009).
277. J. S. Biteen and W. E. Moerner, "Single-Molecule and Superresolution Imaging in Live Bacterial Cells," in *Cell Biology of Bacteria*, L. Shapiro and R. Losick, Eds., Cold Spring Harbor Perspectives in Biology 2010; 2:a000448 (Cold Spring Harbor Laboratory Press, 2011), first published online February 3, 2010.
 278. Q. Wang and W. E. Moerner, "Optimal Strategy for Trapping Single Fluorescent Molecules in Solution Using the ABEL Trap," *Appl. Phys. B* **99**, 23-30 (2010), published online December 12, 2009.
 279. M. A. Thompson*, M. D. Lew*, M. Badieirostami, and W. E. Moerner, (*equal contributions), "Localizing and Tracking Single Nanoscale Emitters in Three Dimensions with High Spatio-Temporal Resolution Using a Double-Helix Point Spread Function," *Nano Letters* **10**, 211 (2010), published online December 15, 2009.
 280. R. Goldsmith and W. E. Moerner, "Watching Conformational- and Photo-Dynamics of Single Fluorescent Proteins in Solution," *Nature Chemistry* **2**, 179-186 (2010), published online January 31, 2010.
 281. S. J. Lord, H.-L. D. Lee, and W. E. Moerner, "Single-Molecule Spectroscopy and Imaging of Biomolecules in Living Cells," **Perspective**, *Anal. Chem.* **82**, 2192-2203 (2010), published online February 17, 2010.
 282. 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-1-75710Z-13 (2010).
 283. J. S. Biteen, L. Shapiro, and W. E. Moerner, "Exploring Protein Superstructures and Dynamics in Live Bacterial Cells Using Single-Molecule and Superresolution Imaging," Ch. 8 of *Single-Molecule Techniques: Methods and Protocols*, E. J. G. Peterman and G. J. L. Wuite, Eds., *Methods in Molecular Biology* Volume **783** (Humana Press, New York, 2011), pp. 139-158.
 284. M. A. Thompson, J. S. Biteen, S. J. Lord, N. R. Conley, and W. E. Moerner, "Molecules and Methods for Super-Resolution Imaging," in *Methods in Enzymology*, Volume **475**, Nils G. Walter, Editor (Elsevier, New York, 2010), Chapter 2, pp. 27-59.
 285. Jerod L. Ptacin, Steven F. Lee, Ethan C. Garner, Esteban Toro, Michael Eckart, Luis R. Comolli, W.E. Moerner, and Lucy Shapiro, "A spindle-like apparatus guides bacterial chromosome segregation," *Nature Cell Biology* **12**, 791-798 (2010), published online July 25, 2010.
 286. S. Y. Kim, E. J. Miller, J. Frydman, and W. E. Moerner, "Action of the chaperonin GroEL/ES on a non-native substrate observed with single-molecule FRET," *J. Molec. Biol.* **401**, 553-563 (2010), published online 30 June 2010.
 287. Michael A. Thompson, Jason M. Casolari, Majid Badieirostami, Patrick O. Brown, and W.E. Moerner, "Three-dimensional tracking of single mRNA particles in *S. cerevisiae* using a Double-Helix Point Spread Function," **Inaugural Article**, *Proc. Nat. Acad. Sci. (USA)* **107**, 17864-17871 (2010), published online 4 October 2010.
 288. Hsiao-lu D. Lee, Samuel J. Lord, Shigeki Iwanaga, Ke Zhan, Hexin Xie, Jarrod C. Williams, Hui Wang, Grant R. Bowman, Erin D. Goley, Lucy Shapiro, Robert J. Twieg,

- Jianghong Rao, and W. E. Moerner, "Superresolution Imaging of Targeted Proteins in Fixed and Living Cells Using Photoactivatable Organic Fluorophores," *J. Am. Chem. Soc.* **132**, 15099-15101 (2010), published online October 11, 2010.
289. Majid Badieirostami, Matthew D. Lew, Michael 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), published online October 18, 2010.
290. Matthew D. Lew, Steven F. Lee, Majid Badieirostami, and W. E. Moerner, "Corkscrew point spread function for far-field three-dimensional nanoscale localization of point objects," *Optics Lett.* **36**, 202-204 (2011), published online December 14, 2010.
291. Steven F. Lee*, Michael A. Thompson*, Monica Schwartz, Lucy Shapiro, and W. E. Moerner, (*equal contributions), "Super-Resolution Imaging of the Nucleoid-Associated Protein HU in *Caulobacter crescentus*," *Biophys. J. Lett.* **100**, L31-L33 (2011).
292. Julie S. Biteen and W. E. Moerner, "Live-cell single-molecule and superresolution imaging of proteins in bacteria," *Proc SPIE* **7905**, 79050Q-1-79050Q-8 (2011).
293. Lana Lau, Yin Loon Lee, Maja Matis, Jeff Axelrod, Tim Stearns, and W. E. Moerner, "STED Super-resolution Microscopy in Drosophila Tissue and in Mammalian Cells," *Proc SPIE* **7910**, 79101N-1-79101N-8 (2011).
294. A. E. Cohen and W. E. Moerner, "Anti-Brownian Traps," in *Encyclopedia of Biophysics*, G. C. K. Roberts (Ed.) (Springer, Berlin, Heidelberg, 2012), pp. 95-97.
295. Quan Wang and W. E. Moerner, "An Adaptive Anti-Brownian Electrokinetic Trap with Real-time Information on Single-Molecule Diffusivity and Mobility," *ACS Nano* **5**, 5792-5799 (2011), published online May 25, 2011.
296. Whitney C. Duim, Bryan Chen, Judith Frydman, and W. E. Moerner, "Sub-Diffraction Imaging of Huntingtin Protein Aggregates by Fluorescence Blink-Microscopy and Atomic Force Microscopy," *ChemPhysChem* **12**, 2387-2390 (2011), published online July 6, 2011.
297. Yan Jiang, Nicholai R. Douglas, Nicholas R. Conley, Erik J. Miller, Judith Frydman, and W. E. Moerner, "Sensing Cooperativity in ATP Hydrolysis for Single Multi-Subunit Enzymes in Solution," *Proc. Nat. Acad. Sci. (USA)* **108**, 16962-16967 (2011), published online 6 September 2011. **Highlighted** in a Commentary by Taekjip Ha and Sua Myong, "A single-molecule view of chaperonin cooperativity," *Proc. Natl. Acad. Sci. (USA)* **108**, 16865-16866 (2011).
298. Randall H. Goldsmith, Leandro C. Tabares, Dorota Kostrz, Christopher Dennison, Thijs J. Aartsma, Gerard W. Canters, and W. E. Moerner, "Redox cycling and kinetic analysis of single molecules of solution-phase nitrite reductase," *Proc. Nat. Acad. Sci. (USA)* **108**, 17269-17274 (2011), published online 3 October 2011.
299. Matthew D. Lew*, Steven F. Lee*, Jerod L. Ptacin, Marissa K. Lee, Robert J. Twieg, Lucy Shapiro, and W. E. Moerner, "Three-dimensional super-resolution co-localization of intracellular protein superstructures and the cell surface in live *Caulobacter crescentus*," *Proc. Nat. Acad. Sci. (USA)* **108**, E1102-E1110 (2011) and **108**, 18577-18578 (2011), published online 26 October 2011.
300. Samuel Bockenhauer, Alexandre Fürstenberg, Xiao Jie Yao, Brian Kobilka, and W. E.

- Moerner, "Conformational Dynamics of Single G Protein-Coupled Receptors in Solution," *J. Phys. Chem. B* **115**, 13328-13338 (2011), published online 19 September 2011.
301. Julie Biteen, Erin D. Goley, Lucy Shapiro, and W. E. Moerner, "Three-Dimensional Super-Resolution Imaging of the Midplane Protein FtsZ in Live *Caulobacter crescentus* Cells Using Astigmatism," *ChemPhysChem* **13**, 1007-1012 (2012), published online January 20, 2012.
 302. Michael A. Thompson, Matthew D. Lew, and W. E. Moerner, "Extending Microscopic Resolution with Single-Molecule Imaging and Active Control," *Annual Reviews of Biophysics* **41**, 321-342 (published online 9 Jun 2012).
 303. Matthew D. Lew, Steven F. Lee, Michael A. Thompson, Hsiao-lu D. Lee, and W. E. Moerner, "Single-Molecule Photocontrol and Nanoscopy," in Far-Field Optical Nanoscopy, P. Tinnefeld, C. Eggeling, and S. W. Hell, Eds., Springer Series on Fluorescence (Springer, Berlin, Heidelberg, 2012), published online 21 February 2012.
 304. Nicholas R. Conley, Anca Dragulescu-Andrasi, Jianghong Rao, and W. E. Moerner, "A Selenium Analogue of Firefly D-Luciferin with Red-Shifted Bioluminescence Emission," *Angew. Chemie Int. Ed. Engl.* **51**, 3350-3353 (2012), published online 17 February 2012.
 305. Stephanie C. Weber, Michael A. Thompson, W. E. Moerner, Andrew J. Spakowitz, and Julie A. Theriot, "Analytical tools to distinguish the effects of localization error, confinement and medium elasticity on the velocity autocorrelation function," *Biophys. J.* **102**, 2443-2450 (2012).
 306. Hsiao-lu D. Lee*, Steffen J. Sahl*, Matthew D. Lew, and W. E. Moerner, (*equal contributions), "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), published online 9 April 2012.
 307. Samuel Bockenhauer, Alexandre Fürstenberg, Xiao Jie Yao, Brian K. Kobilka, and W. E. Moerner, "Anti-Brownian ELectrokinetic (ABEL) Trapping of Single β_2 -Adrenergic Receptors in the Absence and Presence of Agonist," *Proc. SPIE* **8228**, 822805(1-16), (2012).
 308. Jason M. Casolari, Michael A. Thompson, Julia Salzman, Lowry M. Champion, W. E. Moerner, and Patrick O. Brown, "Widespread mRNA Association with Cytoskeletal Motor Proteins and Identification and Dynamics of Myosin-Associated mRNAs in *S. cerevisiae*," *PLoS ONE* **7**(2), e31912(1-20) (2012), published 16 Feb 2012.
 309. Quan Wang, Randall H. Goldsmith, Yan Jiang, Samuel D. Bockenhauer, and W.E. Moerner, "Probing single biomolecules in solution using the Anti-Brownian ELectrokinetic (ABEL) trap," *Acc. Chem. Res.* **45**, 1955-1964 (**Paul Barbara Special Issue**) (2012), published online 22 May 2012.
 310. W. E. Moerner, "Microscopy beyond the diffraction limit using actively controlled single molecules," *J. Microsc.* **246**, 213-220 (2012), published online 12 April 2012, DOI: 10.1111/j.1365-2818.2012.03600.x
 311. Anika A. Kinkhabwala, Zongfu Yu, Shanhui Fan, and W.E. Moerner, "Fluorescence correlation spectroscopy at high concentrations using gold bowtie nanoantennas," *Chem. Phys.* **406**, 3-8 (2012), published online 21 April 2012; **406C**, 3-8 (2012).

312. Lana Lau, Yin Loon Lee, Steffen J. Sahl, Tim Stearns, and W. E. Moerner, "STED Microscopy with Optimized Labeling Density Reveals 9-fold Arrangement of a Centriole Protein," *Biophys. J.* **102**, 2926-2935 (2012), published online 19 June 2012.
313. Samuel Bockenhauer, Quan Wang, and W. E. Moerner, "Spectrally Resolved Anti-Brownian ELectrokinetic (ABEL) Trapping of Single Peridinin-Chlorophyll-Proteins in Solution," *Proc. SPIE* **8427**, 84274C(1-9) (2012).
314. Alison E. Ondrus*, Hsiao-lu D. Lee*, Shigeki Iwanaga, William H. Parsons, Brian M. Andresen, W. E. Moerner, and J. Du Bois (*equal contributions), "Fluorescent Saxitoxins for Live Cell Imaging of Single Voltage-Gated Sodium Ion Channels Beyond the Optical Diffraction Limit," *Chemistry and Biology* **19**, 902-912 (2012), published online 26 July 2012.
315. Marissa K. Lee, Jarrod Williams, Robert J. Twieg, Jianghong Rao, and W. E. Moerner, "Enzymatic Activation of Nitro-Aryl Fluorogens in Live Bacterial Cells for Enzymatic Turnover-Activated Localization Microscopy," *Chemical Science* **4** (1), 220-225 (2013), published online 5 October 2012.
316. Mikael P. Backlund*, Matthew D. Lew*, Adam S. Backer, Steffen J. Sahl, Ginni Grover, Anurag Agrawal, Rafael Piestun, and W. E. Moerner (*equal contributions), "Simultaneous, accurate measurement of the 3D position and orientation of single molecules," *Proc. Nat. Acad. Sci. (USA)* **109**, 19087-19092 (2012), published online 5 November 2012.
317. Steffen J. Sahl*, Lucien E. Weiss*, Whitney C. Duim, Judith Frydman, and W. E. Moerner (*equal contributions), "Cellular Inclusion Bodies of Mutant Huntingtin Exon1 Obscure Small Fibrillar Aggregate Species," *Scientific Reports* **2**, 895 (2012).
318. Quan Wang and W. E. Moerner, "Lifetime and spectrally resolved characterization of the photodynamics of single fluorophores in solution using the Anti-Brownian Electrokinetic trap," **Special Issue in memory of Paul F. Barbara**, *J. Phys. Chem. B* **117**, 4641-4648 (2013), published online 30 November 2012.
319. Matthew D. Lew*, Mikael P. Backlund*, and W. E. Moerner (*equal contributions), "Rotational Mobility of Single Molecules Affects Localization Accuracy in Super-Resolution Fluorescence Microscopy," *Nano Lett.* **13**, 3967-3972 (2013), DOI:10.1021/nl304359p, published online January 29, 2013.
320. Andreas Gahlmann, Jerod L. Ptacin, Ginni Grover, Sean Quirin, Alexander R. S. von Diezmann, Marissa K. Lee, Mikael P. Backlund, Lucy Shapiro, Rafael Piestun, and W. E. Moerner, "Quantitative Multicolor Subdiffraction Imaging of Bacterial Protein Ultrastructures in Three Dimensions," *Nano Lett.* **13**, 987-993 (2013), published online February 15, 2013.
321. Matthew D. Lew*, Alexander R. S. von Diezmann,* and W. E. Moerner (*equal contributions), "Easy-DHPSF open-source software for three-dimensional localization of single molecules with precision beyond the optical diffraction limit," *Protocol Exchange* doi: 10.1038/protex.2013.026, published online 25 February 2013.
322. Mikael P. Backlund*, Matthew D. Lew*, Adam S. Backer, Steffen J. Sahl, Ginni Grover, Anurag Agrawal, Rafael Piestun, and W. E. Moerner (*equal contributions), "The double-helix point spread function enables precise and accurate measurement of 3D single-

- molecule position and orientation,” *Proc. SPIE* **8590**, 85900L1-11 (2013).
323. Adam S. Backer, Mikael P. Backlund, Matthew D. Lew, and W. E. Moerner, “Single-molecule orientation measurements with a quadrated pupil,” *Optics Lett.* **38**, 1521-1523 (2013), published online March 15, 2013.
 324. G.S. Schlau-Cohen, Q. Wang, J. Southall, R.J. Cogdell, W.E. Moerner, "Single-molecule spectroscopy reveals LH2 complexes switch between emissive states," *Proc. Nat. Acad. Sci. (USA)* **110**, 10899-10903 (2013), published online 19 June 2013.
 325. S. Bockenhauer and W. E. Moerner, “Photo-Induced Conformational Flexibility in Single Solution-Phase Peridinin-Chlorophyll-Proteins,” *J. Phys. Chem. A* **117**, 8399-8406 (2013), DOI: 10.1021/jp405790a, published online 6 August 2013.
 326. Steffen J. Sahl and W. E. Moerner, "Super-Resolution Fluorescence Imaging with Single Molecules,” *Curr. Opin. Struct. Biol.* **23**, 778-787 (2013), DOI: 10.1016/j.sbi.2013.07.010, published online 8 August 2013.
 327. Christopher P. Calderon, Michael A. Thompson, Jason M. Casolari, Randy C. Paffenroth, and W. E. Moerner, “Quantifying Transient 3D Dynamical Phenomena of Single mRNA Particles in Live Yeast Cell Measurements,” **Michael D. Fayer Festschrift**, *J. Phys. Chem. B* **117**, 15701-15713 (2013) (DOI: 10.1021/jp4064214, published online September 9, 2013).
 328. Andreas Gahlmann and W. E. Moerner, “Exploring bacterial cell biology with single-molecule tracking and super-resolution imaging,” *Nature Reviews Microbiology* **12**, 9-22 (2014), (DOI: 10.1038/nrmicro3154, published online December 16, 2013).
 329. Mikael P. Backlund, Matthew D. Lew, Adam S. Backer, Steffen J. Sahl, and W. E. Moerner, “The role of molecular dipole orientation in single-molecule fluorescence microscopy and implications for super-resolution imaging,” **Minireview**, *ChemPhysChem* **15**, 587-599 (2014) (DOI: 10.1002/cphc.201300880, published online December 30, 2013).
 330. Samuel D. Bockenhauer, Thomas M. Duncan, W. E. Moerner and Michael Börsch, “The regulatory switch of F1-ATPase studied by single-molecule FRET in the ABEL Trap,” *Proc. SPIE* **8950**, 89500H 1-14 (2014), DOI: 10.1117/12.2042688.
 331. Adam S. Backer, Mikael P. Backlund, Matthew D. Lew, Alexander R. Diezmann, Steffen J. Sahl, and W. E. Moerner, “Single-molecule orientation measurements with a quadrated pupil,” *Proc. SPIE* **8950**, 89500L 1-6 (2014), DOI:10.1117/12.2042097.
 332. Quan Wang and W. E. Moerner, “Spectroscopic and transport measurements of single molecules in solution using an electrokinetic trap,” *Proc. SPIE* **8950**, 895004 1-10 (2014), DOI:10.1117/12.2038320.
 333. Quan Wang and W. E. Moerner, “Single-molecule motions enable direct visualization of biomolecular interactions in solution,” *Nature Methods* **11**, 555-558 (2014) (DOI:10.1038/nmeth.2882, published online March 9, 2014).
 334. Jerod L. Ptacin, Andreas Gahlmann, Grant R. Bowman, Adam M. Perez, Alexander R. S. von Diezmann, Michael R. Eckart, W. E. Moerner, and Lucy Shapiro, “Bacterial scaffold directs pole-specific centromere segregation,” *Proc. Nat. Acad. Sci. (USA)* **111**, E2046-E2055 (2014) (DOI:10.1073/pnas.1405188111, published online 28 April 2014).

335. Gabriela S. Schlau-Cohen, Samuel Bockenhauer, Quan Wang, and W. E. Moerner, “Single-molecule spectroscopy of photosynthetic proteins in solution: exploration of structure–function relationships,” **Minireview**, *Chem. Sci.* **5**, 2933-2939 (2014) (DOI:10.1039/C4SC00582A, published online 15 April 2014).
336. Christopher P. Calderon, Lucien E. Weiss, and W. E. Moerner, “Robust hypothesis tests for detecting statistical evidence of two-dimensional and three-dimensional interactions in single-molecule measurements,” *Phys. Rev. E* **89**, 052705(8) (2014) (DOI: 10.1103/PhysRevE.89.052705, published online 12 May 2014).
337. A. S. Backer, M. P. Backlund, A. R. von Diezmann, S. J. Sahl, and W. E. Moerner, “A bisected pupil for studying single-molecule orientational dynamics and its application to 3D super-resolution microscopy,” *Appl. Phys. Lett.* **104**, 193701(5) (2014).
338. Adam S. Backer and W. E. Moerner, “Extending Single-Molecule Microscopy Using Optical Fourier Processing,” **James Skinner Festschrift**, *J. Phys. Chem. B* **118**, 8313-8329 (2014) (DOI: 10.1021/jp501778z, published online April 18, 2014).
339. Yin Loon Lee, Joshua Santé, Colin J. Comerci, Benjamin Cyge, Luis F. Menezes, Feng-Qian Li, Gregory G. Germino, W. E. Moerner, Ken-Ichi Takemaru, and Tim Stearns, “Cby1 promotes Ahl1 recruitment to a ring-shaped domain at the centriole–cilium interface and facilitates proper cilium formation and function,” *Mol. Biol. Cell* **25** (19) 2919-2933 (2014) (DOI: 10.1091/mbc.E14-02-0735, published online August 7, 2014.)
340. Yoav Shechtman, Steffen J. Sahl, Adam S. Backer, and W. E. Moerner, “Optimal Point Spread Function Design for 3D Imaging,” *Phys. Rev. Lett.* **113**, 133902 (2014), (DOI: 10.1103/PhysRevLett.113.133902, published online September 26, 2014)
341. Marissa K. Lee, Prabin Rai, Jarrod Williams, Robert J. Twieg, and W. E. Moerner, “Small-Molecule Labeling of Live Cell Surfaces for Three-Dimensional Super-Resolution Microscopy,” *J. Amer. Chem. Soc.* **136**, 14003-14006 (2014) (DOI: 10.1021/ja508028h, published online, September 15, 2014)
342. Matthew D. Lew and W. E. Moerner, “Azimuthal polarization filtering for accurate, precise, and robust single-molecule localization microscopy,” *Nano Lett.* **14**, 6407-6413 (2014) (DOI:10.1021/nl502914k, published online October 1, 2014).
343. Mikael P. Backlund, Ryan Joyner, Karsten Weis, and W. E. Moerner, “Correlations of three-dimensional motion of chromosomal loci in yeast revealed by the double-helix point spread function microscope,” *Mol. Biol. Cell* **25** (22) 3619-3629 (2014) (DOI: 10.1091/mbc.E14-06-1127, published online October 15, 2014).
344. Whitney C. Duim, Yan Jiang, Koning Shen, Judith Frydman, and W. E. Moerner, “Super-Resolution Fluorescence of Huntingtin Reveals Growth of Globular Species into Short Fibers and Coexistence of Distinct Aggregates,” *ACS Chem. Biol.* **9**, 2767-2778 (2014) (DOI: 10.1021/cb500335w, published online October 20, 2014).
345. Adam S. Backer and W. E. Moerner, “Determining the rotational mobility of a single molecule from a single image: a numerical study,” *Optics Express* **23**, 4255-4276 (2015). (DOI: 10.1364/OE.23.004255, published online February 11, 2015).
346. Gabriela S. Schlau-Cohen, Hsiang-Yu Yang, Tjaart P. J. Krüger, Pengqi Xu, Michal Gwizdala, Rienk van Grondelle, Roberta Croce, and W. E. Moerner, “Single-Molecule

