

A. JEFF TSAO C.V. (JUNE, 2014)

Addresses:

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Education:

Harvard University (1977-1981)

PhD in Applied Physics under Prof N Bloembergen (IR Multiphoton Pumping of Electronically Excited Molecules)

SM in Applied Physics (Major Fields: Quantum Electronics, Solid-State Physics, Materials Science)

Stanford University (1973-1977)

MS in Electrical Engineering, BS in Mathematics

Employment:

2011-: Distinguished Member of Technical Staff, Sandia National Labs
2009-: Chief Scientist, Energy Frontier Research Center for Solid-State Lighting Science
2001-: Principal Member of Technical Staff, Sandia National Labs
2000-2001: Vice-President, Research & Development, E2O Communications
1998-1999: Visiting Lecturer, Institute of Matls Research and Engineering, Singapore
1991-2000: Manager, Semiconductor Materials/Process Depts 1144/1311/1126, Sandia National Labs
1984-1991: Member of Technical Staff, Sandia National Labs
1981-1984: Member of Technical Staff, MIT-Lincoln Lab
1980-1981: Consultant, Tachisto Lasers, Inc.
1978-1981: Research Assistant and Teaching Fellow, Harvard University

Professional Awards, Accomplishments and Experience:

2013 Asian American Engineer of the Year
2012 Sandia National Laboratories Entrepreneurial Spirit Award
2010- Science Advisory Boards: RPI's Smart Lighting ERC; U Michigan's Solar/Thermal Energy Conversion EFRC; UCSB's Center for Energy Efficiency Materials EFRC; USC's Center for Energy Nanoscience; Strategies in Light Advisory Panel
2011 Technical Advisory Board: Inari (Malaysia); Industrial Technology Research Institute (Taiwan)
2009 Fellow, American Association for the Advancement of Science
2007 Sandia National Labs Employee Recognition Awards: Individual Technical Excellence (07); Team (08)
2005-7 Coordinator, DOE-SC workshops on