- Identification of Quenched and Unquenched States of LHCII,” *J. Phys. Chem. Lett.* **6**, 860-867 (2015). (DOI: 10.1021/acs.jpcclett.5b00034, published online February 18, 2015).
347. Mikael P. Backlund and W. E. Moerner, “Motion of chromosomal loci and the mean-squared displacement of a fractional Brownian motion in the presence of static and dynamic errors,” *Proc. SPIE* **9331**, 933106 (2015) (DOI: 10.1117/12.2079703, published online March 9, 2015).
 348. Hsiang-Yu Yang, Gabriela S. Schlau-Cohen, Michal Gwizdala, Tjaart Krüger, Pengqi Xu, Roberta Croce, Rienk van Grondelle, W. E. Moerner, “Single-Molecule Exploration of Photoprotective Mechanisms in Light-Harvesting Complexes,” *Proc. SPIE* **9331**, 933109 (2015) (DOI: 10.1117/12.2083628, published online March 9, 2015).
 349. Yoav Shechtman, Lucien E. Weiss, Adam S. Backer, Steffen J. Sahl, and W. E. Moerner, “Precise Three-Dimensional Scan-Free Multiple-Particle Tracking over Large Axial Ranges with Tetrapod Point Spread Functions,” *Nano Lett.* **15**, 4194-4199 (2015) (DOI: 10.1021/acs.nanolett.5b01396, published online May 5, 2015).
 350. Ljiljana Milenkovic*, Lucien E. Weiss*, Joshua Yoon, Theodore L. Roth, YouRong S. Su, Steffen J. Sahl, Matthew P. Scott, and W. E. Moerner (*equal contributions), “Single-molecule imaging of Hedgehog pathway protein Smoothed in primary cilia reveals binding events regulated by Patched1,” *Proc. Nat. Acad. Sci. (USA)* **112**, 8320-8325 (2015) (DOI: 10.1073/pnas.1510094112, published online June 22, 2015).
 351. Mikael P. Backlund, Ryan Joyner, and W. E. Moerner, “Chromosomal locus tracking with proper accounting of static and dynamic errors,” *Phys. Rev. E* **91**, 062716 1-12 (2015) (DOI: 10.1103/PhysRevE.91.062716, published online June 29, 2015).
 352. Steffen J. Sahl, Lana Lau, Willianne I. M. Vonk, Lucien E. Weiss, Judith Frydman, and W. E. Moerner, “Aggregation of mutant huntingtin into inclusion bodies is incomplete, spurring formation of a long-lived residual population of fibrils,” *Quart Revs Biophys QRB Discovery* (2015) (DOI:10.1017/S0033583515000219, published online 9 September 2015)
 353. W. E. Moerner, “Single-Molecule Spectroscopy, Imaging, and Photocontrol: Foundations for Super-Resolution Microscopy (**Nobel Lecture**),” *Angew. Chem. Int. Ed.* **54**, 8067-8093 (2015) (DOI: 10.1002/anie.201501949, published online June 18, 2015).
 354. Quan Wang and W. E. Moerner, “Dissecting pigment architecture of individual photosynthetic antenna complexes in solution,” *Proc. Nat. Acad. Sci. (USA)* **112**, 13880-13885 (2015) (DOI: 10.1073/pnas.1514027112, published online October 5, 2015).
 355. Alex von Diezmann, Maurice Y. Lee, Matthew D. Lew, and W. E. Moerner, “Correcting field-dependent aberrations with nanoscale accuracy in three-dimensional single-molecule localization microscopy,” *Optica* **2**, 985-993 (2015) (DOI: 10.1364/OPTICA.2.000985, published online November 19, 2015).
 356. W. E. Moerner, Yoav Shechtman, and Quan Wang, “Single-molecule spectroscopy and imaging over the decades,” **Introductory Article**, *Faraday Discuss.* **184**, 9-36 (2015) (DOI:10.1039/c5fd00149h, published online November 30, 2015).
 357. W. E. Moerner, “Single-Molecule Spectroscopy, Imaging, and Photocontrol: Foundations for Super-Resolution Microscopy (**Nobel Lecture**),” *Rev. Mod. Phys.* **87**, 1183-1212

- (2015) (DOI: 10.1103/RevModPhys.87.1183, published online October 21, 2015).
358. Mikael P. Backlund, Amir Arbabi, Petar N. Petrov, Ehsan Arbabi, Saumya Saurabh, Andrei Faraon, and W. E. Moerner, "Removing orientation-induced localization biases in single-molecule microscopy using a broadband metasurface mask," *Nat. Photonics* **10**, 459-462 (DOI: 10.1038/NPHOTON.2016.93, published online May 16, 2016).
 359. Adam E. Backer, Maurice Y. Lee, and W. E. Moerner, "Enhanced DNA imaging using super-resolution microscopy and simultaneous single-molecule orientation measurements," *Optica* **3**, 659-666 (2016) (DOI: 10.1364/optica.3.000659, published online 17 June 2016).
 360. Yoav Shechtman, Lucien E. Weiss, Adam S. Backer, Maurice Lee, and W. E. Moerner, "Multicolour localization microscopy by point-spread-function engineering," *Nat. Photonics* **10**, 590-594 (2016). (DOI: 10.1038/nphoton.2016.13, published online 8 August 2016).
 361. Saumya Saurabh, Adam M. Perez, Colin J. Comerci, Lucy Shapiro, and W. E. Moerner, "Super-resolution imaging of live bacteria cells using a genetically-directed, highly photostable fluoromodule," *J. Amer. Chem. Soc.* **138** (33), 10398-10401 (2016) (DOI: 10.1021/jacs.6b05943, web publication date 1 August 2016).
 362. Alex von Diezmann, Yoav Shechtman, and W. E. Moerner, "Three-Dimensional Localization of Single Molecules for Super-Resolution Imaging and Single-Particle Tracking," *Chem. Revs.* **117**, 7244-7275 (2017), Special Issue on Super-Resolution and Single-Molecule Imaging (DOI: 10.1021/acs.chemrev.6b00629, published online 2 February 2017).
 363. Petar Petrov, Yoav Shechtman, and W. E. Moerner, "Measurement-based estimation of global pupil functions in 3D localization microscopy," *Optics Express* **25** (7), 7945-7959 (2017) (DOI: 10.1364/OE.25.007945, published online 28 March 2017).
 364. Anna Lippert*, Agnieszka A. Janeczek*, Alexandre Fürstenberg, Aleks Ponjavic, W. E. Moerner, Roel Nusse, Jill A. Helms, Nicholas D. Evans, and Steven F. Lee, (*equal contributions), "Single-molecule imaging of Wnt3A protein diffusion on living cell membranes," *Biophys. J.* **113**, 2762-2767 (2017) (DOI: 10.1016/j.bpj.2017.08.060, published online 19 December 2017).
 365. Allison H. Squires and W. E. Moerner, "Direct single-molecule measurements of phycoyanobilin photophysics in monomeric C-phycoyanin," *Proc. Nat. Acad. Sci. (USA)* **114**, 9779-9784 (2017) (DOI: 10.1073/pnas.1705435114, published online 28 August 2017).
 366. Yoav Shechtman, Anna-Karin Gustavsson, Petar N. Petrov, Elisa Dultz, Maurice Y. Lee, Karsten Weis, and W.E. Moerner, "Observation of live chromatin dynamics in cells via 3D localization microscopy using Tetrapod point spread functions," *Biomed Opt Expr* **8**, 5735-5748 (2017) (DOI: 10.1364/BOE.8.005735, published online 21 November 2017).
 367. Saumya Saurabh, Adam M. Perez, Colin J. Comerci, Lucy Shapiro, and W. E. Moerner, "Super-resolution microscopy and single-protein tracking in live bacteria using a genetically encoded, photostable fluoromodule," *Current Protocols in Cell Biology* **75**, 4.32.1-4.32.22 (2017). (DOI: 10.1002/cpcb.21, published online June 2017).

368. Quan Wang, Andrew J. Serban, Rebekka M. Wachter, and W. E. Moerner, "Single-molecule diffusometry reveals the nucleotide-dependent oligomerization pathways of *Nicotiana tabacum* Rubisco activase," *J. Chem. Phys.* **148**, 123319 (2018) (DOI: 10.1063/1.5005930, published online 9 January 2018).
369. Anna-Karin Gustavsson, Petar N. Petrov, Maurice Y. Lee, Yoav Shechtman, and W.E. Moerner, "3D single-molecule super-resolution microscopy with a tilted light sheet," *Nature Commun.* **9**, 123 (2018) (DOI: 10.1038/s41467-017-02563-4, published online 9 January 2018).
370. Anna-Karin Gustavsson, Petar N. Petrov, Maurice Y. Lee, Yoav Shechtman, and W.E. Moerner, "Tilted light sheet microscopy with 3D point spread functions for single-molecule super-resolution imaging in mammalian cells," *Proc. of SPIE* **10500**, 105000M (2018). (DOI: 10.1117/12.2288443, published online 20 February 2018).
371. Camille A. Bayas, Jiarui Wang, Marissa K. Lee, Jared M. Schrader, Lucy Shapiro, and W. E. Moerner, "Spatial organization and dynamics of RNase E and ribosomes in *Caulobacter crescentus*," *Proc. Nat. Acad. Sci. (USA)* **115**, E3712-E3721 (2018). (DOI: 10.1073/pnas.1721648115, published online April 2, 2018).
372. Anna-Karin Gustavsson, Petar N. Petrov, and W. E. Moerner, "Light sheet approaches for improved precision in 3D localization-based superresolution imaging in mammalian cells [Invited]," *Optics Express* **26**, 13122-13147 (2018). (DOI: 10.1364/OE.26.013122, published online 7 May 2018).
373. Hsiang-Yu Yang and W. E. Moerner, "Resolving Mixtures in Solution by Single-Molecule Rotational Diffusivity," *Nano Lett.* **18**, 5279-5287 (2018) (DOI: 10.1021/acs.nanolett.8b02280, published online 12 July 2018).
374. Peter D. Dahlberg, Annina M. Sartor, Jiarui Wang, Saumya Saurabh, Lucy Shapiro, and W. E. Moerner, "Identification of PAmKate as a Red Photoactivatable Fluorescent Protein for Cryogenic Super-Resolution Imaging," *J. Amer. Chem. Soc.* **140**, 12310-12313 (2018) (DOI: 10.1021/jacs.8b05960, published online 17 September 2018).
375. Allison H. Squires, Adam E. Cohen, and W. E. Moerner, "Anti-Brownian Traps," in G. C. K. Roberts, A. Watts, European Biophysical Societies (eds.), *Encyclopedia of Biophysics*. Springer, Berlin, Heidelberg, 2018. (DOI: 10.1007/978-3-642-35943-9_486-1).
376. W. E. Moerner, "Localization microscopy of single molecules enhanced by 3D imaging and light sheet illumination," *J. Phys. D: Appl. Phys.* **52**, 011001 (2019) (DOI: 10.1088/1361-6463/aae632, published online 24 October 2018).
377. Joshua Yoon, Colin J. Comerci, Lucien E. Weiss, Ljiljana Milenkovic, Tim Stearns, and W. E. Moerner, "Revealing the nanoscale morphology of the primary cilium using super-resolution fluorescence microscopy," *Biophys. J.* **116**, 319-329 (2019) (DOI: 10.1016/j.bpj.2018.11.3136, published online 7 December 2018).
378. Lucien E. Weiss*, Ljiljana Milenkovic*, Joshua Yoon, Tim Stearns, and W. E. Moerner, (*equal contributions), "Motional dynamics of single Patched1 molecules in cilia are controlled by Hedgehog and cholesterol," *Proc. Nat. Acad. Sci. (USA)* **116**, 5550-5557 (2019) (DOI: 10.1073/pnas.1816747116, published online 28 February 2019).
379. Allison H. Squires, Peter D. Dahlberg, Haijun Liu, Nikki Cecil M. Magdaong, Robert E.

- Blankenship, and W.E. Moerner, “Single-molecule trapping and spectroscopy reveals photophysical heterogeneity of phycobilisomes quenched by Orange Carotenoid Protein.” *Nature Commun.* **10**, article 1172 (2019) (DOI: 10.1038/s41467-019-09084-2, published online 12 March 2019).
380. Camille Bayas, Alex von Diezmann, Anna-Karin Gustavsson, and W. E. Moerner, “Easy-DHPSF 2.0: open-source software for three-dimensional localization and two-color registration of single molecules with nanoscale accuracy,” 24 April 2019, PROTOCOL (Version 1) available at Protocol Exchange DOI: 10.21203/rs.2.9151/v1; 10 June 2019, PROTOCOL (Version 2) available at Protocol Exchange DOI: 10.21203/rs.2.9151/v2
 381. Carolyn R. Shurer, Joe Chin-Hun Kuo, LaDeidra Mone’t Roberts, Jay G. Gandhi, Marshall J. Colville, Thais A. Enoki, Hao Pan, Jin Su, Jade M. Noble, Michael J. Hollander, John P. O’Donnell, Rose Yin, Kayvon Pedram, Leonhard Möckl, Lena F. Kourkoutis, W. E. Moerner, Carolyn R. Bertozzi, Gerald W. Feigenson, Heidi L. Reesink, and Matthew J. Paszek, “Physical Principles of Membrane Shape Regulation by the Glycocalyx,” *Cell* **177**, 1-14 (2019) (DOI: 10.1016/j.cell.2019.04.017, published online 2 May 2019).
 382. Leonhard Möckl*, Kayvon Pedram*, Anish R. Roy, Venkatesh Krishnan, Anna-Karin Gustavsson, Oliver Dorigo, Carolyn R. Bertozzi, W. E. Moerner, (*equal contributions), “Quantitative Super-Resolution Microscopy of the Mammalian Glycocalyx,” *Dev. Cell* **50**, 57-72 (2019) (DOI: 10.1016/j.devcell.2019.04.035, published online 16 May 2019).
 383. Colin J. Comerci*, Jonathan Herrmann*, Joshua Yoon, Fatemeh Jabbarpour, Xiaofeng Zhou, John F. Nomellini, John Smit, Lucy Shapiro, Soichi Wakatsuki, and W.E. Moerner, (*equal contributions), “Topologically-Guided Continuous Protein Crystallization Controls Bacterial Surface Layer Self-Assembly,” *Nature Commun.* **10**, 2731 (2019) (DOI: 10.1038/s41467-019-10650-x, published online 21 June 2019).
 384. Allison H. Squires, Abhijit A. Lavania, Peter D. Dahlberg, and W.E. Moerner, “Interferometric scattering enables fluorescence-free electrokinetic trapping of single nanoparticles in free solution,” *Nano Letters* **19**, 4112-4117 (2019) (DOI: 10.1021/acs.nanolett.9b01514, published online 22 May 2019).
 385. Xiaofeng Zhou, Jiarui Wang, Jonathan Herrmann, W. E. Moerner, and Lucy Shapiro, "Asymmetric division yields progeny cells with distinct modes of regulating cell cycle-dependent chromosome methylation," *Proc. Nat. Acad. Sci. (USA)* **116** (31) 15661-15670 (2019) (DOI: 10.1073/pnas.1906119116, published online 17 July 2019).
 386. Leonhard Möckl, Petar N. Petrov, and W. E. Moerner, “Accurate phase retrieval of complex 3D point spread functions with deep residual neural networks,” *Appl. Phys. Lett.* **115**, 251106 (2019) (DOI: 10.1063/1.5125252, published online 18 December 2019).
 387. Leonhard Möckl*, Anish E. Roy*, Petar N. Petrov, and W. E. Moerner (*equal contributions), “Accurate and rapid background estimation in single-molecule localization microscopy using the deep neural network BGnet,” *Proc. Nat. Acad. Sci. (USA)* **117**, 60-67 (2020) (DOI: 10.1073/pnas.1916219117, published online 23 December 2019).
 388. Henrietta W. Bennett*, Anna-Karin Gustavsson*, Camille A. Bayas, Petar N. Petrov, Nancie Mooney, W. E. Moerner, and Peter K. Jackson, (*equal contributions), “Novel fibrillar structure in the inversin compartment of primary cilia revealed by 3D single-molecule super-resolution microscopy,” *Molec. Biol. Cell* **31**, 619-639 (2020) (DOI:

- 10.1091/mbc.E19-09-0499, published online 2 January 2020).
389. Keren Lasker*, Lexy von Diezmann*, Xiaofeng Zhou, Daniel G. Ahrens, Thomas H. Mann, W. E. Moerner, and Lucy Shapiro, (*equal contributions), "Selective sequestration of signalling proteins in a membraneless organelle reinforces the spatial regulation of asymmetry in *Caulobacter crescentus*," *Nature Microbio.* **5**, 418-419 (2020) (DOI: 10.1038/s41564-019-0647-7, published online 20 January 2020).
 390. Annina M. Sartor, Peter D. Dahlberg, Jiarui Wang, Saumya Saurabh, Lucy Shapiro, and W.E. Moerner, "Cryogenic single-molecule active control microscopy with a photoactivatable fluorescent protein," *Proc. SPIE* **11246**, Single Molecule Spectroscopy and Superresolution Imaging XIII, 112460G (13 February 2020) (DOI: 10.1117/12.2546333).
 391. Abhijit A. Lavania, Allison H. Squires, Peter D. Dahlberg, W. E. Moerner, "Interferometric scattering for fluorescence-free electrokinetic trapping of single nanoparticles in free solution," *Proc. SPIE* **11246**, Single Molecule Spectroscopy and Superresolution Imaging XIII, 112460W (13 February 2020) (DOI: 10.1117/12.2546638).
 392. Leonhard Möckl, Anish R. Roy, and W. E. Moerner, "Deep learning in single-molecule microscopy: fundamentals, caveats, and recent developments," Invited review, *Biomed Opt Expr* **11**, 1633-1661 (2020) (DOI: 10.1364/BOE.386361, published online 27 February 2020).
 393. Peter D. Dahlberg*, Davis Perez*, Zhaoming Su, Wah Chiu, and W.E. Moerner, (*these authors contributed equally), "Cryogenic Correlative Single-Particle Photoluminescence Spectroscopy and Electron Tomography for Investigation of Nanomaterials," *Angew. Chem. Int. Ed.* **59**, 15642-15648 (in press, 2020) (DOI: 10.1002/anie.202002856, published online 24 April 2020).
 394. Petar N. Petrov and W. E. Moerner, "Addressing systematic errors in axial distance measurements in single-emitter localization microscopy," *Opt Expr* **28**, 18616 (2020) (DOI: 10.1364/OE.391496, published online 8 June 2020).
 395. Peter D. Dahlberg, Saumya Saurabh, Annina M. Sartor, Jiarui Wang, Patrick G. Mitchell, Wah Chiu, Lucy Shapiro, and W. E. Moerner, "Cryogenic single-molecule fluorescence annotations for electron tomography reveal in situ organization of key proteins in *Caulobacter*," *Proc. Nat. Acad. Sci. (USA)* **117**, 13937-13944 (in press, 2020) (DOI: 10.1073/pnas.2001849117, published online 8 June 2020).
 396. Damien Garbett, Anjali Bisaria, Changsong Yang, Dannielle G. McCarthy, Arnold Hayer, W. E. Moerner, Tatyana M. Svitkina, and Tobias Meyer, "T-Plastin reinforces membrane protrusions to bridge matrix gaps during cell migration," *Nature Commun.* **11**, 4818 (2020) (DOI: 10.1038/s41467-020-18586-3, published online 23 September 2020).
 397. Marjoke F. Debets*, Omur Y. Tastan*, Simon P. Wisnovsky, Stacy A. Malaker, Nikolaos Angelis, Leonhard K. R. Moeckl, Junwon Choi, Helen Flynn, Lauren J. S. Wagner, Ganka Bineva-Todd, Aristotelis Antonopoulos, Anna Cioce, William M. Browne, Zhen Li, David C. Briggs, Holly L. Douglas, Gaelen T. Hess, Anthony J. Agbay, Chloe Roustan, Svend Kjaer, Stuart M. Haslam, Ambrosius P. Snijders, Michael C. Bassik, W. E. Moerner, Vivian S. W. Li, Carolyn R. Bertozzi, and Benjamin Schumann (*equal contributions), "Metabolic precision labeling enables selective probing of O-linked N-

- acetylgalactosamine glycosylation,” *Proc. Nat. Acad. Sci. (USA)* **117**, 25293-25301 (2020) (DOI: 10.1073/pnas.2007297117, published online 28 Sept 2020).
398. Bo Gu*, Colin J. Comerci*, Dannielle G. McCarthy*, Saumya Saurabh, W. E. Moerner, and Joanna Wysocka (*these authors contributed equally), “Opposing effects of cohesin and transcription on CTCF organization revealed by super-resolution imaging,” *Molec. Cell* **80**, 699-711 (2020) (DOI: 10.1016/j.molcel.2020.10.001, published online 21 October 2020).
 399. Leonhard Möckl and W. E. Moerner, “Super-resolution microscopy with single molecules in biology and beyond – essentials, current trends, and future challenges,” **Perspective Article**, *J. Am. Chem. Soc.* **142**, 17828-17844 (2020) (DOI: 10.1021/JACS.0c08178, published online 9 October 2020).
 400. W. E. Moerner, “Viewpoint: Single Molecules at 31: What’s Next?” *Nano Lett* **20**, 8427-8429 (2020) (DOI: 10.1021/acs.nanolett.0c04042, published online 10 November 2020).
 401. Simon Wisnovsky, Leonhard Möckl, Stacy A. Malaker, Kayvon Pedram, Gaelen T. Hess, Nicholas M. Riley, Melissa A. Gray, Benjamin A.H. Smith, Michael C. Bassik, W.E. Moerner, and Carolyn R. Bertozzi, “Genome-Wide CRISPR Screens Reveal a Specific Ligand for the Glycan-Binding Immune Checkpoint Receptor Siglec-7,” *Proc. Nat. Acad. Sci. (USA)* **118**, e2015024118 (2021) (DOI: 10.1073/pnas.2015024118, published online 25 January 2021).
 402. Peter D. Dahlberg and W. E. Moerner, “Cryogenic Super-Resolution Fluorescence and Electron Microscopy Correlated at the Nanoscale,” *Ann. Revs. Phys. Chem.* **72**, 253-78 (April 2021) (DOI: 10.1146/annurev-physchem-090319-051546, published online 13 January 2021).
 403. Jiarui Wang, Lucy Shapiro, and W. E. Moerner, “A localized adaptor protein performs distinct functions at the *Caulobacter* cell poles,” *Proc. Nat. Acad. Sci. (USA)* **118**, e2024705118 (2021) (DOI: 10.1073/pnas.2024705118, published online 22 March 2021).
 404. Anish R. Roy, Wei Zhang, Zeinab Jahed, Ching-Ting Tsai, Bianxiao Cui, and W. E. Moerner, “Exploring Cell Surface–Nanopillar Interactions with 3D Super-Resolution Microscopy,” *ACS Nano* **16**, 192-210 (2022) (DOI: 10.1021/acsnano.1c05313, published online 28 September 2021).
 405. Saumya Saurabh, Trisha N. Chong, Camille Bayas, Peter D. Dahlberg, Heather N. Cartwright, W. E. Moerner, and Lucy Shapiro, “ATP-responsive biomolecular condensates tune bacterial kinase signaling,” *Sci. Advances* **8**, eabm6570 (2022) (DOI: 10.1126/sciadv.abm6570, published online 16 February 2022).
 406. Alison H. Squires*, Quan Wang*, Peter D. Dahlberg*, and W. E. Moerner (*co-first authors), “A bottom-up perspective on photodynamics and photoprotection in light-harvesting complexes using anti-Brownian trapping,” *J. Chem. Phys.* **156**, 070901 (2022) (DOI: 10.1063/5.0079042, published online 16 February 2022).
 407. W. E. Moerner, “Autobiography of W. E. (William Esco) Moerner,” published as part of *The Journal of Physical Chemistry* virtual special issue “W. E. Moerner Festschrift,” with Publications, Curriculum vitae, and Colleagues as Supporting Information, *J. Phys. Chem. B* **126**, 1159-1159 (2022). (DOI: 10.1021/acs.jpcc.2c00137, published online 17 February 2022).

408. Jiarui Wang*, Mengting Han*, Anish R. Roy, Haifeng Wang, Leonhard Möckl, Leiping Zeng, W.E. Moerner, and Lei S. Qi (*equal contribution), "Multi-color super-resolution imaging to study human coronavirus RNA during cellular infection," *Cell Reports Methods* **2**, 100170 (2022) (DOI: 10.1016/j.crmeth.2022.100170, published online 28 February 2022).
409. Anna-Karin Gustavsson, Rajarshi P. Ghosh, Petar N. Petrov, Jan T. Liphardt, and W. E. Moerner, "Fast and parallel nanoscale three-dimensional tracking of heterogeneous mammalian chromatin dynamics," *Molec Biol Cell* **33**(6), (2022) (DOI: 10.1091/mbc.E21-10-0514, published online 30 March 2022).
410. William B. Carpenter, Abhijit A. Lavania, Julia S. Borden, Luke M. Oltrogge, Davis Perez, Peter D. Dahlberg, David F. Savage, and W. E. Moerner, "Ratiometric Sensing of Redox Environments Inside Individual Carboxysomes Trapped in Solution," *J. Phys. Chem Lett.* **13**, 4455-4462 (2022) (DOI: 10.1021/acs.jpcclett.2c00782, published online May 13, 2022).
411. Davis Perez, Peter D. Dahlberg, Jiarui Wang, Annina M. Sartor, Julia S. Borden, Lucy Shapiro, and W.E. Moerner, "Identification and demonstration of roGFP2 as an environmental sensor for cryogenic correlative light and electron microscopy," *J. Struct. Biol.* **214**, 107881 (2022) (DOI: 10.1016/j.jsb.2022.107881, published online 8 July 2022).
412. Peter D. Dahlberg, Davis Perez, Corey W. Hecksel, Wah Chiu, and W.E. Moerner, "Metallic support films reduce optical heating in cryogenic correlative light and electron tomography," *J. Struct. Biol.* **214**, 107901 (2022) (DOI: 10.1016/j.jsb.2022.107901, published online 1 October 2022).
413. Abhijit A. Lavania, William B. Carpenter, Luke M. Oltrogge, Davis Perez, Julia B. Turnšek, David F. Savage, and W. E. Moerner, "Exploring Masses and Internal Mass Distributions of Single Carboxysomes in Free Solution Using Fluorescence and Interferometric Scattering in an Anti-Brownian Trap," Part of Special Issue "Steven G. Boxer Festschrift," *J. Phys. Chem. B* **126**, 8747-8759 (2022) (DOI: 10.1021/acs.jpcc.2c05939, published online 25 October 2022).

Published Conference Abstracts

1. W. E. Moerner, E. J. Peterman, H. Sosa, S. Brasselet, R. M. Dickson, S. Kummer, R. Sakowicz, and L. S. B. Goldstein, "Single-Molecule Studies of Fluorescent Proteins and Enzymes," *Biophys. J.* **76**, A20-A20 (1999).
2. P. Schwille, S. Kummer, W. E. Moerner, and W. W. Webb, "Fluorescence Correlation Spectroscopy (FCS) of Different GFP Mutants Reveals Fast Light-Driven Intramolecular Dynamics", *Biophys. J.* **76**, A260-A260 (1999).
3. E. J. Peterman, S. Brasselet, and W. E. Moerner, "The Fluorescence Dynamics of Single Molecules of Green Fluorescent Protein: Effect of Mutations, pH and Matrix", *Biophys. J.* **76**, A445-A445 (1999).
4. H. J. Sosa, E. J. Peterman, W. E. Moerner, and L. S. B. Goldstein, "Orientation and Dynamics of Kinesin Motors Revealed by Fluorescence Polarization Microscopy of Many and Single Molecules", *Biophys. J.* **80**, 572A-572A (2001).
5. M. F. Paige, E. Bjerneld, and W. E. Moerner, "A Comparison of Through-the-Objective Total Internal Reflection and Epifluorescence Microscopies for Single-Molecule Fluorescence Experiments", *Biophys. J.* **82**, 45A-46A (2002).
6. J. Deich, B. Lounis, F. I. Rosell, S. G. Boxer, and W. E. Moerner, "Photophysics of DsRed, a Red Fluorescent Protein, from the Ensemble to the Single-Molecule Level", *Biophys. J.* **82**, 46A-47A (2002).
7. J. Deich, K. Mairing, F. I. Rosell, T. B. McAnaney, W. E. Moerner, and S. G. Boxer, "Enhancement of the Blue Fluorescent Protein's Fluorescence by High Pressure or Low Temperature", *Biophys. J.* **82**, 427A-427A (2002).
8. M. Vrljic, S. Y. Nishimura, S. Brasselet, W. E. Moerner, H. M. McConnell, "Uncorrelated Diffusion of MHC Class II Proteins in the Plasma Membrane", *Biophys. J.* **82**, 523A-523A (2002).
9. S. Y. Kim, D. Fromm, S. Hess, R. J. Twieg, G. W. Farr, A. L. Horwich, J. Frydman, and W. E. Moerner, "Probing Local Polarity Changes in GroEL/ES with Fluorescence Spectroscopy," *Biophys. J.* **84**, 26A-26A (2003).
10. M. Vrljic, S. Y. Nishimura, W. E. Moerner, and H. M. McConnell, "The Effect of Varying Cholesterol Concentrations on the Translational Diffusion of Individual Class II MHC Membrane Proteins in Cells," *Biophys. J.* **84**, 325A-325A (2003).
11. A. Kurtz, E. T. Kool, and W. E. Moerner, "Real-Time Observations of T7 DNA Polymerase Activity by Single-Molecule Fluorescence Spectroscopy," Biophysical Society 1757-Pos, February, 2005.
12. S. Nishimura, M. Vrljic, H. M. McConnell, and W. E. Moerner, "Evidence for Condensed Complexes in the Plasma Membrane," Biophysical Society 377-Pos, February, 2005.
13. S. Y. Kim, Z. Gitai, L. Shapiro, and W. E. Moerner, "Motion of Single MreB Proteins in Caulobacter Imply Short, Oriented Filaments," Biophysical Society 2853-Pos, February, 2006.
14. Yasuhiro M. Umemura, Takahiro K. Fujiwara, Kenichi G. N. Suzuki, Marija Vrljic, Stefanie Y. Nishimura, W. E. Moerner, and Akihiro Kusumi, "Both MHC class II and its GPI-

- anchored form undergo hop diffusion as observed by single-molecule tracking,”
Biophysical Society, 2515-POS/B730, March, 2007.
15. Whitney C. Duim, Jian Cui, Erik J. Miller, So Yeon Kim, Dmitriy Gremyachinskiy, Klaus M. Hahn, Robert J. Twieg, Judith Frydman, and W. E. Moerner, “Probing TRiC-Mediated Folding of Actin *in vitro* With Bulk and Single-Molecule Fluorescence Measurements,” 2008 Biophysical Society Meeting Abstracts. *Biophysical Journal* **94**, 2488-Pos (2008).
 16. H.-L. Lee, E. A. Goun, H. Hwang, A. N. Semyonov, H. Wang, L. R. Jones, R. J. Twieg, P. A. Wender, and W. E. Moerner, “Single-Molecule Motions of Oligoarginine Cell-Penetrating Peptides on the Plasma Membrane of CHO Cells Imply Multiple Entry Mechanisms,” 2008 Biophysical Society Meeting Abstracts. *Biophysical Journal*, *Biophysical Journal* **94**, 2495-Pos (2008).
 17. Squires, A. H., Dahlberg, P. D., Liu, H., Blankenship, R. E., & Moerner, W. E., “Single-Molecule Measurements of Quenching and Photophysical Heterogeneity in Phycobiliproteins,” *Biophysical Journal*, **114** (3), 522a-523a (2018).
 18. Dahlberg, P. D., Squires, A. H., Sartor, A. M., Liu, H., Blankenship, R. E., & Moerner, W. E., “Cryogenic Dissection of the Phycobilisome’s Electronic Structure,” *Biophysical Journal*, **114** (3), 169a, (2018).
 19. Yang, H. Y., & Moerner, W. E., “Precise Measurement of Single-Molecule Rotational Diffusivity in Solution,” *Biophysical Journal*, **114** (3), 170a, (2018).
 20. Alex von Diezmann, Keren Lasker, Thomas H. Mann, Daniel G. Ahrens, Lucy Shapiro, W. E. Moerner, “A Polar Matrix Microdomain Constrains Diffusion and Regulates Intracellular Signaling,” *Biophysical Journal*, **114** (3), 548a, (2018).
 21. Gustavsson, A.-K., Petrov, P. N., Lee, M. Y., Shechtman, Y., Moerner, W. E., “3D Single-Molecule Super-Resolution Microscopy in Mammalian Cells Using a Tilted Light Sheet,” *Biophysical Journal*, **114** (3) 14a, (2018).
 22. Wang, J., Shapiro L., & Moerner, W.E., “Probing Asymmetric Behavior of a Cell Cycle Regulatory Protein in Live *Caulobacter* using Single-Molecule Imaging,” *Biophysical Journal*, **114** (3), 350a, (2018).
 23. Lee, M. Y., Chen, X., Gustavsson, A.-K., Chang, H. Y., & Moerner, W. E., “In Situ Imaging of Spatial Organization of Accessible Chromatin at the Nanoscale with ATAC-see and Single-Molecule Super-resolution Fluorescence Microscopy,” *Biophysical Journal*, **114** (3), 539a, (2018).
 24. Comerci, C. J., Herrmann, J., Shapiro, L., Wakatsuki, S., Moerner, W. E., “Two-Color STED Microscopy to Visualize S-Layer Biogenesis in *Caulobacter Crescentus*,” *Biophysical Journal*, **114** (3), 613a, (2018).
 25. Moeckl, L., Pedram, K., Roy, A. R., Bertozzi, C., & Moerner, W. E., “Quantitative Super-Resolution Imaging Reveals Mammalian Glycocalyx Dynamics,” *Biophysical Journal*, **114** (3), 537a–538a, (2018).
 26. Sartor, A. M., Dahlberg, P. D., Wang, J., Shapiro, L., & Moerner, W. E., “A Red Fluorescent Protein for Cryogenic Single-Molecule Superresolution Imaging,” *Biophysical Journal*, **114** (3), 529a-530a, (2018).
 27. Bayas, C. A., Wang, J., Lee, M. K., Schrader, J. M., Shapiro, L., & Moerner, W. E., “Spatial

- Organization and Dynamics of RNA Processing in *Caulobacter crescentus*,” *Biophysical Journal*, **114** (3), 251a, (2018).
28. Comerci, C. J., Herrmann, J., Yoon, J., Jabbarpour, F., Zhou, X., Nomellini, J. F., Smit, J., Shapiro, L., Wakatsuki, S., Moerner, W. E., “Continuous, Topologically Guided Protein Crystallization Drives Self-Assembly of a Bacterial Surface Layer,” *Biophysical Journal* **118** (3), 201A–202A (2020).
29. Dahlberg, P. D., Saurabh, S., Wang, J., Sartor, A. M., Chiu, W., Shapiro, L., Moerner, W. E., “Cryogenic Superresolution Fluorescence Correlated with Cryogenic Electron Tomography: Combining Specific Labeling and High Resolution,” *Biophysical Journal* **118** (3), 20A–21A (2020).
30. Saurabh, S., Chong, T., Bayas, C., Dahlberg, P. D., Moerner, W. E., Shapiro, L., “Robust Modulation of a Bacterial Kinase by Protein Phase Separation,” *Biophysical Journal* **118** (3), 203A (2020).

Invited Presentations: William Esco (W. E.) Moerner

1. "Conductivity and Optical Properties of Glow-Discharge Deposited Amorphous Silicon - A Promising New Semiconductor," Solid State Seminar, Cornell University Physics Department, November 15, 1977.
2. "Progress in Frequency Domain Optical Memories," Conference on Lasers and Electro-Optics (CLEO '82), Phoenix, Arizona, April 14-16, 1982. With G. C. Bjorklund and F. M. Schellenberg.
3. "Recent Progress in PHB Optical Memories," Symposium on Unconventional Photoactive Solids, Wasserschloss Mitwitz, Mitwitz, West Germany, June 28 - July 1, 1982. With G. C. Bjorklund, F. M. Schellenberg, and P. Pokrowsky.
4. "Persistent Spectral Hole Burning for a Molecular Vibrational Mode in a Crystalline Solid," Universität Bayreuth, Bayreuth, West Germany, July 2, 1982.
5. "Progress in Frequency Domain Optical Memories," Chemical Physics Institute, ETH-Zürich, Switzerland, July 8, 1982. With G. C. Bjorklund.
6. "Progress in Frequency Domain Optical Memories," Institute for Inorganic Chemistry, Universität Bern, Switzerland, July 9, 1982. With G. C. Bjorklund.
7. "Progress in Frequency Domain Optical Memories and Hole-Burning at GaAlAs Laser Wavelengths," IBM Zürich Research Laboratory, Rüschlikon, Switzerland, July 12, 1982. With G. C. Bjorklund.
8. "Materials for Frequency Domain Optical Memories," Research Seminar, IBM Thomas J. Watson Research Center, October 13, 1982.
9. "Materials for Frequency Domain Optical Memory Applications: Progress and Remaining Problems," NRL - ONR Photochemistry Conference, Washington, D.C., October 15, 1982. With G. C. Bjorklund.
10. "Materials for Frequency Domain Optical Memory Applications: Progress and Outlook," SRI International, Menlo Park, California, November 3, 1982. With G. C. Bjorklund.
11. "Frequency Domain Optical Memories: An Important Application of Laser Spectroscopy," Physics Colloquium, University of Santa Clara, Santa Clara, California, April 18, 1983.
12. "Photochemical and Photophysical Spectral Hole Dynamics in Organic and Inorganic Systems," Chemical Physics Seminar, Stanford University, Stanford, California, April 21, 1983.
13. "Materials Requirements for Frequency Domain Optical Memories," Quantum Electronics Seminar on Experimental Techniques in Lasers and Optics, Stanford University, Stanford, California, October 24, 1983.
14. "Materials for Frequency Domain Optical Memories," 1983 Office of Naval Research and Naval Research Laboratory Photochemistry Conference, University of California at Los Angeles, Los Angeles, California, November 11, 1983.
15. "Hole-Burning Materials for Frequency Domain Optical Memories," March Meeting of the American Physical Society, Detroit, Michigan, March 28, 1984.

16. "Frequency Domain Optical Storage: The Quest for the Ultimate Material," Solid State Physics Seminar, Cornell University, Ithaca, New York, April 3, 1984.
17. "Frequency Domain Optical Storage: A Potentially Exciting Application of Laser Spectroscopy," Physics Colloquium, San Jose State University, San Jose, California, April 12, 1984.
18. "Organic Photoreactions for Frequency Domain Optical Storage," Gordon Research Conference on Electron Donor Acceptor Interactions, Plymouth, New Hampshire, August 13-17, 1984.
19. "A Challenge for Laser Spectroscopy of Solids: Frequency Domain Optical Storage," Lasers '84, San Francisco, California, November 26, 1984.
20. "Photochemical Hole-Burning," IBM Scientific Advisory Committee Meeting on Optical Storage, Boulder, Colorado, February 14, 1985.
21. "Laser-Light-Induced Physical Processes in Optical Materials: Persistent Spectral Hole-Burning," SPIE Critical Review on Radiation Effects in Optical Materials, Southwest Conference on Optics, Albuquerque, New Mexico, March 6, 1985.
22. "Persistent Spectral Hole-Burning: Dynamical Requirements for Frequency Domain Optical Storage," Gordon Research Conference on Molecular Electronic Spectroscopy, Wolfeboro, New Hampshire, August 12-16, 1985.
23. "Dynamical Hole-Burning Requirements for Frequency Domain Optical Storage," Second International Conference on Unconventional Photoactive Solids, Cleveland, Ohio, September 9-12, 1985.
24. "Materials for Photon-Gated Spectral Hole-Burning," Hewlett-Packard Laboratories, Palo Alto, California, February 11, 1986.
25. "Mechanisms for Photon-Gated Spectral Hole-Burning," Physical Chemistry Seminar, University of California, Santa Cruz, California, February 13, 1986.
26. "Frequency Domain Optical Storage Using Persistent Spectral Hole-Burning: Photon Gating," Society of Photographic Scientists and Engineers Annual Meeting, Minneapolis, Minnesota, May 19, 1986.
27. "Frequency Domain Optical Storage: Photon-Gated Materials," Xerox Palo Alto Research Center ICL Seminar, Palo Alto, California, August 18, 1986.
28. "Spectroscopy of Inhomogeneously Broadened Zero-Phonon Transitions in Solids: Persistent Spectral Hole-Burning and Beyond," Chemistry Department Colloquium, Indiana University, Bloomington, Indiana, September 24, 1987.
29. "Statistical Fine Structure in Inhomogeneously Broadened Absorption Lines in Solids," International Laser Science Conference ILS-III, Atlantic City, New Jersey, November 1-5, 1987. With T. P. Carter.
30. "Spectroscopy of Inhomogeneously Broadened Zero-Phonon Transitions in Solids: Persistent Spectral Hole-Burning and Beyond," Chemistry Colloquium, University of California, Riverside, California, November 11, 1987.
31. "Statistical Fine Structure in Inhomogeneously Broadened Spectral Lines," American Physical Society March Meeting, New Orleans, Louisiana, March 21-25, 1988.

32. "Statistical Fine Structure of Inhomogeneously Broadened Absorption Lines," Condensed Matter Seminar, University of California, Santa Cruz, California, May 8, 1988.
33. "Photon-Gating and High-Density Frequency Domain Optical Storage," IEEE Vail Computer Elements Workshop, Vail, Colorado, June 28, 1988.
34. "Statistical Fine Structure in Inhomogeneously Broadened Spectral Lines," AT&T Bell Laboratories, Murray Hill, New Jersey, July 1, 1988.
35. "New Developments in Laser Spectroscopy of Solids: Statistical Fine Structure," Cornell University Optical Science Seminar, Ithaca, New York, September 19, 1988.
36. "New Developments in Laser Spectroscopy of Solids--Statistical Fine Structure," Physical Chemistry Seminar, Iowa State University, Ames, Iowa, November 18, 1988.
37. "How to Use Inhomogeneous Broadening to Your Advantage: Statistical Fine Structure and Single Molecule Spectroscopy in Solids," American Physical Society March Meeting, St. Louis, Missouri, March 20-24, 1989.
38. "Statistical Properties of Inhomogeneously Broadened Lines in Solids," American Chemical Society Annual Meeting, Dallas, Texas, April 9-14, 1989.
39. "Photon-Gated Persistent Spectral Hole-Burning," International Symposium on Optical Memory, ISOM 89, Kobe, Japan, September 26-28, 1989.
40. "Ultrasensitive Laser Spectroscopy in Solids: Single-Molecule Detection," Fourth International Conference on Unconventional Photoactive Solids, The Almaden Symposium, San Jose, California, October 15-18, 1989.
41. "Fundamental Aspects of Persistent Spectral Hole-Burning: Photon-Gating, Statistical Fine Structure, and Absorption Spectra of Single Dopant Centers in Solids," invited talk presented at:
 - (i) The Research Center for Advanced Science and Technology, University of Tokyo, Tokyo, Japan, October 23, 1989;
 - (ii) SONY Corporation Central Research Center, Yokohama, Japan, October 24, 1989;
 - (iii) Nikon Corporation Research Laboratory, Tokyo, Japan, October 25, 1989;
 - (iv) Mitsubishi Central Research Laboratory, Hyogo, Japan, October 26, 1989;
 - (v) Toray Industries Electronic and Imaging Materials Research Laboratory, Otsu, Japan, October 27, 1989.
42. "Organic Optoelectronic Materials," IBM 1989 Computer Science Symposium on Novel Computing, Gotemba, Japan, October 29, 1989. With G. C. Bjorklund.
43. "Persistent Spectral Hole-Burning: Photon-Gating and Fundamental Statistical Limits," International Symposium on Polymers for Microelectronics Science and Technology (PME '89), University of Tokyo, Tokyo, Japan, October 29 - November 2, 1989.
44. "Laser Spectroscopy of Solids: From \sqrt{N} to $N = 1$," U. S. - Japan Exchange Seminar on Dynamics of Excited States, East-West Center, University of Hawaii, Honolulu, Hawaii, November 6-10, 1989.
45. "Laser Spectroscopy of Solids: From \sqrt{N} to $N = 1$," Stanford Chemical Physics Seminar, Stanford, California, November 30, 1989.

46. "How to Find a Single Molecule in a Haystack: Optical Detection and Spectroscopy of a Single Molecule in a Solid," Chemistry Department Colloquium, Columbia University, New York, New York, December 14, 1989.
47. "Finding a Single Molecule in a Haystack: Single-Absorber Optical Spectroscopy in Molecular Solids," Western Spectroscopy Association Thirty-Seventh Annual Conference, Asilomar, California, January 25, 1990.
48. "New Observations in Laser Spectroscopy of Solids: From \sqrt{N} to $N = 1$," Washington University Physics Department Colloquium, St. Louis, Missouri, February 7, 1990.
49. "Finding a Needle in a Haystack: Optical Detection and Spectroscopy of Single Absorbers in Molecular Crystals," Physical Chemistry Colloquium, University of California, San Diego, San Diego, California, April 24, 1990.
50. "Finding a Needle in a Haystack: Optical Detection and Spectroscopy of Single Absorbers in Solids," International Quantum Electronics Conference IQEC 90, Anaheim, California, May 22, 1990. With L. Kador.
51. "Finding a Single Molecule in a Haystack: Laser Spectroscopy of Solids from \sqrt{N} to $N = 1$," University of Oregon, Chemical Physics Institute Retreat, Charleston, Oregon, September 22, 1990.
52. "Finding a Single Molecule in a Haystack: Laser Spectroscopy of Solids from \sqrt{N} to $N = 1$," University of Utah Physics Department Colloquium, Salt Lake City, Utah, October 18, 1990.
53. "Demonstration of Photorefractivity in Organic Polymers," Postdeadline Paper Optical Society of America Annual Meeting, Boston, Massachusetts, November 5-9, 1990. With S. Ducharme, J. C. Scott, and R. J. Twieg.
54. "Finding a Single Molecule in a Haystack: Laser Spectroscopy of Solids from \sqrt{N} to $N = 1$," SPIE Conference 1435 on Ultrasensitive Laser Spectroscopy, Los Angeles, California, January 21-23, 1991. With W. P. Ambrose.
55. "Finding a Single Molecule in a Haystack: Laser Spectroscopy of Solids from \sqrt{N} to $N = 1$," Simon Fraser University Physics Department Colloquium, Vancouver, British Columbia, April 3, 1991. With W. P. Ambrose.
56. "Finding a Single Molecule in a Haystack: Laser Spectroscopy of Solids from \sqrt{N} to $N = 1$," Physics Department Colloquium, University of British Columbia, Vancouver, British Columbia, April 4, 1991. With W. P. Ambrose.
57. "Observation of the Photorefractive Effect in Doped Nonlinear Polymers," Materials Research Society Spring Meeting, Anaheim, California, April 30 - May 1, 1991. With S. Ducharme, J. C. Scott, and R. J. Twieg.
58. "Observation of the Photorefractive Effect in Doped Nonlinear Polymers," Quantum Electronics and Laser Science QELS 91, Baltimore, Maryland, May 13-17, 1991. With S. Ducharme, J. C. Scott, and R. J. Twieg.
59. "Photorefractivity in Doped Nonlinear Organic Polymers," Soc. Photo-Opt. Instrum. Engr. Conference on Nonlinear Optical Properties of Organic Materials IV, San Diego, California, July 24-26, 1991. With S. Ducharme, J. C. Scott, and R. J. Twieg.

60. "The Photorefractive Effect in Nonlinear Polymers," International Topical Conference on Optical Probes of Conjugated Polymers, Snowbird, Utah, August 19-22, 1991. With J. C. Scott, S. Ducharme, and R. J. Twieg.
61. "The Photorefractive Effect in Nonlinear Polymers," ACS Symposium on Polymeric Materials for Photonic and Optical Applications, New York, New York, August 25-30, 1991. With J. C. Scott, S. Ducharme, and R. J. Twieg.
62. "Single Molecule Spectral Diffusion in a Solid Detected by Fluorescence Spectroscopy," 1991 International Conference on Dynamical Processes in the Excited States of Solids, Leiden, The Netherlands, August 27-30, 1991. With W. P. Ambrose and Th. Basché.
63. "Properties of Photorefractive Polymers," Observatoire Francais des Techniques Avancees Molecular Electronics Group Meeting, Paris, France, September 13, 1991.
64. "Observations of Spectral Diffusion in Solids on the Single Molecule Level," Fourth Congress of the French Chemical Society Colloquium on Perspectives in Molecular Electronics, Strasbourg, France, September 19, 1991.
65. "Optical Spectra of Single Impurity Molecules in a Polymer: Spectral Diffusion and Persistent Spectral Hole-Burning," Postdeadline Paper, First International Topical Meeting on Persistent Spectral Hole-Burning Science and Applications, Monterey, California, September 26-28, 1991. With Th. Basché.
66. "Photorefractivity in Doped Nonlinear Polymers," University of Arizona Optical Sciences Center Colloquium, Tucson, Arizona, October 24, 1991.
67. "Observations of Spectral Diffusion and Hole-Burning for a Single Molecule in a Solid," Physical Chemistry Seminar, University of California, Santa Barbara, California, January 14, 1992.
68. "Optical Spectroscopy of Single Impurity Molecules in Solids," Laser Applications in Chemical Analysis OSA Topical Meeting LACA III, Salt Lake City, Utah, January 27-30, 1992.
69. "A Solid as a Single-Molecule Trap: Observations of Spectral Diffusion and Hole-Burning of a Single Impurity Molecule," American Physical Society March Meeting, Indianapolis, Indiana, March 16-20, 1992.
70. "Characterization of Photorefractive Polymers: Proving Photorefractivity," American Chemical Society Symposium on Organic Optoelectronic Materials, Monterey, California, March 31 - April 3, 1992.
71. "Nonlinear Optical Properties of Organic Photorefractive Polymers," Materials Research Society Symposium V, San Francisco, California, April 27-May 1, 1992. With C. A. Walsh, S. M. Silence, R. J. Twieg, T. J. Matray, J. C. Scott, V. Y. Lee, R. D. Miller, F. Hache, D. M. Burland, and G. C. Bjorklund.
72. "A Solid as a Single-Molecule Trap: Spectral Diffusion, Hole-Burning, and Photon Antibunching," Quantum Electronics and Laser Science QELS 92, Anaheim, California, May 10-15, 1992. With Th. Basché, W. P. Ambrose, and M. Orrit.
73. "Photoconduction and Photorefraction in Molecularly Doped Polymers," European Materials Research Society Meeting, Strasbourg, France, June 8-12, 1992. With J. C. Scott, and L. Th. Pautmeier.

74. "Photorefractivity in Doped Nonlinear Polymers: Shifted Phase Gratings, Higher Speed, and Sensitization," Gordon Research Conference on Electronic Processes in Organic Materials, Andover, New Hampshire, July 27-31, 1992.
75. "Photorefractive Polymers: Visions and Present Status," Institute for Experimental Physics Colloquium, University of Bayreuth, Bayreuth, Germany, September 9, 1992.
76. "Photorefractive Polymers - A New Class of Materials for Optical Processing," Institute for Physical Chemistry Seminar, University of Munich, Munich, Germany, September 11, 1992.
77. **Plenary Lecture**, "A Solid as a Single-Molecule Trap: Optical Spectroscopy of Single Impurity Centers in a Solid," OSA Topical Meeting on Spectral Hole-Burning and Luminescence Line-Narrowing, Ascona, Switzerland, September 14-18, 1992.
78. "Photorefractivity in Nonlinear Organic Polymers," Optical Society of America Annual Meeting, Albuquerque, New Mexico, September 21, 1992. With S. Silence, J. C. Scott, C. A. Walsh, F. Hache, R. J. Twieg, T. Matray, V. Y. Lee, D. M. Burland, and G. C. Bjorklund.
79. "Optical Spectroscopy Using a Solid as a Single-Molecule Trap," Optical Society of America Annual Meeting, Albuquerque, New Mexico, September 21, 1992. With Th. Basché, and M. Orrit.
80. "Probing a Single Molecule Hidden Deep Inside a Solid," DOE Workshop on Advanced Laser Techniques for Chemical Measurements, Santa Fe, New Mexico, October 19-21, 1992.
81. "Physical Studies in Solids at the Single-Molecule Level," CLS-2 Seminar, Los Alamos National Laboratory, Los Alamos, New Mexico, October 21, 1992.
82. "Nonlinear Optical Properties of Photorefractive Polymers," OE-LASE Conference, Los Angeles, California, January 19-21, 1993. With S. M. Silence, F. Hache, M. Donckers, C. A. Walsh, D. M. Burland, G. C. Bjorklund, and R. J. Twieg.
83. **Samuel M. McElvain Lecture**, "Recent Developments in the Optical Spectroscopy of Single Molecular Impurities in Solids," Chemistry Department, University of Wisconsin, Madison, Wisconsin, March 2, 1993.
84. "New Developments in Photorefractive Polymers," American Physical Society March Meeting, Seattle, Washington, March 22-26, 1993.
85. "Optical Spectroscopy of Single Molecules in Solids," American Chemical Society Annual Meeting, Denver, Colorado, March 29 - April 2, 1993.
86. "New Developments in Organic Photorefractive Polymers," Materials Research Society Spring Meeting Symposium on Organic Materials for Nonlinear Optical Applications, San Francisco, California, April 14-16, 1993. With S. M. Silence, M. Donckers, F. Hache, C. A. Walsh, E. Ginsburg, P. K. Jenkner, G. C. Bjorklund, D. M. Burland, R. D. Miller, J. C. Scott, and R. J. Twieg.
87. "Optical Spectroscopy of a Single Impurity Molecule in a Solid: Spectral Diffusion, Photon Antibunching, and Single-Spin Magnetic Resonance," Condensed Matter Seminar, University of California, Berkeley, California, April 21, 1993.

88. "Optical Spectroscopy of a Single Impurity Molecule in a Solid," Physical Chemistry Seminar, University of Pittsburg, Pittsburg, Pennsylvania, April 29, 1993.
89. "Recent Progress in Photorefractive Polymers," Quantum Electronics and Laser Science Conference (QELS 93), Baltimore, Maryland, May 2-7, 1993. With S. M. Silence, M. C. J. M. Donckers, C. A. Walsh, F. Hache, E. J. Ginsburg, P. K. Jenkner, J. C. Scott, R. J. Twieg, R. D. Miller, G. C. Bjorklund, and D. M. Burland.
90. "Single-Molecule Spectral Diffusion in Crystals and Polymers," Ninth International Conference on Dynamical Processes in Excited States of Solids, Cambridge, Massachusetts, August 2-6, 1993.
91. "Overview of Single-Molecule Spectroscopy in Condensed Media," 1993 International Conference on Luminescence and Optical Spectroscopy in Condensed Matter, Storrs, Connecticut, August 9-13, 1993.
92. "Spectral Hole-Burning and Quantum Effects of Single Impurity Molecules in a Solid," 1993 International Conference on Luminescence and Optical Spectroscopy in Condensed Matter, Storrs, Connecticut, August 9-13, 1993. With Th. Basché.
93. "Examining the Components of the Ensemble Average Using Single-Molecule Spectroscopy in Solids: Spectral Diffusion, Phototransformations, and Single-Spin Experiments," Stanford University Physical Chemistry Seminar, Stanford, California, September 30, 1993.
94. "Recent Advances in Photorefractive Polymers: High Efficiency, Improved Speed, and Net Two-Beam Coupling Gain," ACS/OSA Topical Meeting on Organic Thin Films for Photonic Applications, Toronto, Ontario, Canada, October 6-8, 1993. With G. C. Bjorklund, D. M. Burland, P. K. Jenkner, R. D. Miller, J. C. Scott, S. M. Silence, R. J. Twieg, and C. A. Walsh.
95. "Recent Developments in Single-Molecule Spectroscopy in Solids: Spectral Diffusion, Vibrational Spectroscopy, and Magnetic Resonance of a Single Molecular Spin," Physical Chemistry Seminar, University of Munich, Munich, Germany, 10 November 1993.
96. "Recent Developments in Single-Molecule Spectroscopy in Solids: Spectral Diffusion, Vibrational Spectroscopy, and Magnetic Resonance of a Single Molecular Spin," Laser Seminar, Max Planck Institute for Quantum Optics, Garching, Germany, 11 November 1993.
97. "Recent Developments in the Spectroscopy of Single Molecules in Solids," Inorganic Chemistry Seminar, University of Bern, Bern, Switzerland, 18 November 1993.
98. "Recent Developments in Single-Molecule Spectroscopy in Solids: Spectral Diffusion, Vibrational Spectroscopy, and Magnetic Resonance of a Single Molecular Spin," Laser Seminar, IBM Zürich Research Laboratory, Rüschlikon, Switzerland, 6 December 1993.
99. "Recent Developments in Single-Molecule Spectroscopy in Solids: Spectral Diffusion, Vibrational Spectroscopy, and Magnetic Resonance of a Single Molecular Spin," Organic Chemistry Seminar, ETH Zürich, Zürich, Switzerland, 15 December 1993.
100. "Recent Developments in the Spectroscopy of Single Molecules in Solids," Physics Colloquium, University of Ulm, Ulm, Germany, January 21, 1994.

101. "New Frontiers in Single-Molecule Spectroscopy in Solids: Spectral Diffusion, Vibrational Modes, and Magnetic Resonance of a Single Molecular Spin," Laboratory for Physical Chemistry Colloquium, ETH-Zürich, Zürich, Switzerland, February 15, 1994.
102. **Ehrenfest Colloquium**, "Spectroscopy of Individual Molecules in Solids," University of Leiden, Leiden, The Netherlands, March 16, 1994.
103. "Photorefractive Polymers," Philips Research Laboratories, Eindhoven, The Netherlands, March 17, 1994.
104. "Detection and Spectroscopy of Single Molecules in Solids," Conference on Development of Sensors for Environmental Microbes, Logan, Utah, April 11, 1994.
105. "New Frontiers in Solids at the Level of a Single Impurity Molecule," Physics Seminar, University of Utah, Salt Lake City, Utah, April 12, 1994.
106. "Photorefractive Polymers," Laser Seminar, ETH-Hönggerberg, Zürich, Switzerland, April 25, 1994.
107. "Recent Advances in Single-Molecule Spectroscopy in Solids: Vibrational Modes and Near-Field Excitation at Low Temperatures," Optical Spectroscopy and Magnetic Resonance on Single Molecules, WE-Heraeus-Seminar 130, Physikzentrum Bad Honnef, Germany, May 30 – June 1, 1994.
108. "New Frontiers in Single Molecule Spectroscopy in Solids," Gordon Research Conference on Electronic Processes in Organic Materials, Proctor Academy, New Hampshire, July 24-29, 1994.
109. "Spectroscopy of Individual Molecules Trapped in Solids," 14th International Conference on Atomic Physics, Boulder, Colorado, July 31-August 5, 1994.
110. "Photorefractive Polymers **Tutorial**," ACS/OSA Symposium on Polymeric Thin Films for Photonic Applications, Washington, D. C., August 21-24, 1994. With S. M. Silence, G. C. Bjorklund, D. M. Burland, R. D. Miller, J. J. Stankus, and R. J. Twieg.
111. "New Frontiers in Single-Molecule Spectroscopy in Solids: Resonance Frequency Shifts, Vibrational Modes, and Magnetic Resonance of a Single Molecular Spin," American Chemical Society National Meeting, Washington, D. C., August 21-24, 1994.
112. "Science and Applications of Photorefractive Polymers," OSA Topical Meeting on Spectral Hole-Burning and Related Spectroscopies, Tokyo, Japan, August 24-26, 1994. With S. M. Silence, G. C. Bjorklund, D. M. Burland, R. D. Miller, J. J. Stankus, and R. J. Twieg.
113. "Spectroscopy of Individual Molecules in Solids," NRC-CNRC Gerhard Herzberg Honorary Conference on The Future of Spectroscopy, Ste-Adèle, Quebec, September 26-28, 1994.
114. "Photorefractive Polymers and Their Applications," Optical Society of America Annual Meeting - ILS IX, Dallas, Texas, October 2-7, 1994. With G. C. Bjorklund, S. M. Silence, and J. J. Stankus.
115. "New Frontiers in Single-Molecule Spectroscopy in Solids," Chemistry Department Colloquium, University of Chicago, Chicago, Illinois, October 24, 1994.

116. "Probing Nanoenvironments in Solids with Individual Impurity Molecules," Physical Chemistry Seminar, University of California, Berkeley, California, November 1, 1994.
117. "New Frontiers in Single-Molecule Spectroscopy in Solids," Condensed Matter Seminar, University of California, Davis, California, November 10, 1994.
118. "Guacamoles as Probes of Local Environments in Solids," Aspen 1995 Winter Conference on Condensed Matter Physics, Aspen, Colorado, January 15-21, 1995.
119. "New Frontiers in the Spectroscopy of Individual Molecules in Solids," Physical Chemistry Seminar, University of Illinois, Urbana, Illinois, January 25, 1995.
120. "Dynamics and Vibrational Spectra of Individual Molecules in Polymer Glasses," Photonics West Conference on Advanced Optical Methods for Ultrasensitive Detection, San Jose, California, February 6-7, 1995. With Anne B. Myers and P. Tchénio.
121. "Guacamoles, Shpol'skii Matrices, and Subwavelength Optical Spectroscopy," Science Colloquium, IBM Almaden Research Center, San Jose, California, February 10, 1995.
122. **Arthur D. Little Lecture in Physical Chemistry**, "Science and Applications of Photorefractive Polymers," Massachusetts Institute of Technology, Boston, Massachusetts, March 7, 1995.
123. **Arthur D. Little Lecture in Physical Chemistry**, "Probing Nanoenvironments in Solids with Single Impurity Molecules," MIT/Harvard Physical Chemistry Seminar, Massachusetts Institute of Technology, Boston, Massachusetts, March 9, 1995.
124. **Tutorial Lecture**, "Science and Applications of Photorefractive Polymers," March Meeting of the American Physical Society, San Jose, California, March 19, 1995.
125. "Near-Field Optical Spectroscopy of Single Molecules in Solids," Joint U. S.-European Conference on Nanostructures, University of California, Santa Barbara, March 27-28, 1995.
126. **Plenary Lecture**, "Magnetic Resonance Spectroscopy of A Single Molecular Spin," 36th Experimental Nuclear Magnetic Resonance Conference, Boston, Massachusetts, March 26-30, 1995. With J. Köhler, E. J. J. Groenen, and J. Schmidt.
127. "Photorefractivity in Organic Polymeric Materials," SPIE Conference on Xerographic Photoreceptors and Photorefractive Polymers, San Jose, California, July 10-11, 1995. With C. Poga, D. M. Burland, T. Hanemann, C. R. Moylan, S. M. Silence, and R. J. Twieg.
128. "Photon-Gated Spectral Hole-Burning Materials," Conference on Material Requirements for Persistent Spectral Hole Burning and Time-Domain Optical Storage and Processing, Bozeman, Montana, August 3-4, 1995.
129. "Photorefractive Polymer Composites: A New Class of Optical Holographic Materials," Society for Applied Spectroscopy and Golden Gate Polymer Forum, Menlo Park, California, September 7, 1995.
130. "Near-Field Optical Spectroscopy of Single Molecules in Solids," Seventh International Conference on Unconventional Photoactive Systems, Palo Alto, California, September 5-8, 1995. With D. Pohl, and U. P. Wild.

131. "Near-Field Excitation and Stark Effect of Single Molecules in Solids," Optical Society of America Annual Meeting/ILS-XI, Portland, Oregon, September 10-15, 1995. With U. P. Wild, and D. Pohl.
132. "Photorefractive Polymers for Holographic Optical Storage," OSA/ACS Topical Meeting on Organic Thin Films for Photonics Applications, Portland, Oregon, September 11-14, 1995. With C. Poga, Y. Jia, and R. J. Twieg.
133. "Probing Nanoenvironments in Solids with Single Impurity Molecule Spectroscopy," Condensed Matter Physics Seminar, UCSD, La Jolla, California, October 4, 1995.
134. "Probing Nanoenvironments in Solids Using Single Impurity Molecule Spectroscopy," University of Arizona Optical Sciences Center Colloquium, Tucson, Arizona, October 26, 1995.
135. "Probing Nanoenvironments in Solids with Single Impurity Molecules," Todai Institute of Solid State Physics Symposium 1995, Tokyo, Japan, November 8-10, 1995.
136. "Fundamentals of Single-Molecule Spectroscopy," International Workshop on Single Molecule Spectroscopy: New Systems and Methods, Monte Verita, Ascona, Switzerland, March 10-15, 1996.
137. "Mechanisms of Photorefractivity in Polymer Composites," ACS Annual Meeting Symposium on Charge Transfer Interactions in Polymers, New Orleans, Louisiana, March 24-29, 1996. With D. M. Burland, C. R. Moylan, and R. J. Twieg.
138. "High-Resolution Spectroscopy of Single Molecules in Solids," (**Plenary**) 51st Ohio State University International Symposium on Molecular Spectroscopy, Columbus, Ohio, June 10-14, 1996.
139. "Optical Spectroscopy of Individual Molecules in Solids," Gordon Research Conference on Atomic and Molecular Interactions, Colby-Sawyer College, New London, New Hampshire, June 30 - July 5, 1996.
140. "Mechanisms of Photorefractivity in Polymer Composites," SPIE Conference on Organic Photorefractive Materials and Xerographic Photoreceptors, Denver, Colorado, August 7-8, 1996.
141. "High-Density Digital Data Storage in Organic Photorefractive Materials," SPIE Conference on Organic Photorefractive Materials and Xerographic Photoreceptors, Denver, Colorado, August 7-8, 1996. With P. M. Lundquist, C. Poga, R. G. Devoe, R. M. Shelby, and R. J. Twieg.
142. "Fundamentals of Single-Molecule Spectroscopy in Solids," Fifth International Meeting on Hole Burning and Related Spectroscopies, Brainerd, Minnesota, September 13-17, 1996. With D. J. Norris.
143. "Single-Molecule Nanophotonics: Gels and Molecular Motors," Physical Chemistry Seminar, University of California San Diego, La Jolla, California, October 8, 1996.
144. "Single-Molecule Nanophotonics," Sixth NEC Symposium on Fundamental Approaches to New Material Phases: Quantum Optical Phenomena in Spatially Confined Materials, Karuizawa, Japan, October 13-17, 1996.

145. "Single-Molecule Nanophotonics," University of Texas Organic Chemistry Seminar, Austin, Texas, October 25, 1996.
146. "Probing Nanoenvironments in Condensed Media with Single Fluorophores," Chemistry Division Seminar, Argonne National Laboratory, Argonne, Illinois, December 2, 1996.
147. "Mechanisms of Photorefractivity in Polymer Composites," Third International Conference on Organic Nonlinear Optics, Marco Island, Florida, December 16-20, 1996. With A. Grunnet-Jepsen, and C. Thompson.
148. "Observation of Beam Fanning in a Photorefractive Polymer," Materials Research Society 1997 Spring Meeting, San Francisco, California, March 31- April 4, 1997. With A. Grunnet-Jepsen, and C. L. Thompson.
149. "Polyacrylamide Gels for Single-Molecule Biophysics," Symposium on Chemistry of Single Molecules, American Chemical Society Annual Meeting, San Francisco, California, April 13-17, 1997. With R. M. Dickson.
150. "Single-Molecule Nanophotonics," La Jolla Interfaces in Science Conference, April 18, 1997.
151. "Recent Advances in Photorefractive Polymer Materials," SPIE Symposium 3147, Nonlinear Optical Properties of Organic Materials X, San Diego, California, July 30 – August 1, 1997. With A. Grunnet-Jepsen, and C. L. Thompson.
152. "Single-Molecule Spectroscopy in Chemistry and Biophysics: Peeling Back the Ensemble Average," R. B. Woodward Lecture, Department of Chemistry and Chemical Biology, Harvard University, Cambridge, Massachusetts, September 15, 1997.
153. "Mechanisms and Applications of Photorefractivity in New Polymer Composites," R. B. Woodward Lecture, Department of Chemistry and Chemical Biology, Harvard University, Cambridge, Massachusetts, September 18, 1997.
154. "Recent Advances in High Gain Photorefractive Polymers," IEEE Lasers and Electro-Optics Society Annual Meeting, San Francisco, California, November 10-13, 1997. With A. Grunnet-Jepsen.
155. "Optical Probes of Single Molecules and Proteins in Gels," Advances in Cellular Imaging, Cambridge Healthtech Institute, San Diego, California, November 13-14, 1997. With R. M. Dickson and S. Kummer.
156. "Single-Molecule Nanophotonics in Solids, Liquids, and Proteins," Japan-U. S. Information Exchange Seminar on Photophysics and Photoconversion in Small domains by Near-Field Scanning Optical Microscopy," Napa Valley, California, January 10-14, 1998. With R. M. Dickson and S. Kummer.
157. "Understanding Photorefractivity in Polymers: Materials for an Optical Transistor?" Physical Chemistry Colloquium, University of California, Berkeley, Berkeley, California, January 27, 1998.
158. "Photorefractive Polymers: Materials for Optical Processing Applications," Weissberger-Williams Lecture, Eastman Kodak Company, Rochester, New York, February 6, 1998.

159. "Optical Studies of Individual Molecules, One at a Time—What Can We Learn?," Physical Chemistry Seminar, University of California Irvine, Irvine, California, February 17, 1998.
160. "Optical Studies of Single Molecules and Proteins in Biocompatible Gels," Annual Meeting, Biophysical Society, Kansas City, Missouri, February 22-26, 1998. With R. M. Dickson and S. Kummer.
161. "Optical Properties of Single Small Fluorophores and Single Green Fluorescent Protein Molecules in Poly(acrylamide) Gels," March Meeting, American Physical Society, Los Angeles, California, March 16-20, 1998.
162. "Recent Advances in Photorefractive Polymer Composites," Dallas National Meeting, American Chemical Society, Dallas, Texas, March 29 – April 2, 1998. With A. Grunnet-Jepsen, B. Smith, and D. Wright.
163. "Single-Molecule Optical Probes of Local Environments in Gels and Proteins," Dallas National Meeting, American Chemical Society, Dallas, Texas, March 29 – April 2, 1998. With R. M. Dickson and S. Kummer.
164. "Single-Molecule 'Astronomy' in Condensed Media: Peeling Back the Ensemble Average," Chemical Sciences and Technology Laboratory Colloquium, National Institute of Standards and Technology, Gaithersburg, Maryland, April 15, 1998.
165. "Recent Advances in High Gain Photorefractive Polymers," Conference on Lasers and Electro-Optics CLEO '98, San Francisco, California, May 3-8, 1998. With A. Grunnet-Jepsen, D. A. Wright, and B. R. Smith.
166. "High-Speed Photorefractive Polymer Composites," Postdeadline Paper, Conference on Lasers and Electro-Optics CLEO '98, San Francisco, California, May 3-8, 1998. With M. A. Diaz-Garcia, D. Wright, M. DeClue, J. Casperson, B. R. Smith, and R. J. Twieg.
167. "Recent Advances in Single-Molecule Spectroscopy in Chemistry and Biophysics: Peeling Back the Ensemble Average," Gordon Conference on Electronic Processes in Organic Materials, Salve Regina University, Newport, Rhode Island, July 26-31, 1998.
168. "Mechanisms of Photorefractivity in Polymer Composites," Summer School on Molecular Optoelectronics, Cursos de Verano, San Lorenzo de El Escorial, Madrid, Spain, August 3-7, 1998.
169. "Applications of Photorefractive Polymers," Summer School on Molecular Optoelectronics, Cursos de Verano, San Lorenzo de El Escorial, Madrid, Spain, August 3-7, 1998.
170. "Fast and Efficient Photorefractivity in Polymer Composites," American Chemical Society Annual Meeting Symposium on Organic Thin Films for Photonic Applications, Boston, Massachusetts, August 23-27, 1998. With M. A. Diaz-Garcia, A. Grunnet-Jepsen, D. Wright, M. Bratcher, M. DeClue, J.S. Siegel, and R.J. Twieg.
171. "Optical Probes of Single Molecules and Proteins in Aqueous Environments," 4th International Workshop on Single Molecule Detection and Ultrasensitive Analysis in the Life Sciences, Berlin Adlershof, September 30-October 2, 1998. With R. M. Dickson, S. Kummer, and E. J. Peterman.
172. "Optical Detection of Single Molecules and Individual Proteins in Poly(Acrylamide)

- Gels,” Optical Society of America Annual Meeting, Baltimore, Maryland, October 4-9, 1998. With R. M. Dickson, S. Kummer, E. J. Peterman, J. Deich and J. Frazier.
173. “Mechanisms for High Gain in Photorefractive Polymers,” Optical Society of America Annual Meeting, Baltimore, Maryland, October 4-9, 1998. With M. A. Diaz-Garcia, A. Grunnet-Jepsen, and D. Wright.
 174. “Optical Spectroscopy of Individual Molecules in Solids and Biological Environments,” Physics Research Conference Colloquium, California Institute of Technology, October 15, 1998.
 175. “Those Blinking Single Molecules!” Science and Technology Colloquium, IBM Almaden Research Center, October 23, 1998.
 176. “Optical Spectroscopy of Individual Molecules in Solids and Biological Environments,” Chemical Physics Seminar, California Institute of Technology, November 3, 1998.
 177. “Single-Molecule Spectroscopy,” Frontiers in Spectroscopy Lectures, Ohio State University, Columbus, Ohio, January 20-22, 1999.
 178. “Single-Molecule Optical Probes in Physical Chemistry and Biophysics,” Optics and Quantum Electronics Seminar, Stanford University, Stanford, California, February 8, 1999.
 179. “Single-Molecule Studies of Fluorescent Proteins and Enzymes,” Biophysical Society Annual Meeting, Baltimore, Maryland, February 13-17, 1999. With E. J. Peterman, H. Sosa, S. Brasselet, R. M. Dickson, S. Kummer, R. Sakowicz, and L. S. B. Goldstein.
 180. “Single-Molecule Spectroscopy and Detection and Low and Room Temperature,” Seventh Japan Science and Technology Corporation International Symposium on Molecular Processes and Biosystems, Tokyo, Japan, February 24-25, 1999. With S. Brasselet, and E. J. Peterman.
 181. “New Insights into Trapping and Compensation in Photorefractive Polymers,” Material Research Society Spring Meeting Symposium F, San Francisco, California, April 5-9, 1999. With D. Wright, M. Diaz-Garcia, A. Goonesekera, J. Casperson, B. Smith, M. S. DeClue, E. Glazer, J. S. Siegel, and R. J. Twieg.
 182. “Understanding Trapping in Photorefractive Polymer Composites for Optical Processing Applications,” Conference on Lasers and Electro-Optics CLEO ‘99, Baltimore, Maryland, May 23-28, 1999. With A. Grunnet-Jepsen, D. Wright, J. Casperson, E. Glazer, M. DeClue, J. S. Siegel, and R. J. Twieg.
 183. “Single-Molecule Optical Science in Physical Chemistry and Biophysics,” Nobel Conference on Single-Molecule Spectroscopy in Physics, Chemistry, and Biology, Lindigo, Sweden, June 5-9, 1999.
 184. “Understanding Photorefractivity in High-Performance Polymer Composites,” Seventh Topical Meeting on Photorefractive Materials, Effects, and Devices, PR’99, Elsinore, Denmark, June 27-30, 1999. With A. Grunnet-Jepsen, D. Wright, M. S. DeClue, J. S. Siegel, and R. J. Twieg.
 185. **Plenary Lecture**, “Single-Molecule Optical Imaging and Spectroscopy Can Probe Hidden Complexity,” International Conference on Photochemistry ICP’99, Duke University, Durham, North Carolina, August 2-6, 1999.

186. **Critical Review**, "Single Molecules Under an Optical Spotlight," Interdisciplinary Laser Science Conference ILS-XV, Santa Clara, California, September 26-October 1, 1999.
187. "Trap Dynamics in Photorefractive Polymer Composites," Materials Research Society Fall Meeting, Boston, Massachusetts, November 29 - December 3, 1999. With D. Wright, A. Goonesekera, M. A. Diaz-Garcia, and R. J. Twieg.
188. "Shedding Light on Single Biomolecules," *Frontiers in Biosciences Series*, Stanford University, Stanford, California, January 13, 2000.
189. "Single Molecules Under an Optical Spotlight," Special Seminar, Laboratoire de Photonique Quantique et Moléculaire, Ecole Normale Supérieure de Cachan, France, January 28, 2000.
190. "Single-Molecule Optical Spectroscopy in Condensed Matter," 6th French-Israeli Symposium on Nonlinear Quantum Optics, FRISNO6, Ecole de Physique, Les Houches, France, January 30 – February 4, 2000.
191. "Single Molecules Under an Optical Spotlight," Third Flory Conference on Physical and Macromolecular Chemistry, Stanford University, Stanford, CA, February 11-12, 2000.
192. "Single Photons on Demand from Individual Molecules," Quantum Entanglement Symposium, Stanford University, Stanford, CA, March 20-22, 2000. With B. Lounis.
193. "Optical Studies of Single Biomolecules in Aqueous Environments," American Chemical Society Annual Meeting, Washington, DC, August 20-24, 2000. With S. Brasselet, B. Lounis, E. J. G. Peterman, H. Sosa, and L. S. B. Goldstein.
194. "Single-Molecule Studies of Fluorescent Proteins and Molecular Motors," Third European Biophysics Congress, Munich, Germany, September 9-13, 2000.
195. "Advanced Microscopy for Protein Localization in Caulobacter," DARPA Biofutures Meeting, Hilton Washington Dulles, November 1-2, 2000. With M. Paige, S. Nishimura, E. Judd, and L. Shapiro.
196. "Mechanisms of Photorefractivity in Polymer Composites," Northwestern University Organic Materials Symposium, Evanston, Illinois, November 17, 2000.
197. "Trap Dynamics in Photorefractive Polymers: Mechanisms and Applications," Symposium on Field-Responsive Polymers, American Chemical Society POLY Millennial 2000, Waikoloa, Hawaii, December 9-13, 2000. With D. Wright, A. Goonesekera, M. DeClue, J. S. Siegel, and R. J. Twieg.
198. "Recent Progress in Photorefractive Polymers: Mechanisms and Applications," International Congress of Pacific Basin Societies, Pacificchem 2000, Honolulu, Oahu, Hawaii, December 14-19, 2000. With D. Wright, U. Gubler, A. Goonesekera, M. DeClue, J. S. Siegel, M. He, and R. J. Twieg.
199. "Single-Molecule Spectroscopy, from Quantum Optics to Molecular Motors," Aspen Winter Workshop on Single Molecule Biophysics, Aspen, Colorado, January 14-20, 2001.
200. **Public Lecture**, "Visualizing Single Molecules with Lasers," Aspen Center for Physics Winter Conference 2001, Aspen, Colorado, January 17, 2001.
201. "Single-Molecule Spectroscopy: From Biophysics to Quantum Optics," Physical Chemistry Seminar, University of California, Berkeley, California, January 23, 2001.

202. "Single-Molecule Spectroscopy to Explore Fluorescent Proteins and Molecular Motors," Chemistry Department Seminar, Boston College, Boston, Massachusetts, February 22, 2001.
203. "Single-Molecule Spectroscopy, from Molecular Motors to Quantum Optics," Physics Department Colloquium, University of Chicago, Chicago, Illinois, March 1, 2001.
204. **William Draper Harkins Lecture**, "Pushing Back Ensemble Averaging with Single-Molecule Spectroscopy," Chemistry Department, University of Chicago, Chicago, Illinois, March 5, 2001.
205. "Single-Molecule Spectroscopy and Imaging: History, Fundamentals, and Recent Examples," Tutorial Lecture, T6: Single Molecule Imaging in Condensed Matter and Biology, American Physical Society March Meeting, Seattle, Washington, March 11, 2001.
206. **Earle K. Plyler Prize Lecture**, "Single-Molecule Spectroscopy: From 2K, to Molecular Motors, to Quantum Optics," American Physical Society March Meeting, Seattle, Washington, March 12-16, 2001.
207. "Single-Molecule Spectroscopy: From Quantum Optics to Molecular Motors," American Chemical Society Annual Meeting, April 1-5, 2001. With B. Lounis, H. Sosa, E. J. G. Peterman, and L. S. B. Goldstein.
208. "Photorefractive Polymers: What They Are and What You Can Do With Them," Quantum Electronics Seminar, Department of Applied Physics, Stanford University, Stanford, California, April 16, 2001.
209. "Photorefractive Polymer Design Strategies," Society of Photo-Optical Instrumentation Engineers Annual Meeting, San Diego, California, July 29 - August 3, 2001. With D. Wright, U. Gubler, M. He, R. J. Twieg, M. DeClue, and J. S. Siegel.
210. "Single-Biomolecule Optical Detection and Spectroscopy, from Molecular Motors to MHCII in Live Cells," Fourth International Conference on Biological Physics, ICBP 2001, Kyoto, Japan, July 30 - August 3, 2001. With M. Vrljic, S. Nishimura, H. M. McConnell, H. Sosa, E. Peterman, and Larry Goldstein.
211. **Moses Gomberg Lecture**, "Single-Molecule Spectroscopy, from Quantum Optics to Molecular Motors," Department of Chemistry, University of Michigan, September 6, 2001.
212. "Optical Spectroscopy of Single Biomolecules," Optical Society of America Annual Meeting / Interdisciplinary Laser Science XVII, Long Beach, California, October 14-18, 2001. With M. Vrljic, S. Nishimura, and H. McConnell.
213. "Single-Molecule Spectroscopy: From Low-Temperature Physical Chemistry to Biophysics," Nobel Jubilee Centennial Symposium: "Frontiers in Molecular Science," Friiberghs Herdegaard, Stockholm, Sweden, December 4-7, 2001.
214. "Recent Advances in the Understanding and Development of Photorefractive Polymers and Glasses," Sixth International Conference on Organic Nonlinear Optics, ICONO'6, Tucson, Arizona, December 16-20, 2001. With D. Wright, U. Gubler, O. Ostroverkhova, M. He, A. Sastre-Santos, and R. J. Twieg.
215. "Single-Molecule Spectroscopy, from Quantum Optics to Molecular Motors," Chemistry

- Colloquium, Department of Chemistry, Cornell University, Ithaca, New York, February 14, 2002.
216. "Single-Molecule Spectroscopy: From Molecular Motors to Quantum Optics," Physical Chemistry Seminar, Colorado State University, Ft. Collins, Colorado, March 21, 2002.
 217. "Single-Molecule Spectroscopy, from Biophysics to Quantum Optics," Chemical Physics Seminar, Department of Chemistry and Biochemistry, University of Colorado and JILA, Boulder, Colorado, March 22, 2002.
 218. "High-Performance Photorefractive Organic Glasses: Understanding Mechanisms and Limitations," Society of Photo-Optical Instrumentation Engineers Annual Meeting, Seattle, Washington, July 7-11, 2002. With O. Ostroverkhova, U. Gubler, D. Wright, M. He, and R. J. Twieg.
 219. "Emerging Frontiers in Single-Molecule Spectroscopy," Volkswagen Stiftung Third International Symposium on Physics, Chemistry, and Biology with Single Molecules, Tutzing, Germany, September 22-25, 2002.
 220. "Emerging Frontiers in Single-Molecule Spectroscopy," Eighth International Workshop on Single Molecule Detection and Ultrasensitive Analysis in Life Sciences," Berlin-Adlershof, Germany, September 25-27, 2002.
 221. "Emerging Frontiers in Single-Molecule Spectroscopy," Physics Colloquium, University of Illinois at Urbana-Champaign, Urbana, IL, October 10, 2002.
 222. "Single-Molecule Biophysics," Biophysics Seminar, University of Illinois at Urbana-Champaign, Urbana, IL, October 11, 2002.
 223. "Optical Measurements of Single Molecules in Cells," NIH-NIDA Workshop on Emerging Technologies: Analysis of Endogeneous Biomaterials and Single-Molecule Studies, Rockville, MD, December 4-5, 2002.
 224. "New Fluorophores and Analyses for Single-Molecule Spectroscopy and Enzymology," Second Aspen Conference on Single-Molecule Biophysics, Aspen, CO, January 5-11, 2003.
 225. "High Performance Photorefractive Polymers and Glasses: Mechanisms and Applications," IBM Almaden Science and Technology Colloquium, San Jose, CA, February 7, 2003.
 226. "Single Molecules as Nanophotonic Probes and Sources," March Meeting of the American Physical Society, Austin, TX, March 3-7, 2003.
 227. "Single Molecules as Local Nanoscopic Probes," Nanoscience and Technology Conference, Groningen, The Netherlands, May 18-21, 2003.
 228. "Optically Sensing the State of a Single Molecule," Quantum Electronics and Laser Science Conference, Baltimore, MD, June 1-6, 2003. With K. A. Willets and O. Ostroverkhova.
 229. "Lighting the Way with Single Molecules," DC to Daylight: A Symposium Honoring Prof. A. J. Sievers, Cornell University, Ithaca, NY, June 14, 2003.
 230. "Single Molecules as Local Nanophotonic Probes and Sources", a series of lectures presented in the Conference Universitaire de Suisse Occidentale du 3ème Cycle en

Chimie:

- (a) "Single-Molecule Spectroscopy as a Local Nanoscopic Probe," University of Basel, June 18, 2003
 - (b) "Optical Spectroscopy of Single Molecules in Condensed Phases," University of Bern, June 19, 2003
 - (c) "Biophysical Studies Using Single-Molecule Local Probes," EPFL Lausanne, June 20, 2003
 - (d) "Fundamentals of Single-Molecule Spectroscopy and Nanophotonics," University of Geneva, June 23, 2003
 - (e) "Applications of Single Molecules as Nanophotonic Probes and Sources," University of Geneva, June 24, 2003
229. "Observing Single Molecules in Cells, and a New Class of Single-Molecule Fluorophores," Gordon Research Conference on Electronic Spectroscopy and Dynamics, Bates College, Lewiston, ME, July 6-11, 2003.
230. "Single Molecules as Local Nanoscopic Probes," Eighth International Meeting on Hole Burning, Single Molecule, and Related Spectroscopies: Science and Applications, Bozeman, MT, July 27-31, 2003.
231. "Emerging Frontiers in Single-Molecule Fluorescence Imaging," American Chemical Society Annual Meeting, New York, NY, September 7-11, 2003.
232. "A Single Molecule as a Nanoscale Probe," Nanoscale Science and Technology Workshop 2003, University of Washington Center for Nanotechnology, Seattle, WA, September 22-23, 2003. With S. Y. Nishimura.
233. "Optical Probing of Single Molecules: Examples from Physics, Chemistry, and Biophysics," Physics Department, University of Queensland, Brisbane, Queensland, Australia, November 25, 2003.
234. "Single Molecules March to Different Drummers: Jellyfish, Cholesterol, and Quantum Communication," Toyota Lecture, Australian National University, Canberra, Australian Capital Territory, Australia, November 26, 2003.
235. "Optical Probing of Single Molecules: Examples from Physics, Chemistry, and Biophysics," Swinburne Institute of Technology, Melbourne, Victoria, Australia, November 27, 2003.
236. "Single Molecules as Nanophotonic Probes and Sources," Geoffrey Frew Fellowship Lecture, Australian Conference on Optics, Lasers, and Spectroscopy ACOLS03, University of Melbourne, Melbourne, Victoria, Australia, December 1, 2003.
237. "Single Molecules and Defect Centers in Solids as Nanophotonic Probes and Sources," Stanford-ENS Quantum Entanglement Symposium, Stanford University, Stanford, California, December 15-18, 2003.
238. "Single Molecules as Nanophotonic Probes and Sources," Chemistry Department Colloquium, University of California, Davis, California, February 4, 2004.
239. "Single Molecules as Local Nanoscopic Probes," Department of Chemistry and

- Biochemistry Seminar, Arizona State University, Tempe, Arizona, March 12, 2004.
240. "Single-Molecule Fluorescence Imaging of Biomolecular Dynamics," Minerva-Gentner Symposium on Optical Spectroscopy of Biomolecular Dynamics, Kloster Banz, Germany, March 21-25, 2004.
 241. "Single-Molecule Fluorophores from Nonlinear Optical Chromophores," Materials Research Society Spring Meeting, San Francisco, California, April 12-16, 2004. With K. A. Willets, P. Callis, and R. J. Twieg.
 242. "Single Molecules as Nanophotonic Probes and Sources," Gordon Research Conference on Electronic Processes in Organic Materials, Mount Holyoke College, South Hadley, Massachusetts, July 25-30, 2004.
 243. "Optical Explorations of Single Molecules, *in vitro* and *in vivo*," 5th International Conference on Biological Physics ICBP2004, Gothenburg, Sweden, August 23-27, 2004.
 244. "Visualizing Single-Molecule Dynamics in Cells," Symposium on Biophysical Chemistry and Novel Imaging of Single Molecules and Single Cells, American Chemical Society Annual Meeting, Philadelphia, Pennsylvania, August 22-26, 2004.
 245. "Nanophotonics with Single Molecules and Small Metallic Nanostructures," FACSS 31st Annual Meeting, Nanomaterials for Photonics Symposium, Portland, Oregon, October 3-7, 2004. With D. P. Fromm, A. Sundaramurthy, P. J. Schuck, K. Willets, and G. Kino.
 246. "Single Photon Sources Based on Single Molecules and Nanocrystals," Optical Society of America Annual Meeting, Frontiers in Optics 2004 / Laser Science XX, Rochester, New York, October 10-14, 2004.
 247. "Nanophotonics with Single Molecules and Small Metallic Nanostructures," First MIT-ENS Cachan Workshop on Molecular Photonics and Biophotonics at the Micro and Nanoscale," Boston, Massachusetts, October 12-13, 2004. With D. P. Fromm, A. Sundaramurthy, P. J. Schuck, K. Willets, and G. Kino.
 248. "Single-molecule emitters as nanoscale probes and sources," NIST Quantum Information Program Distinguished Lectureship, National Institute of Standards and Technology, Gaithersburg, Maryland, November 4, 2004.
 249. "Single Molecules as Nanoscale Reporters, *in vitro* and *in vivo*," Plenary Lecture, Western Spectroscopy Association Annual Meeting, Asilomar, California, January 26-28, 2005.
 250. "Single-Molecule Biophysics and Nanophotonics," Nanotechnology Symposium, American Association for the Advancement of Science Annual Meeting, Washington, DC, February 17-21, 2005.
 251. "Single-Molecule Biophysics, Nanophotonics, and Trapping," Chemistry Colloquium, University of Washington, Seattle, Washington, April 6, 2005.
 252. "Single-Molecule Biophysics, Nanophotonics, and Trapping," DOE Workshop on Single-Molecule Research in the New Millennium," Rockville, Maryland, April 10-12, 2005.
 253. "Single-Molecule Biophysics, Nanophotonics, and Trapping," Molecular Science Institute Seminar, Berkeley, California, April 28, 2005.
 254. "Single-Molecule Biophysics, Nanophotonics, and Trapping," Applied Physics Department, Stanford University, Stanford, California, May 16, 2005.

255. "Single-Molecule Biophysics, Nanophotonics, and Trapping," Institute for Atomic and Molecular Sciences, Academia Sinica, Taipei, Taiwan, June 17, 2005.
256. "Single-Molecule Imaging: Challenges in Living Cells," Bio-Image Summer School, Ecole Normale Supérieure, Paris, France, July 19, 2005.
257. "Novel Approaches to Single-Molecule Detection and Trapping," Bio-Image Summer School, Ecole Normale Supérieure, Paris, France, July 12, 2005
258. "Recent Progress in Single-Molecule Spectroscopy and Imaging," Telluride Workshop on Single-Molecule Measurements: Theory and Experiment, Telluride, Colorado, August 9-12, 2005. With Stefanie Nishimura, Jaesuk Hwang, SoYeon Kim, Sam Lord, and Kallie Willets.
259. "Single-Molecule Biophysics, Nanophotonics, and Trapping," American Chemical Society Annual Meeting, Washington, DC, August 28 – September 1, 2005. With Adam Cohen, David Fromm, So Yeon Kim, Stefanie Nishimura, P. James Schuck, and Harden McConnell.
260. "Nanophotonics and Single Molecules," Optical Society Annual Meeting, Frontiers in Optics 2005 - Laser Science XXI, Tucson, Arizona, October 16-20, 2005.
261. "Single-Molecule Biophysics, Nanophotonics, and Trapping," Physics Department Colloquium, Washington University, St. Louis, Missouri, November 16, 2005.
262. "Measuring, Trapping, and Controlling Single Molecules and Nanoparticles," Pacificchem International Conference 2005, Honolulu, Hawaii, December 15-20, 2005. With Adam Cohen, David Fromm, Hanshin Hwang, Soyeon Kim, Stefanie Nishimura, Samuel Lord, P. James Schuck, Arvind Sundaramurthy, Katherine A. Willets, Harden McConnell, Gordon Kino, and Robert J. Twieg.
263. "Single-Molecule Spectroscopy at High Resolution and Low Temperature: The Early Years," A. R. Gordon Lecture, Department of Chemistry, University of Toronto, January 4, 2006.
264. "Single-Molecule Biophysics: From Proteins to Cells," A. R. Gordon Lecture, Department of Chemistry, University of Toronto, January 5, 2006.
265. **A. R. Gordon Lecture**, "Novel Approaches to Single-Molecule Studies: Local Reporters, Nanoantennas, and Trapping," Department of Chemistry, University of Toronto, January 6, 2006.
266. "Pumping, Probing, Grabbing, and Manipulating Single Molecules," University of California, Berkeley, Workshop on Advanced Imaging Methods, Berkeley, California, January 19-20, 2006.
267. "Single-Molecule Biophysics, Nanophotonics, and Trapping," Chemistry Department Colloquium, Northwestern University, Evanston, Illinois, February 17, 2006.
268. "Probing, Imaging, and Trapping Single Biomolecules," Imaging Focus Group Seminar Series, University of Texas Southwestern Medical School, Dallas, Texas, February 27, 2006.

269. "Single Molecules as Nanoscale Reporters in Biophysics, Chemistry, and Materials Science," IUPAC XXI International Symposium on Photochemistry, Kyoto Japan, April 2-7, 2006.
270. "Single-Molecule Emitters as Reporters of Dynamics and Function in Living Cells," NIH Frontiers in Live Cell Imaging Conference, Bethesda, Maryland, April 19-21, 2006.
271. "Optical Observations of Single Biomolecules," Gordon Research Conference on Single-Molecule Approaches to Biology, Colby-Sawyer College, New London, New Hampshire, June 18-23, 2006.
272. Single-molecule fluorescence tracking probes membrane dynamics," American Chemical Society Annual Meeting, Surface Chemistry Symposium in honor of Gabor Somorjai, San Francisco, California, September 10-14, 2006. With Hanshin Hwang, So Yeon Kim, Anika Kinkhabwala, and Stefanie Nishimura.
273. "Single-molecule fluorescence imaging reports on biomolecular dynamics," American Chemical Society Annual Meeting, Symposium on Frontiers in Single-Molecule Biophysical Chemistry and Imaging, San Francisco, California, September 10-14, 2006. With Adam Cohen, Nicholas R. Conley, So Yeon Kim, Anika Kinkhabwala, Marcelle Koenig, Andrea H. Kurtz, Samuel J. Lord, Zhikuan Lu, Hui Wang, and Robert J. Twieg.
274. "Single-Molecule Biophysics, Nanophotonics, and Trapping," Herbert H. King Lecture, Department of Chemistry, Kansas State University, Manhattan, Kansas, October 26, 2006.
275. "Visualizing Single Molecules with Lasers," Yunker Lecture, Department of Physics, Oregon State University, Corvallis, Oregon, November 6, 2006.
276. "Single-Molecule Fluorescence Imaging Reports on Biomolecular Dynamics," Workshop on Single-Molecule Fluorescence, PicoQuant GMBH and the Center for Biophotonics, UC Davis, Sacramento, California, January 18-19, 2007
277. "Fluorescence and Single-Molecule Studies of Chaperonin Nanomachines: Overview," Nanomedicine Center for Protein Folding Machinery Nanomedicine Lecture, Webex, February 22, 2007.
278. "Observing Dynamics of Individual Biomolecules with Single-Molecule Microscopy," Symposium on Nanomachines and Nanotechnologies, Biophysical Society Annual Meeting, Baltimore, Maryland, March 3-7, 2007.
279. "Refining Single-Molecule Fluorescence Imaging for Chaperonin Studies," 21st Annual Symposium of the Protein Society, Boston, Massachusetts, July 21-25, 2007.
280. "Recent Progress in Single-Biomolecule Fluorescence Imaging," Symposium on Single-Molecule Spectroscopy, Imaging, and Manipulation of Biomolecular Systems," American Chemical Society Annual Meeting, Boston, Massachusetts, August 19-23, 2007.
281. **Invited Tutorial**, "Single-Molecule Biophysical Imaging, Superresolution, and Trapping," Optical Society of America Annual Meeting, Frontiers in Optics/Laser Science, San Jose, California, September 16-20, 2007.
282. "Single-Molecule Superresolution Imaging and Trapping," BIOS 2008 Hot Topics Plenary Event, San Jose, California, January 19, 2008

283. **Keynote Lecture**, “Recent Progress in Single-Biomolecule Fluorescence Imaging,” BIOS 2008 Conference 6862 on Single Molecule Spectroscopy and Imaging, San Jose, California, January 19-24, 2008
294. “Recent Progress in Single-Biomolecule Fluorescence Imaging, In and Out of Cells,” PULSE Seminar, Stanford Linear Accelerator Center, April 10, 2008.
295. **Wolf Prize Lecture**, “Single-Molecule Optical Spectroscopy and Imaging: Early Steps to Recent Advances,” Tel-Aviv Symposium in Chemical Physics on Single-Molecule Spectroscopy in Chemistry, Physics, and Biology, Tel-Aviv University, Tel-Aviv, Israel, May 27, 2008.
296. **Wolf Prize Lecture and Pathway Seminar**, “Single-Molecule Optical Spectroscopy and Imaging: Early Steps to Recent Advances,” Hebrew University of Jerusalem, Jerusalem, Israel, May 28, 2008.
297. “Single-Molecule Optical Spectroscopy and Imaging: Early Steps to Recent Advances,” Wolf Prize Mini-Symposium, Weizmann Institute of Science, Rehovot, Israel, May 29, 2008.
298. “Single-Molecule Spectroscopy and Imaging: Early Steps to Recent Advances,” Nobel Symposium on Single-Molecule Spectroscopy in Chemistry, Physics, and Biology, Sanga-Saby, Sweden, June 1-6, 2008.
299. “Single-Molecule Biophysical Imaging, Superresolution, and Trapping,” Hitachi Global Storage Technology Research Colloquium, San Jose, California, July 2, 2008.
300. **DuPont-Marshall Lecture**, “Single-Molecule Optical Spectroscopy and Imaging: From Early Steps to Recent Advances,” Department of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania, October 7, 2008.
301. “Single-Molecule Optical Spectroscopy and Imaging: Early Steps to Recent Advances,” Science Colloquium, IBM Almaden Research Center, San Jose, California, January 16, 2009.
302. **Arthur S. Noyes Lecture**, “Single-Molecule Optical Spectroscopy and Imaging: From Early Steps to Recent Advances,” Department of Chemistry and Biochemistry, University of Texas at Austin, Austin, Texas, February 5, 2009.
303. **Neil Gordon Frontiers in Chemistry Lecture**, “Single-Molecule Optical Spectroscopy and Imaging: From Early Steps to Recent Advances,” Department of Chemistry, Wayne State University, Detroit, Michigan, March 9, 2009
304. **Langmuir Prize Lecture**, “Single-Molecule Fluorescence Imaging: Nanoscale Emitters with Photoinduced Switching Enable Superresolution,” American Physical Society March Meeting, Pittsburgh, Pennsylvania, March 17, 2009.
305. “Imaging Beyond the Diffraction Limit in Cells Using Single-Molecule Active Control,” American Chemical Society Annual Meeting, Salt Lake City, Utah, March 22, 2009.
306. “Single-Molecule Optical Spectroscopy and Imaging: Early Steps to Recent Advances,” Kavli Nanoscience Colloquium, California Institute of Technology, Pasadena, California, April 14, 2009.

307. “Single-Molecule Optical Spectroscopy and Imaging: Early Steps to Recent Advances,” Physical Chemistry Seminar, University of California, Berkeley, Berkeley, California, April 21, 2009.
308. “Imaging and Trapping Single Biomolecules, In and Out of Cells,” TSRI Distinguished Lecture, The Scripps Research Institute, La Jolla, California, May 10, 2009.
309. “Single-Molecule Biophysical Imaging, Superresolution, and Trapping,” Leica Scientific Forum Lecture, Heidelberg, Germany, May 25, 2009.
310. **Karl Friedrich Bonhoeffer Lecture**, “Single-Molecule Biophysical Imaging, Superresolution, and Trapping,” Max Planck Institute for Biophysical Chemistry, Göttingen, Germany, May 27, 2009.
311. “Nanoscale Single-Molecule Emitters with Photoinduced Switching Enable Superresolution in Three Dimensions (and other topics),” 10th International Conference on Hole-Burning, Single-Molecule, and Related Spectroscopies (HBSM 2009), Palm Cove, Queensland, Australia, June 22-27, 2009.
312. “Single-Molecule Optical Spectroscopy and Imaging: From Early Steps to Superresolution Imaging in Living Cells,” Single-Molecule Imaging, Spectroscopy, and Manipulation of Biological Systems, Fragrant Hill Science Conference, Beijing, China, July 8-10, 2009.
313. “Single-Molecule Biophysical Imaging, Superresolution, and Trapping,” Kavli Institute of Theoretical Physics Lecture, Beijing, China, July 13, 2009.
314. “Molecules and Methods for Superresolution Imaging by Single-Molecule Photoswitching (and other topics),” 15th International Workshop on Single-Molecule Spectroscopy and Ultrasensitive Analysis in Life Sciences, SMD15, Berlin-Adlershof, Germany, September 15-18, 2009.
315. “Lighting Up Single Molecules to Probe Complex Environments, From Crystals to Cells,” Evans Award Public Lecture, The Ohio State University, Columbus, Ohio, October 8, 2009.
316. “Single-Molecule Superresolution Imaging and Trapping,” **The Evans Award Lecture**, The Ohio State University, Columbus, Ohio, October 9, 2009.
317. “Three-Dimensional Superresolution Using Single-Molecule Photoswitches and a Double-Helix PSF,” 2009 Computational Optical Sensing and Imaging (COSI) Conference, San Jose, California, October 13-15, 2009. With Michael Thompson, Matthew Lew, Majid Badieirostami, Samuel J. Lord, Nicholas R. Conley, Hsiao-lu D. Lee, Sri Rama Prasanna Pavani, and Rafael Piestun.
318. “Single-Molecule Biophysical Imaging, Superresolution, and Trapping,” 2009 Frontiers in Optics (FiO)/Laser Science XXV (LS) Conference, San Jose, California, October 11-15, 2009.
319. **Keynote Lecture**, “Single-Molecule Approaches to Biomolecular Dynamics and Imaging of Cellular Superstructures,” Keystone Symposium on Structural Biology/Structural Genomics, Breckenridge, Colorado, January 8-13, 2010.
320. “Lighting Up Single Molecules to Probe Complex Environments, from Crystals to Cells,” BioMedSci 231 Fluorescence Guest Lecture, University of California San Diego, La Jolla, California, January 21, 2010.

321. "Recent Progress in Single-Molecule Biophysical Imaging, Superresolution, and Trapping," Pharmacology Department Seminar, University of California San Diego, La Jolla, California, January 21, 2010.
322. "Single-Molecule Biophysical Imaging, Superresolution, and Trapping," Physics Colloquium, Washington University, St. Louis, Missouri, February 3, 2010.
323. "Superresolution Imaging and Trapping Single Biomolecules, In and Out of Cells," Biophysics and Chemistry/Chemical Biology Seminar, University of California, San Francisco, California, February 25, 2010.
324. **Joe L. Franklin Lecture**, "Three Single-Molecule Stories: 3D Superresolution, Trapping, and Nanophotonic Enhancement," Department of Chemistry, Rice University, Houston, Texas, March 10, 2010.
325. "Two Single-Molecule Stories: 3D Superresolution Imaging and Nanophotonic Enhancements," Stanford University Photonics Retreat, Napa, California, April 10, 2010.
326. "Single-Molecule Biophysical Imaging, Superresolution, and Trapping," Physical Chemistry Seminar, University of California, Irvine, California, May 4, 2010.
327. **Tutorial Lecture**, "Single-Molecule Approaches for Superresolution Imaging, Trapping, and Nanophotonics," Conference on Lasers and Electro-Optics (CLEO) 2010, San Jose, California, May 16-21, 2010.
328. "Molecules and Methods for Superresolution Imaging in Living Cells", American Chemical Society Annual Meeting, Boston, Massachusetts, August 22-26, 2010.
329. "Single Molecules as Nanoscopic Probes of 3D Structure and Metallic Nanoantennas," American Chemical Society Annual Meeting, Boston, Massachusetts, August 22-26, 2010.
330. "Single-molecule and super-resolution microscopy of cells, nanoantennas, and biomolecules in solution," Aarhus University iNANO Summer School N7 on Nanooptics, Fuglsoecentret, Aarhus, Denmark, September 3-7, 2010.
331. "Molecules and Methods for Super-Resolution Optical Imaging in Living Cells," Recent Advances and Future Prospects for Visualizing Macromolecular Complexes and Cellular Structures Conference, National Institute of Health, Bethesda, Maryland, October 12-13, 2010.
332. "Extracting Superresolution and 3D Information from Cells with Single Fluorescent Molecules," MIT/Harvard Physical Chemistry Seminar, Cambridge, Massachusetts, October 14, 2010.
333. "Examples, Molecules, and Methods for Superresolution Imaging in Cells," Advanced Imaging Methods Workshop, University of California, Berkeley, January 19-21, 2011.
334. "Optical Localization and Super-Resolution Studies of Biological Systems with Single Molecules," Computational Optical Science and Imaging Seminar, Department of Electrical Engineering, University of Colorado, Boulder, Colorado, February 14, 2011.
335. "Three-Dimensional Tracking of Single mRNA Particles in *S. cerevisiae* Using a Double-Helix Point Spread Function," Biophysical Society Annual Meeting New and Notable, March 5-9, 2011.

336. **Willis H. Flygare Memorial Lecture**, “New Insights from Single Molecules as Nanoscale Points of Light,” Department of Chemistry, University of Illinois at Urbana-Champaign, Urbana, Illinois, March 14, 2011.
337. “Single Fluorescent Molecules as Nano-Illuminators for Biological Structure and Function,” American Physical Society March Meeting, Dallas, Texas, March 21-24, 2011.
338. “Examples, Molecules, and Methods for Super-Resolution Imaging in Cells with Single Molecules,” a series of lectures presented in the **Leica Scientific Forum** at:
 - (a) Institute of Integrated Biology, University of Liverpool, June 27, 2011
 - (b) Department of Pharmacology, University of Oxford, June 28, 2011
 - (c) Department of Chemistry, University of Cambridge, June 29, 2011
 - (d) Department of Physics, Imperial College London, June 30, 2011
339. “Super-Resolution Imaging in Cells with Single Molecules: Examples and Methods,” Single Molecule Spectroscopy: Current Status and Perspectives, W.E. Hereaus Symposium 488, Chemnitz, Germany, July 12-15, 2011.
340. “Single Fluorescent Molecules as Nano-Illuminators for Biological Structure and Function,” American Chemical Society Annual Meeting, Denver, Colorado, August 29, 2011.
341. “Single-Molecule Studies of Biomolecular Dynamics in Solution and Fluorescence Enhancements by Metallic Nanoantennas,” Paul Barbara Memorial Symposium on Forces Driving Contemporary Themes in Physical Chemistry, American Chemical Society Annual Meeting, Denver, Colorado, September 1, 2011.
342. “Super-Resolved Optical Microscopy: A New View of Bacterial Protein Superstructures,” Society for General Microbiology Autumn Meeting, The University of York, York, UK, September 6, 2011.
343. “New Insights from Single Molecules: From 3D Super-Resolution in Cells to Biomolecular Diversity in Solution,” Student-Hosted Colloquium Kickoff Lecture, Department of Chemistry, Stanford University, Stanford, California, October 6, 2011.
344. “Optical Explorations of Single Biomolecules and Enzymes in Solution with an Anti-Brownian Electrokinetic Trap,” Frontiers in Optics/Laser Science Conference, San Jose, California, October 18, 2011.
345. “Single fluorescent molecules as nano-illuminators for biological structure and function in cells,” Single Molecules Meet Systems Biology Symposium, HHMI Janelia Farm Research Campus, Ashburn, Virginia, October 26, 2011.
346. “Single fluorescent molecules as nano-illuminators for biological structure and function in cells,” **Pittsburgh Conference Lecture**, Department of Chemistry, University of Pittsburgh, Pittsburgh, Pennsylvania, October 27, 2011.
347. “Single-molecule studies of biomolecular dynamics in solution and fluorescence enhancements by metallic nanoantennas,” **Pittsburgh Conference Lecture**, Department of Chemistry, University of Pittsburgh, Pittsburgh, Pennsylvania, October 28, 2011.
348. “Photodynamics of Single Antenna Proteins and Redox Enzymes in Solution by

- Suppression of Brownian Motion,” DOE-BES Photosynthetic Systems Research Meeting, Baltimore, Maryland, November 8, 2011.
349. “Single-Molecule Active-Control Microscopy for Nanoscale 3D Cell Images,” Nano/Biophotonics **Plenary Lecture**, BIOS/Photonics West, San Francisco, California, January 24, 2012.
 350. “Single-Molecule Studies of Trapped Biomolecules in Solution with the ABEL Trap,” Nanoscience Subgroup, Biophysical Society Annual Meeting, San Diego, California, February 25, 2012.
 351. “Single Molecules as Light Sources for Super-Resolution Imaging and Probes for Single Biomolecules in Solution,” Pittsburgh Spectroscopy Award Lecture, Pittcon 2012, Orlando, Florida, March 13, 2012.
 352. “Watching Dynamical Processes for Single Biomolecules in Solution with the ABEL Trap,” American Chemical Society Spring National Meeting, San Diego, California, March 25, 2012.
 353. “Breaking the Optical Diffraction Limit in Cells with Single Molecules and STED Microscopy,” Stanford Symposium on Biomedical Imaging, Center for Biomedical Imaging at Stanford (CBIS), Stanford, California, April 6, 2012.
 354. “Single Molecules as Light Sources for 3D Super-Resolution Imaging and Probes for Single Biomolecules in Solution,” Biomedical Plenary Lecture, ICFO (Institute of Photonic Sciences), Barcelona, Spain, May 3, 2012.
 355. “Single-Molecule Active-Control Microscopy Illuminates Cells Beyond the Diffraction Limit,” Special Focus Lecture, International Symposium on Biomedical Imaging (ISBI) 2012, Barcelona, Spain, May 4, 2012.
 356. “Single Molecules as Light Sources for 3D Super-Resolution Imaging and Probes for Single Biomolecules in Solution,” Ehrenfest Colloquium, Leiden University, Leiden, The Netherlands, June 20, 2012.
 357. “Super-Resolution Imaging of Protein and DNA Localization Patterns in Bacteria,” Biology and Physics of Bacterial Chromosome Organization, Leiden, The Netherlands, June 21, 2012.
 358. “What's New With Single Molecules: From Light Sources for 3D Super-Resolution Imaging in Cells to Biomolecular Photodynamics in Solution,” Center for Nanoscale Science Special Seminar Honoring Prof. Dr. Chris Bräuchle, Ludwig Maximilian Universität München, Germany, July 6, 2012.
 359. “Exploring Protein Superstructures in Bacteria Using Two- and Three-Dimensional Super-Resolution Imaging,” CECAM Conference: Toward *in silico* bacterial cells, EPFL, Lausanne, Switzerland, July 9, 2012.
 360. “Single-Molecule Active Control Microscopy for Optical 3D Cell Images to Sub-40 nm Resolution,” International Conference on X-Ray Microscopy XRM 2012, Shanghai, China, August 9, 2012.
 361. “Watching dynamical processes for single molecules in solution,” (Keynote), Eleventh International Conference on Hole-Burning, Single-Molecule, and Related Spectroscopies: Science and Applications, University of Tübingen, Germany, August 27-30, 2012.

362. “Single Molecules as Light Sources for Super-Resolution Imaging and Probes for Single Biomolecules in Solution,” (Keynote), Swiss Single-Molecule Localization Microscopy Symposium, EPFL, Lausanne, Switzerland, August 29-31, 2012.
363. “Single Molecules as Light Sources for Super-Resolution Imaging and Probes for Single Biomolecules in Solution,” Symposium on Atomic, Molecular, and Optical Sciences, Institute for Atomic and Molecular Science, Academia Sinica, Taipei, Taiwan, November 12, 2012.
364. “Single Molecules as Light Sources for Super-Resolution Imaging and Probes for Single Biomolecules in Solution,” 16th Future of Light Symposium, Boston University Photonics Center, Boston, Massachusetts, November 29, 2012.
365. “Recent Progress in Wide-Field 3D Super-Resolution Cellular Imaging Using Single Molecules,” Symposium on Understanding Cell Behavior Through Single Cell and Single Molecule Biology, University of New Mexico, Albuquerque, New Mexico, January 10-12, 2013.
366. “Recent Progress in 3D Super-Resolution Imaging in Cells Using Single Molecules,” Advanced Imaging Methods Workshop, University of California, Berkeley, California, January 30 – February 1, 2013.
367. “Biophysical Variables Which Are (Now) Available from Single-Molecule Optical Studies,” American Physical Society March Meeting, Industrial Physics Forum, Baltimore, Maryland, March 19, 2013.
368. “Exploring Protein Superstructures in Bacterial and Mammalian Cells using Single-Molecule Active-Control Microscopy,” Pittcon 2013 Conference, Philadelphia, Pennsylvania, March 21, 2013.
369. “Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics,” **Samuel Krimm Lecture** in Biophysics, University of Michigan, Ann Arbor, Michigan, April 5, 2013.
370. “Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics,” **Peter Debye Award Lecture**, American Chemical Society Annual Meeting, New Orleans, Louisiana, April 9, 2013.
371. “Lighting Up Nature with Single Molecules,” Department of Electrical Engineering Seminar, Washington University, St. Louis, Missouri, April 18, 2013.
372. “Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics,” **E. K. C. Lee Lecture**, Chemistry Department, University of California at Irvine, Irvine, California, May 30, 2013.
373. “Applications of Single-Molecule Fluorophores to Observe Cellular Structures and Processes on the Nanoscale,” American Association for the Advancement of Science Webinar, June 12, 2013.
374. “Actively-Controlled Single-Molecule Emitters Enable 3D Super-Resolution Imaging in Cells,” Plenary, International Conference on Photochemistry, Leuven, Belgium, July 24, 2013.
375. “Challenges and opportunities for 3D single-molecule localization microscopy in cells,” Cold Spring Harbor – Asia Conference on New Advances in Optical Imaging of Live

- Cells and Organisms, Suzhou Dushu Lake Conference Center, August 22, 2013.
376. "Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics," Molecular Foundry Seminar, Lawrence Berkeley National Laboratory, Berkeley, California, August 27, 2013.
 377. "Quantitative Aspects of 3D Super-Resolution Imaging in Cells," Frontiers in Single-Cell Analysis Conference, Stanford University, Stanford, California, September 5, 2013.
 378. "Recent Progress in 3D Super-Resolution Imaging in Cells Using Single Molecules (plus Observing Single-Molecule Photodynamics in Solution with the ABEL Trap)," Methods and Applications of Fluorescence 13, Genoa, Italy, September 10, 2013.
 379. "Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics," 2013 **Walter Kauzmann Lecture** in Biophysical Chemistry, Department of Chemistry, Princeton University, Princeton, New Jersey, September 25, 2013.
 380. "Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics," 2013 **John Gamble Kirkwood Award Lecture**, Department of Chemistry, Yale University, New Haven, Connecticut, September 27, 2013.
 381. "Photodynamics of Single Photosynthetic Antenna Proteins in Solution," 23rd Western Photosynthesis Conference, Asilomar Conference Center, Pacific Grove, California, January 2-5, 2014.
 382. "Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics," Russell Berrie Nanotechnology Institute – Technion – Israel Institute of Technology Winter School, HaGoshrim Hotel, Israel, February 9-13, 2014.
 383. "Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics," Chemistry Department Seminar, University of Santa Clara, February 28, 2014.
 384. "Single-Molecule Spectroscopy," Dreyfus Presidential Symposium on Chemical Instrumentation, American Chemical Society Spring National Meeting, Dallas, Texas, March 18, 2014.
 385. "Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics," Physical Chemistry Seminar, University of California, Berkeley, California, April 1, 2014.
 386. "Single-Molecule Spectroscopy and Imaging: 3D Nanoscopy and Biomolecular Dynamics," Biological Sciences Seminar, University of Southern California, Los Angeles, California, April 25, 2014.
 387. "James Skinner Turns 60, and the Theory of Single-Molecule Spectroscopy Turns 21," Skinner Symposium, University of Wisconsin, Madison, Wisconsin, May 20, 2014.
 388. "Dual Roles for Single Molecules: Light Sources for 3D Nanoscopy and Reporters of Multivariate Dynamics in Solution," Physics Colloquium, University of Leipzig, Germany, July 11, 2014.
 389. "Strategies for Precise and Accurate Single-Molecule Localizations for 3D Super-Resolution Microscopy," Gordon Research Conference on Single-Molecule Approaches to Biology," Renaissance Tuscany Il Ciocco Resort, Italy, July 13-19, 2014.

390. "3D Super-Resolution Imaging in Cells Using Single Molecules: Fluorophore Requirements and Applications," FB3 (Fluorescent Biomolecules & Building Blocks Design & Applications), University of California, San Diego, California, August 6-9, 2014.
391. "Multivariate Single-Molecule Dynamics in Solution by Suppression of Brownian Motion," Murray Goodman Award Symposium in honor of Steven G. Boxer, American Chemical Society National Meeting, San Francisco, California, August 13, 2014.
392. "Single-Molecule and High-Resolution Imaging of Developmental Signal Transducers in the Primary Cilium," with Lucien Weiss, Ljiljana Milenkovic, and Matthew Scott, BioX Interdisciplinary Initiatives Program Symposium, Stanford University, Palo Alto, California, August 27, 2014.
393. "Single Molecules as Nanoscale Light Sources for Super-Resolution Imaging and Probes for Biomolecular Dynamics in Solution," 20th International Anniversary Workshop on Single Molecule Spectroscopy and Ultra Sensitive Analysis in the Life Sciences, Berlin-Adlershof, Germany, September 2-5, 2014.
394. "Challenges and Opportunities for 3D Super-Resolution Imaging in Cells," National Cancer Institute Workshop on Multi-Scale Imaging for Cancer Biology, Houston Methodist Research Institute, Houston, Texas, September 18-19, 2014.
395. "Single Molecules as Nanoscale Light Sources for Super-Resolution Microscopy and Dynamical Reporters in Solution," Third International Workshop on Fundamentals of Light-Matter Interaction, Physics Department, UFPE, Recife, Brazil, October 5-8, 2014.
396. "Single-Molecule Detection and Spectroscopy: Foundations of Super-Resolution Microscopy," Frontiers in Optics/Laser Science Conference, OSA Annual Meeting, Tucson, Arizona, October 20, 2014.
397. "Dual Roles for Single Molecules: Light Sources for 3D Nanoscopy and Reporters of Multivariate Dynamics in Solution," Institute of Atomic and Molecular Science 2014 Symposium, Academia Sinica, Taipei, Taiwan, November 11, 2014.
398. "Single Molecules as Nanoscale Light Sources for Super-Resolution Microscopy and for Sensing Dynamics of Individual Biomolecules," Holland Research School of Molecular Chemistry, 20th Anniversary Lustrum Symposium, Amsterdam, The Netherlands, November 20, 2014.
399. "Pupil Plane Modulation for 3D and Orientational Imaging of Single Molecules," Special Seminar, SciLifeLab, Stockholm, Sweden, December 7, 2014.
400. "Single-Molecule Spectroscopy, Imaging, and Photocontrol: Foundations for Super-Resolution Microscopy," Nobel Prize in Chemistry Lecture, Aula Magna, Stockholm University, Stockholm, Sweden, December 8, 2014.
401. "Single Molecules and Super-Resolution Microscopy," High School Lecture, Tullinge Gymnasium, Tullinge, Sweden, December 9, 2014.
402. "Single Molecules and Super-Resolution Microscopy," High School Lecture, Kungsholmens Gymnasium/Stockholms Musikgymnasium, Stockholm, Sweden, December 12, 2014.
403. "Single-Molecule Spectroscopy, Imaging, and Photocontrol: Foundations for Super-

- Resolution Microscopy,” Nobel Lectures at Uppsala University, Uppsala, Sweden, December 13, 2014.
404. “Single-Molecule Spectroscopy, Imaging, and Photocontrol: Foundations for Super-Resolution Microscopy,” Nobel Lectures at Örebro University, Örebro, Sweden, December 15, 2014.
 405. “Single Molecules, Super-Resolution Microscopy, and Molecular Dynamics in Solution,” special Nobel Laureate Lecture, Chalmers University of Technology, Gothenburg, Sweden, December 16, 2014.
 406. “Single Molecules, Super-Resolution Microscopy, and Molecular Dynamics in Solution,” special Nobel Laureate Lecture, Lund University, Lund, Sweden, December 17, 2014.
 407. “The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” Special Nobel Seminar, National Institutes of Health, Bethesda, Maryland, February 5, 2015.
 408. “The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” Uniformed Services University Health Sciences, USUHS Seminar, Bethesda, Maryland, February 6, 2015.
 409. “Extracting Information from Single Molecules in 3D Super-resolution Imaging and from Dynamical Processes in Solution,” Keynote Lecture, SPIE Symposium on Single-Molecule Spectroscopy and Superresolution Imaging VIII, BiOS/Photonics West, San Francisco, California, February 8, 2015.
 410. “Single-Molecule Spectroscopy, Imaging, and Photocontrol: Foundations for Super-Resolution Microscopy,” Nobel Night Plenary Lecture, SPIE BioOS/Photonics West, San Francisco, California, February 8, 2015.
 411. “Single-Molecule Spectroscopy, Imaging, and Photocontrol: Foundations for Super-Resolution Microscopy,” Nobel Celebration Seminar, IBM Almaden Research Center, San Jose, California, February 11, 2015.
 412. “Single Molecules as Light Sources for Super-Resolution Imaging and Sensors of Nanoscale Transport Properties,” Plenary Lecture, 80th Annual Meeting of the Israel Chemical Society, Tel Aviv, Israel, February 18, 2015.
 413. “Single Molecules, Super-Resolution Microscopy, and Molecular Dynamics in Solution,” Weizmann Institute for Science, Rehovot, Israel, February 19, 2015.
 414. “Light and Single-Molecule Spectroscopy, Imaging, and Photocontrol: Foundations for Super-Resolution Microscopy,” Plenary Lecture, Kavli Foundation Special Symposium: Frontiers of Light, American Physical Society March Meeting, San Antonio, Texas, March 4, 2015.
 415. “Fun With Single Molecules - Tiny Nanoscale Points of Light Help Us See Inside Cells!,” Thomas Jefferson High School, San Antonio, Texas, March 6, 2015.
 416. “The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” George B. Kistiakowsky Prize Lecture, Department of Chemistry, Harvard University, Cambridge, Massachusetts, March 12, 2015.
 417. “The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution

- Nanoscopy in Cells and Beyond,” Biophysics Seminar, Massachusetts Institute of Technology, Cambridge, Massachusetts, March 13, 2015.
418. “Detecting Biomolecular Interactions and Photodynamics in Solution by Suppression of Brownian Motion,” ACS Spring National Meeting, Denver, Colorado, March 25, 2015. With Quan Wang, Gabriela Schlau-Cohen, and Hsiang-Yu Yang.
 419. “The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” Department of Chemistry and Biochemistry, University of California, Los Angeles, California, April 6, 2015.
 420. “Fun With Single Molecules - Tiny Nanoscale Points of Light Help Us See Inside Cells!,” Amador Valley High School, Pleasanton, California, April 8, 2015.
 421. “The Story of Light and Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” Keynote, Stanford University Photonics Retreat, Asilomar, California, April 10, 2015.
 422. “Pupil Plane Modulation to Extract Information from Single-Molecule Emitters for Super-Resolution Microscopy,” Plenary, Optical Society of America Biomedical Optics and Photonics Congress: Optics in the Life Sciences, Vancouver, British Columbia, April 13, 2015.
 423. “Single-Molecule Spectroscopy, Blinking, and Photocontrol: Foundations for Super-Resolution Microscopy,” Nobel Workshop and Molecular Frontiers Symposium, Chalmers University of Technology, Gothenburg, Sweden, May 6, 2015.
 424. “Light Paves the Way to Single-Molecule Detection and Photocontrol: Foundations of Super-Resolution Microscopy,” Plenary, Conference on Lasers and Electro-Optics CLEO 2015, San Jose, California, May 11, 2015.
 425. “The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” Paul C. Cross Lecture, Department of Chemistry, University of Washington, Seattle, Washington, May 20, 2015.
 426. “FM Radio at 560 THz Enables Single-Molecule Detection and Spectroscopy, Paving the Way to the Nobel Prize,” Special Lecture, Stanford Amateur Radio Club W6YX, Stanford, California, June 2, 2015.
 427. “Light Paves the Way to Single-Molecule Detection and Photocontrol, Foundations of Super-Resolution Microscopy,” IEEE-SCV Photonics Society, Intel Corporation, Santa Clara, California, June 4, 2015.
 428. “Light Paves the Way to Single-Molecule Detection and Photocontrol, Foundations of Super-Resolution Microscopy,” Plenary, Optical Society of America Imaging and Applied Optics Congress, Arlington, Virginia, June 10, 2015.
 429. “Studying Biomolecules with Super-Resolution Fluorescence Microscopy,” American Chemical Society Northeastern Section Meeting, Nova Biomedical, Waltham, Massachusetts, June 11, 2015.
 430. “The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” UC Systemwide Bioengineering Symposium, University of California, Santa Cruz, California, June 22, 2015.

431. "Fun with Light and Single Molecules: Nanoscale Points of Light and Photocontrol Enable Super-Resolution Microscopy," 65th Lindau Nobel Laureate Meeting with Young Scientists, Lindau Island, Germany, July 2, 2015.
432. "Fun with Light and Single Molecules Opens Up an Amazing New View Inside Cells," Guest Speaker, Hollyhock Fellows Program, Stanford University, Stanford, California, July 15, 2015.
433. "Light Paves the Way to Single-Molecule Detection and Photocontrol, Foundations of Super-Resolution Microscopy," Optical Society Nonlinear Optics (NLO) Topical Meeting, Keynote Address, Kauai, Hawaii, July 29, 2015.
434. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," 12th International Conference on Hole Burning, Single Molecule, and Related Spectroscopies: Science and Applications, Tartu, Estonia, August 24, 2015.
435. "Light Paves the Way to Single-Molecule Detection and Photocontrol, Foundations of Super-Resolution Microscopy," Plenary Lecture, Mexican Optics and Photonics Meeting, Leon, Guanajuato, Mexico, September 9, 2015.
436. "The Road to A New World of Super-Resolution Microscopy in Cells and Beyond," Presidential Distinguished Lecture, University of Texas at San Antonio, San Antonio, Texas, September 11, 2015.
437. "The Road to A New World of Super-Resolution Microscopy in Cells and Beyond," Presidential Distinguished Lecture, University of Texas Health Science Center at San Antonio, San Antonio, Texas, September 11, 2015.
438. "Single-Molecule Spectroscopy and Imaging Over the Decades," Introductory Lecture, Faraday Discussion on Single-Molecule Microscopy and Spectroscopy, Royal Society of Chemistry, London, England, September 14, 2015.
439. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Dutch Biophysics Conference, Veldhoven, The Netherlands, September 28, 2015.
440. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," The University of Amsterdam Science Park, Amsterdam, The Netherlands, September 30, 2015.
441. "My Life in Science and the Path to the Nobel Prize," Chemistry Tour, University of Amsterdam Science Park, Amsterdam, The Netherlands, September 30, 2015.
442. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," 2015 International Institute for Nanotechnology Symposium, Northwestern University, Evanston, Illinois, October 1, 2015.
443. "Seeing Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Microscopy in Cells and Beyond," Seeing is Believing Symposium, European Molecular Biology Organization EMBO, European Molecular Biology Laboratory, Heidelberg, Germany, October 7, 2015.
444. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," University Seminar, University of Bayreuth, Bayreuth,

Germany, October 9, 2015.

445. "Light and Single Molecules Open a New Window into Super-Resolution Imaging in Cells," plenary lecture, 2nd Mediterranean Workshop of Young Researchers (French Chemical Society), Montpellier, France, October 12, 2015.
446. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," University of Marseilles, France, October 13, 2015.
447. "Light and Single Molecules – Tiny Nanoscale Beacons Help Us See Inside Cells Like Never Before," Lumière, Lumières, College de France, Paris, France, October 16, 2015.
448. "Super-resolution optical microscopy of mutant Huntingtin aggregates and fibrils," NINDS Satellite Symposium "How Can Understanding Protein Structure Help Us Unravel the Mysteries of Neurodegenerative Diseases?" Society for Neuroscience, Chicago, Illinois, October 18, 2015.
449. "Light and Single Molecules – My Path to the Nobel Prize," Frontiers in Optics, Division of Laser Science Banquet, San Jose, California, October 20, 2015.
450. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," American Chemical Society Santa Clara Valley Section Monthly Meeting, Mountain View, California, October 27, 2015.
451. "Fun with Light and Single Molecules Opens Up an Amazing New View Inside Cells," Samuel I. Weissman Memorial Public Lecture, Department of Chemistry, Washington University, St. Louis, Missouri, November 5, 2015.
452. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Samuel I. Weissman Memorial Scientific Lecture, Department of Chemistry, Washington University, St. Louis, Missouri, November 6, 2015.
453. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Microscopy, to 3D Dynamics in Cells and Beyond," Epibiome/JLABS Seminar, Johnson and Johnson Labs, South San Francisco, November 11, 2015.
454. "The story of single molecules, from early spectroscopy in solids, to super-resolution microscopy, to 3D dynamics of biomolecules in cells," Sir Ernst Chain Lecture, Imperial College of London, London, England, November 16, 2015.
455. "Fun with Light and Single Molecules Opens Up an Amazing New View Inside Cells," 50th Anniversary Celebration of Faculty of Science, University of Chile, Santiago, Chile, December 9, 2015.
456. "The story of single molecules, from early spectroscopy in solids, to super-resolution microscopy, to 3D dynamics of biomolecules in cells," American Society of Cell Biology Annual Meeting, San Diego, California, December 13, 2015.
457. "The story of single molecules, from early spectroscopy in solids, to super-resolution nanoscopy in cells and beyond," Pacificchem 2015 Symposium on Single-Molecule Fluorescence Imaging (#208), Honolulu, Hawaii, December 16, 2015.
458. "Super-Resolution Imaging in Cells Using Single Molecules Places New Requirements on Fluorophore Labels," Pacificchem 2015 Symposium on Molecular Probes and

- Fluorophores for Biological Imaging (#280), Honolulu, Hawaii, December 17, 2015.
459. "Quantitating Position and Orientation of Single-Molecule Emitters in Localization and Super-Resolution Microscopy," Keynote Lecture, Conference on Quantitative Biological Imaging 2016, Delft, The Netherlands, January 13, 2016.
 460. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Microscopy in Cells and Beyond," Joint Chemistry and Physics Colloquium, Johannes Gutenberg University and the Max Planck Institute for Polymerforschung, Mainz, Germany, January 18, 2016.
 461. "Thoughts from a Nobel Laureate," Basic Industries and Rethinking the State of the World with Nobel Laureates, World Economic Forum Annual Meeting, Davos, Switzerland, January 22, 2016.
 462. "A Journey of Discovery with W. E. Moerner," World Economic Forum Annual Meeting Interview by Joe Palca, Davos, Switzerland, January 22, 2016.
 463. "Single-Molecule Imaging and Super-Resolution Microscopy Provide an Unprecedented View of Structures, Dynamics, and Protein Aggregates in Cells," University of Texas MD Anderson Cancer Center Distinguished Speaker Seminar and NIH Nanomedicine Symposium Public Lecture, Houston, Texas, January 28, 2016.
 464. "Fun With Single Molecules - Tiny Nanoscale Points of Light Help Us See Inside Cells!," Blach Middle School, Los Altos, California, February 1, 2016.
 465. "Single-Molecule Nanoemitters, Blinking, and Photocontrol as Foundations for Super-Resolution Microscopy," International Conference on Nanoscience and Nanotechnology, ICONN 2016 Plenary, Canberra, Australia, February 8, 2016.
 466. "The story of single molecules, from early spectroscopy in solids, to super-resolution nanoscopy in cells and beyond," Director's Distinguished Lecture, Research School of Physics and Engineering, Australia National University, Canberra, Australia, February 9, 2016.
 467. "My Route to the Nobel Prize: Fun with Light and Single Molecules Leads to an Amazing New View Inside Cells!," University of New South Wales, Canberra, Australia, February 9, 2016.
 468. "The story of single molecules, from early spectroscopy in solids, to super-resolution nanoscopy in cells and beyond," Australian Research Council Centre of Excellence in Advanced Molecular Imaging, Monash University, Melbourne, Australia, February 11, 2016.
 469. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Microscopy, Opening Up an Amazing New Nanoscale View Inside Cells," Paul D. Gottlieb Lecture, Institute of Cellular and Molecular Biology, The University of Texas at Austin, February 22, 2016.
 470. "Seeing single molecules, from early spectroscopy in solids, to super-resolution microscopy, to 3D dynamics of biomolecules in (and outside) cells," Nanoscale Subgroup, Biophysical Society Meeting, Los Angeles, California, February 27, 2016.
 471. "How Optical Single-Molecule Detection in Solids Led to Super-Resolution Nanoscopy in Cells and Beyond," Wallace H. Coulter Lecture, Pittcon 2016 Conference, Atlanta,

Georgia, March 6, 2016.

472. "The Story of Photonics and Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Keynote Lecture for Photonics Pioneer Award, 2016 Symposium on Frontiers in Photonics Science and Technology, Fitzpatrick Institute for Photonics, Duke University, Raleigh, North Carolina, March 14, 2016.
473. "The story of single molecules, from early spectroscopy in solids, to super-resolution microscopy, which opens up an amazing new view inside cells (and beyond)," Provost Lecture, Temple University, Philadelphia, Pennsylvania, March 16, 2016.
474. "Single Molecules as Nanoscale Probes in Biology and Nanophotonics," Molecular Foundry 10th Anniversary Symposium, Lawrence Berkeley National Laboratory, Berkeley, California, March 24, 2016.
475. "Fun With Single Molecules - Tiny Nanoscale Points of Light Help Us See Inside Cells!," Fred J. Robbins Public Lecture to high school students from 17 schools, Department of Chemistry, Pomona College, Claremont, California, March 28, 2016.
476. "The Story of Single Molecules, from Early Spectroscopy in Solids, to 3D Super-Resolution Microscopy with Its Promise and Challenges," Fred J. Robbins Lecture 2, Department of Chemistry, Pomona College, Claremont, California, March 29, 2016.
477. "Single-molecule approaches to cell biology based on imaging and tracking," Fred J. Robbins Lecture 3, Department of Chemistry, Pomona College, Claremont, California, March 30, 2016.
478. "Multivariate photodynamics of individual molecules in solution with the ABEL trap," Fred J. Robbins Lecture 4, Department of Chemistry, Pomona College, Claremont, California, March 31, 2016.
479. "Fun with Light and Single Molecules Started 27 Years Ago Opens Up an Amazing New View Inside Cells (and beyond)," 75th Anniversary of The Institute of Chemistry, UNAM, Mexico City, Mexico, April 5, 2016.
480. "My Route to the Nobel Prize: Fun with Light and Single Molecules Leads to an Amazing New View Inside Cells!," UNAM Preparatory School ENP 6, Mexico City, Mexico, April 6, 2016.
481. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Microscopy, Which Opens Up an Amazing New View Inside Cells," Nobel Lecture in Materials Science and Engineering, Georgia Institute of Technology, Atlanta, Georgia, April 11, 2016.
482. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Microscopy, Which Opens Up an Amazing New View Inside Cells," Hightower Lecture, Department of Physics, Emory University, Atlanta, Georgia, April 12, 2016.
483. "The Story of Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Microscopy Inside Cells, to Single Biomolecule Dynamics," Andreas C. Albrecht Lecture, Department of Chemistry and Chemical Biology, Cornell University, Ithaca, New York, April 14, 2016.
484. "The Story of Single Molecules: How Precise High-Resolution Spectroscopy at Low

- Temperatures Led to Super-Resolution Microscopy and Beyond,” Hong Kong University of Science and Technology, 25th Anniversary Distinguished Speaker, Hong Kong, May 16, 2016.
485. “The Story of Single Molecules: From Early Days, to Super-Resolution, to 3D Dynamics in Cells,” Korean Society for Biochemistry and Molecular Biology International Conference 2016, Seoul, Korea, May 18, 2016.
 486. “The Story of Single Molecules: How Precise High-Resolution Spectroscopy at Low Temperatures Led to Super-resolution Microscopy and Beyond,” Center for Molecular Spectroscopy and Dynamics, Institute of Basic Science, Korea University, Seoul, Korea, May 19, 2016.
 487. “The Story of Single Molecules: How Precise High-Resolution Spectroscopy at Low Temperatures Led to Super-Resolution Microscopy and Beyond,” Department of Chemistry, Seoul National University, Seoul, Korea, May 20, 2016.
 488. “Seeing Single Molecules: From Early Spectroscopy in Solids to Super-Resolution Microscopy, to 3D Dynamics of Biomolecules in Cells,” 2016 World Congress on In Vitro Biology, San Diego, California, June 12, 2016.
 489. “The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells,” FASEB Symposium on the Molecular Biophysics of Membranes, Snowmass, Colorado, July 10, 2016.
 490. “The story of single molecules and the surprises leading to super-resolution microscopy and beyond,” Symposium in Memory of Richard Keller, American Chemical Society National Meeting, Philadelphia, Pennsylvania, August 22, 2016.
 491. “The story of single molecules and the surprises leading to super-resolution microscopy and beyond,” 31st William S. Johnson Symposium, Department of Chemistry, Stanford University, October 14, 2016.
 492. “How My Life Has Changed Since I Became a Nobel Laureate,” DOE-BES Physical Biosciences PI Meeting, Gaithersburg, Maryland, October 17, 2016.
 493. “Single Molecules as Nanoscale Light Sources for Imaging and as Sentinels for 3D Dynamics,” Frontiers of Imaging, 60th Welch Foundation Conference on Chemical Research, Houston, Texas, October 24, 2016.
 494. “What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells, Imaging Science Seminar, Texas A&M University, College Station, Texas, October 26, 2016.
 495. “The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution,” University Aix-Marseilles Medical Campus, Marseilles, France, November 9, 2016.
 496. “What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells,” Spotlight Lecture, Shaastra – Indian Institute of Technology Madras, Chennai, India, January 2, 2017.
 497. “Science and Single Molecules: How Industrial Basic Research at Low Temperatures 30 Years Ago Led to Super-Resolution Microscopy and Beyond,” Distinguished Invited Lecture, Indian Science Congress, Tirupati, India, January 3, 2017.

498. "What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells," Sree Vidyanikethan Engineering College, Tirupati, India, January 4, 2017.
499. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution," Biophysics Seminar, Indian Institute of Science, Bangalore, India, January 5, 2017.
500. "What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells," Morris Travers Memorial Lecture, Indian Institute of Science, Bangalore, India, January 5, 2017.
501. "What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells," Indian Institute of Technology - Delhi, Delhi, India, January 12, 2017.
502. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution," Student-hosted Johns Hopkins University Biophysics Seminar, Baltimore, Maryland, February 8, 2017.
503. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution," Chemistry Department Seminar, Columbia University, New York, New York, February 9, 2017.
504. "The Story of Photonics and Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Munushian Lecture, Ming Hsieh Department of Electrical Engineering, USC Viterbi School of Engineering, February 17, 2017.
505. "What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells," ACS-Young Chemists Committee Evening Seminar, San Francisco, California, February 21, 2017.
506. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution," Physics Department, Bar-Ilan University, Tel Aviv, Israel, February 26, 2017.
507. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells," Plenary, The 6th OASIS International Conference and Exhibition on Optics and Electro-Optics, Tel Aviv, Israel, February 27, 2017.
508. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells," Technion Photonics Symposium, The Technion University, Haifa, Israel, March 2, 2017.
509. "What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells," 38th Nobel Laureate Lecture Series General Lecture, California State University, Long Beach, California, March 20, 2017.
510. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells," 38th Nobel Laureate Lecture Series Technical Lecture, California State University, Long Beach, California, March 20, 2017.
511. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule

- Tracking in Cells,” University Lecture, University of Texas Southwestern School of Biomedical Science, Dallas, Texas, March 22, 2017.
512. “What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells,” Qizhen Global Vision Lecture, Zhejiang University, Hangzhou, China, March 27, 2017.
513. “What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells,” Heaven and Earth Distinguished Lecture, Nanjing University, Nanjing, China, March 29, 2017.
514. “The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution,” LIFENERGY Distinguished Professorship and Lecture, Nanjing University, Nanjing, China, March 30, 2017.
515. “The story of single-molecule detection and spectroscopy, and the surprises leading to super-resolution microscopy and beyond,” Symposium on Contributions from the IBM Almaden Research Center, American Chemical Society National Meeting, San Francisco, California, April 3, 2017.
516. “What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells,” Plenary Lecture, Chemistry Honors Week, Kent State University, April 13, 2017.
517. “Super-Resolution Microscopy to Study Molecules Within Cells,” Keynote Lecture, Cancer Metastasis in the Lymphatic System, San Francisco, California, April 20, 2017.
518. “My Route to the Nobel Prize: Fun with Light and Single Molecules Leads to an Amazing New View Inside Cells,” Keynote Lecture, California State Science Fair 2017, California Science Center, Los Angeles, California, April 24, 2017.
519. “The Story of Photonics and Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond, Colloquium Lecture, National Institute of Standards and Technology, Gaithersburg, Maryland (presented remotely), May 2, 2017.
520. “The Story of Photonics and Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond, Optical Sciences and Engineering Lunch Seminar, University of New Mexico, Albuquerque, New Mexico, May 11, 2017.
521. “What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells,” Physics/Astronomy Colloquium, University of New Mexico, Albuquerque, New Mexico, May 11, 2017.
522. “The Story of Photonics and Single Molecules, from Early Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” Photonics North 2017 Plenary Lecture, Ottawa, Canada, June 7, 2017.
523. “What Can You Learn from Watching Single Molecules? Nanoscale Points of Light and Photocontrol Enable Super-Resolution Microscopy,” Lindau Meeting of Young Scientists and Nobel Laureates, Lindau, Germany, June 27, 2017.
524. “What Can We Learn from Single-Molecule Imaging and Trapping? From Super-Resolution Microscopy to Multivariate Photodynamics of Individual Pigment-Protein Complexes in Solution,” Gordon Research Conference on Photosynthesis, Sunday River Grand Summit Hotel, Newry, Maine, July 15-21, 2017.

525. "The Story of Photonics and Single Molecules, and the Challenges and Promises of Super-Resolution Microscopy and Dynamical Tracking in Biological Imaging," CLEO-Pacific Rim, Singapore, 1-4 August 2017.
526. "Super-Resolution Microscopy to Study Normal and Diseased Cells," (with Colin Comerci), California Pacific Medical Center Research Institute Seminar, California Pacific Medical Center-Research Institute, San Francisco, California, 22 August 2017.
527. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution," Max Planck Institute for Biochemistry Martinsried Distinguished Visitor Lecture, Martinsried, Germany, 8 September 2017.
528. "Light and Single Molecules Open a New Window Into the Nanoscale and Biomolecular Dynamics," Angewandte Chemie Symposium for GDCh 150th Anniversary Congress, Berlin, Germany, 11 September 2017.
529. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution," Plenary Lecture, Methods and Applications of Fluorescence 2017, Bruges, Belgium, 12 September 2017.
530. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution," 23rd Picoquant Workshop on Single-Molecule Spectroscopy, Berlin-Adlershof, Germany, 14 September 2017.
531. "The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution," 20 Years of Nano-Optics, MPI Science of Light Erlangen, Germany, 18 September 2017.
532. "The Promise and Challenges of 3D Super-Resolution Microscopy, Single-Molecule Tracking in Cells, and Trapping of Biomolecules in Solution," University of Ulm Physics Seminar, Ulm, Germany, 6 November 2017.
533. "What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells," Ulm University 50 Year Anniversary Public Lecture, Ulm, Germany, 6 November 2017.
534. "Breaking the Wall of the Nanoscale," Falling Walls Conference, Berlin, Germany, 9 November 2017.
535. "What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells," Berlin Science Week, Humboldt University, Berlin-Adlershof, Germany, 10 November 2017.
536. "The Story of Photonics and Single Molecules, and the Challenges and Promises of Super-Resolution Microscopy and Dynamical Tracking in Biological Imaging", SPIE Fellows Lunch Keynote, San Francisco, California, January 29, 2018.
537. "The Promise and Challenges of 3D Super-Resolution Microscopy, Single-Molecule Tracking in Cells, and Trapping of Biomolecules in Solution," Physical Chemistry Seminar, Colorado State University, Fort Collins, Colorado, January 31, 2018.
538. "The Promise and Challenges of 3D Super-Resolution Microscopy, Single-Molecule Tracking in Cells, and Trapping of Biomolecules in Solution," E. U. Condon Lecture, University of Colorado, Boulder, Colorado, February 2, 2018.

539. "Single-Molecule and Super-Resolution Approaches to Biophysics," Kamal Shukla Memorial Symposium, Biophysical Society Annual Meeting, San Francisco, California, February 16, 2018.
540. "The Promise and Challenges of 3D Super-Resolution Microscopy, Single-Molecule Tracking in Cells, and Trapping of Biomolecules in Solution," ICON Europe 2018, Bielefeld, Germany, February 27, 2018.
541. "The Promise and Challenges of 3D Super-Resolution Optical Microscopy and Single-Molecule Tracking in Cells as Probes of Structure and Dynamics," DOE-BER Bioimaging Science PI Meeting, Tysons Corner, Virginia, March 1, 2018.
542. "Fun With Single Molecules - Tiny Nanoscale Points of Light Help Us See Inside Cells!," Georgina P. Blach Middle School, Los Altos, California March 13, 2018.
543. "What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells," Nelson Lecture, Department of Chemistry, University of Miami, Coral Gables, Florida, March 21, 2018.
544. "What Can You Learn from Watching Single Molecules? From Super-Resolution Imaging to Nanoscale Probes of 3D Dynamics in Cells," Public Lecture, Department of Physics, University of South Carolina, Columbia, South Carolina, March 23, 2018.
545. "The Promise and Challenges of 3D Super-Resolution Microscopy, Single-Molecule Tracking in Cells, and Trapping of Biomolecules in Solution," S. Town Stephenson Lecture, Physics and Astronomy Department, Washington State University, Pullman, Washington, April 3, 2018.
546. "The Story of Photonics and Single Molecules: From Early FM Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Physics Colloquium, Montana State University, Bozeman, Montana, April 5, 2018.
547. "Single Molecules for 3D Super-Resolution Imaging and Single-Particle Tracking in Cells: Methods and Applications," Yale Biophysics Training Grant Invited Speaker, Yale University, New Haven, Connecticut, April 11, 2018.
548. "The Story of Photonics and Single Molecules: From Early FM Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Hermann Anton Haus Lecture, Massachusetts Institute of Technology, Cambridge, Massachusetts, April 12, 2018.
549. "The Story of Photonics and Single Molecules: What Can we Learn About Structure and Dynamics in Complex Biological Systems?," Inaugural Harden M. McConnell Lecture, California Institute of Technology, Pasadena, California, April 24, 2018.
550. "What Can We Learn from Watching Single Molecules? The Promise and Challenges of Super Resolution Microscopy," Seminar for Leiden University Study Group, Stanford University, May 7, 2018.
551. "Nanophotonics Based on Individual Molecules and Light Gives Rise to 3D Super-Resolution Imaging and Beyond," 11th International Conference on Nanophotonics-2018 plenary, Wroclaw, Poland, 2 July 2018.
552. "Selected New Directions with Single Molecules: Methods and Biological Insights," Gordon Research Conference on Single-Molecule Approaches to Biology, Mt. Snow, Vermont, July 15-19, 2018.

553. "Single-Molecule Nanoscience in Cells Through (Chemistry, of course,) Optics and Imaging," ACS Publications Symposium, Innovations in Materials Science, ShanghaiTech University, Shanghai, China, July 29, 2018
554. "The Story of Single Molecules: From Early Spectroscopy in Solids, to Super-Resolution Microscopy Inside Cells, to Single Biomolecule Dynamics," Jin Si Lecture, Department of Chemistry, Fudan University, Shanghai, China, August 1, 2018.
555. "Single-Molecule Approaches to Cell Biology Based on (3D) Imaging and Tracking," Special Seminar, Institute of Biomedical Sciences, Fudan University Medical School, Shanghai, China, August 2, 2018.
556. "Brief Thoughts on Hole-Burning and Single Molecules Over the Years," 13th International Conference on Hole Burning, Single Molecule, and Related Spectroscopies HBSM 2018, Suzdal, Russia, August 6, 2018.
557. "Single Molecules Across the Decades, from Low Temperature, to 3D Imaging and Tracking in Cells, to Solution Photodynamics," 13th International Conference on Hole Burning, Single Molecule, and Related Spectroscopies HBSM 2018, Moscow State Pedagogical University, Moscow, Russia, August 11, 2018.
558. "Probes and methods for single-molecule tracking and super-resolution microscopy," ProbeFest 2018, HHMI Janelia Research Campus, Ashburn, Virginia, October 14-17, 2018.
559. "Single Molecules as Light Beacons for the Nanoscale," World Laureates Association Forum 2018, Crowne Plaza Shanghai Harbor City, Dishui Lake, Shanghai, China, October 29-31, 2018.
560. "The Story of Photonics and Single Molecules: From Early FM Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Taiwan Physical Society Plenary Lecture, Hsinchu, Taiwan, January 25, 2019.
561. "The Story of Photonics and Single Molecules, from Early FM Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Institute of Atomic and Molecular Sciences (IAMS) Symposium, Academia Sinica, Taipei, Taiwan, January 28, 2019.
562. "Single Molecules for Dynamics and Super-Resolution Microscopy," Chemistry Department Faculty Lunch Seminar, Stanford University, Stanford, California, January 31, 2019.
563. "Single-Molecule Tools for Super-Resolution Imaging and Biomolecular Dynamics in Cells," Regenerative Medicine Seminar, Stanford University, Stanford, California, February 14, 2019.
564. "Providing 3D for Super-Resolution Microscopy and Single-Particle Tracking in Cells with Single Molecules," Biophysical Society Annual Meeting, Baltimore, Maryland, March 5, 2019.
565. "What is a Single Molecule, and What Can You Do With It?" Telluride Town Talk, Telluride Science Research Center, Telluride, Colorado, June 25, 2019.
566. "Single-Molecule Dynamics and Super-Resolution Microscopy," Symposium on Emerging Methods in Single-Molecule Spectroscopy, Telluride Science Research Center, Telluride, Colorado, June 27, 2019.

567. "What Can You Learn From Single Molecules, Even When Trapped Without Optical Forces?" Lindau Nobel Laureate Meeting with Young Scientists LINO19, Lindau, Germany, July 1, 2019.
568. "Nanophotonics Based on Individual Molecules and Light Gives Rise to 3D Super-Resolution Imaging in Cells and Biomolecular Insights," plenary lecture, SPIE Conference on Optics and Photonics/Organic Photonics+Electronics, Molecular and Nanomachines II, San Diego, California, August 13, 2019.
569. "Trapping Single Molecules in Solution Without Optical Forces," SPIE Conference on Optics and Photonics/Nanoscience+Engineering, Optical Trapping and Optical Micromanipulation XVI, San Diego, California, August 14, 2019.
570. "Roger Tsien and Blinking Fluorescent Proteins in the mid-1990s, Plus What's New?," Roger Tsien Memorial Conference, Methods and Applications in Fluorescence 2019, UCSD La Jolla, California, August 24, 2019.
571. "Thirty Years of Single Molecules, from Early Low Temperatures to 3D Super-Resolution Nanoscopy and Tracking/Trapping: What's Next?" Keynote, 25th International Anniversary Workshop on "Single Molecule Spectroscopy and Super-resolution Microscopy in the Life Sciences," Berlin-Adlershof, Germany, September 5, 2019.
572. "The Story of Single Molecules, from Early High-Resolution Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Plenary, XXI Mendeleev Congress on General and Applied Chemistry, 150th Anniversary of the Periodic Table, St. Petersburg, Russia, 9 September 2019.
573. "What is a Single Molecule, and What Can you Do With It?" J. T. Donald Public Lecture, McGill University, Montreal, Quebec, Canada, 23 September 2019.
574. "Providing 3D for Super-Resolution Microscopy and Single-Particle Tracking in Cells with Single Molecules: After 30 Years, What's Next?" J. T. Donald Science Lecture, McGill University, Montreal, Quebec, Canada, 24 September 2019.
575. "Providing 3D for Super-Resolution Microscopy and Single-Particle Tracking in Cells with Single Molecules: After 30 Years, What's Next?" Molecular Medicine Seminar, The Scripps Research Center, La Jolla, CA, 25 September 2019.
576. "Developments in 3D Super-Resolution Microscopy and Single-Particle Tracking in Cells with Single Molecules," Bridging Excellence Lecture, EMBL-SU Alliance, EMBL-Heidelberg, Germany, 7 October 2019.
577. "Selected Recent Advances in 3D Super-Resolution and Cryo-CLEM in Cells," Seeing is Believing-Imaging the Molecular Processes of Life, EMBL-EMBO Symposium, Heidelberg, Germany, 11 October 2019.
578. "What Is a Single Molecule, and What Can You Do With It?" HUST Masters Talk, Huazhong University of Science and Technology, Wuhan, China, 11 November 2019.
579. "Providing 3D for Super-Resolution Microscopy and Single-Particle Tracking in Cells with Single Molecules," Plenary Lecture, International Photonics and Optoelectronics Meeting, POEM 2019, Wuhan, China, 12 November 2019.
580. "Nanophotonics Based on Individual Molecules and Light Gives Rise to 3D Super-Resolution Imaging in Cells and Biomolecular Insights," Plenary Lecture, OVC-EXPO,

Optics Valley, Wuhan, China, 13 November 2019.

581. "Providing 3D for Super-Resolution Microscopy and Single-Particle Tracking in Cells with Single Molecules," Physical Chemistry Student Select Lecture, University of Illinois, Urbana-Champaign, Illinois, 4 December 2019.
582. "Single Molecules and 3D Super-Resolution, 3D Tracking, and Cryo-CLEM in Cells," Keynote Lecture, Microscopy Society of Ireland, Dublin, Ireland, 9 January 2020.
583. "Fun With Single Molecules - Tiny Nanoscale Points of Light Help Us See Inside Cells!" Casa Di Mir Montessori School, Campbell, California, 22 January 2020.
584. "Fun With Single Molecules - Tiny Nanoscale Points of Light Help Us See Inside Cells!" Chemistry 91 presentation to undergraduates interested in Chemistry, Stanford University, Stanford, California, 29 January 2020.
585. "Single-Molecule Imaging: A Window into the Biological Nanoscale from 3D Super-Resolution Microscopy and Neural Nets," Plenary Lecture with Leonhard M \ddot{o} ckl, IBM Symposium on AI for Biomedical Imaging Across Scales, IBM Almaden Research Center, San Jose, California, 4 February 2020.
586. "Single Molecules and 3D Super-Resolution, 3D Tracking, and Cryo-CLEM in Cells," Purdue College of Engineering Distinguished Lecture, Purdue University, West Lafayette, Indiana, 26 February 2020.
587. "Fun with Single Molecules – My Life in Science with a Bit of Early Scouting Days," Virtual Meeting of the Moecomdws District Eagle Scout Group, Great Trails Council, Scouts BSA, Ohio, 25 June 2020.
588. "New developments in single-molecule super-resolution imaging (and tracking)," American Chemical Society Fall Meeting Virtual Symposium on Single-Molecule Microscopy, 18-20 August, 2020.
589. "The Story of Light and Single Molecules: From Early FM Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Oliver Smithies Nobel Symposium Lecture, School of Medicine, University of North Carolina, Raleigh-Durham, North Carolina, 11 September 2020 (remote).
590. "What is a Single Molecule, and What Can You Do With It?" XV All-Russian Science Festival NAUKA 0+, Russia, Public Plenary Lecture, 11 October 2020.
591. "The Story of Light and Single Molecules: From Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," World Laureates Forum 3, Shanghai, China and Virtual (online), October 30-November 1, 2020.
592. "The Story of Light and Single Molecules: From Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Plenary Lecture, Global Young Scientists Summit GYSS 2021, 13 January 2020 (online).
593. "The Story of Light and Single Molecules: From Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond," Keynote Lecture, Advanced Imaging Methods Workshop AIM-2021, 10 February 2021 (online).
594. "What is a Single Molecule, and What Can You Do with It?" Imperial College London ChemSoc public lecture (remote), 17 February 2021.

595. “Single-Molecule Strategies for 3D Super-Resolution Imaging in Cells,” Stanford Bio-X Imaging Workshop Lecture (remote), 28 February 2021.
596. “Single-Molecule Super-Resolution in 2D and 3D to Uncover Hidden Detail in Coronavirus Infection and in Cryo-ET Imaging,” NIGMS Webinar/Videocast (remote), 18 May 2021. Part of the Division of Biophysics, Biomedical Technology, and Computational Biosciences (BBCB) seminar series on advanced biological imaging, also posted with an alternate subtitle: “Hidden Molecules in the *Caulobacter* Bacterium, Coronavirus, and Cells,” highlighted in the NIGMS Feedback Loop blog: <https://loop.nigms.nih.gov/2021/04/nobel-laureate-w-e-moerner-seminar-on-hidden-molecules-in-caulobacter-bacterium-coronavirus-and-cells/>
597. “Single-Molecule Localization Microscopy Unites the Power of Fluorescence and Cryo-Electron Tomography Imaging,” Lindau 70th Anniversary Agora session on New Methods for Biological Imaging (online), 1 July 2021.
598. “New Developments in Single-Molecule Super-Resolution Imaging,” Second Symposium in Memory of Maxime Dahan (online), Institut Curie, Paris, France, 6 December 2021.
599. “The Story of Light and Single Molecules: From Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” Lecture, 13th HOPE Meeting with Nobel Laureates organized by the Japan Society for the Promotion of Science (online) 8 March 2022.
600. “NanoBioScience with Stanford Shared Facilities: Combining Cryo-ET and Super-Resolution Microscopy,” Stanford Shared Facilities Summit (online), 17 March 2022.
601. “The Story of Light and Single Molecules: From Spectroscopy in Solids, to Super-Resolution Nanoscopy in Cells and Beyond,” EE235B class guest lecture, 25 April 2022 (online).
602. “Recent Advances in Correlative Microscopy and Super-Resolution Imaging of Coronavirus Infection,” First European Molecular Biology Laboratory (EMBL) Imaging Centre Symposium, 31 May 2022 (online).
603. “What is a Single Molecule, and What Can You Do With It To See the Nanoscale??” Special Lecture in Series "Lectures of the Future" from the UNESCO Center, Junior Academy of Sciences of Ukraine, 3 June 2022 (online).
604. “What Can Single Molecules Tell Us about Coronavirus RNA and Cryo-Electron Tomography?,” Lindau 71st meeting of Nobel Laureates and Young Scientists, Lindau, Germany, 28 June 2022.
605. “Recent Progress in Super-Resolution Microscopy: Neural Net Background Estimation for 3D, Annotation of Hidden Proteins in Cryo-Electron Tomograms, and Imaging RNA Players in Coronavirus Infection,” BioEng2022 Bioengineering Solutions for Biology and Medicine, Helmholtz Munich, Munich Germany, 4 July 2022.
606. “New Developments in Single-Molecule Super-Resolution Imaging and Tracking/Trapping, Plus Connections to Cryo-Electron Tomography,” Distinguished Lecture, Max-Planck-Institute for the Science of Light, Erlangen, Germany, 7 July 2022.
607. “What Can What Can You Learn with Single Molecules and Light?” Curious 2022 Future Insight Conference, Darmstadt, Germany, 13 July 2022 (remote).

608. “Something Old, Something New: Single Molecules, from the Early Days, to Galaxies of Coronavirus RNA and Annotations of Cryo-Electron Micrograms,” Plenary Lecture, Conference on Hole-Burning, Single Molecule, and Related Spectroscopies HBSM 2022, Bayreuth, Germany, 31 August 2022 (remote).
609. “The Story of Light and Single Molecules: From Spectroscopy in Solids, to Bowtie Nanoantennas, to Super-Resolution Nanoscopy in Cells and Beyond,” Plenary Lecture, Metamaterials 2022, The 16th International Congress on Artificial Materials for Novel Wave Phenomena, Siena, Italy, 12-17 September 2022 (remote).
610. “What Can What Can You Learn with Single Molecules and Light? Beyond Ensemble Averaging, Super-Resolution Microscopy, and “Galaxies” of Coronavirus RNA Inside Cells,” Keynote Lecture, Berkeley-China Summit, University of California, Berkeley, California, 1 October 2022.
611. “What Is a Single Molecule, and What Can You Do With It? The Road to the Nobel Prize, Super-Resolution Microscopy, “Galaxies” of Coronavirus RNA Inside Cells, and Cryo-ET,” Physics Department Colloquium, Oregon State University, Corvallis, Oregon, 17 Oct 2022.
612. “Welch Conference 2022 Overview: Molecules and Sculpted Light,” Kickoff Lecture, Welch Conference, Houston, Texas, 24 October 2022.
613. “What Can Single Molecules Tell Us About Coronavirus Infection and Cryo-Electron Tomography?” Keynote Lecture, 14th International Congress of Cell Biology & 9th Asian Pacific Organization for Cell Biology Joint Meeting, ICCB&APOCB 2022, Academia Sinica, Taipei, Taiwan, 8 November 2022 (remote).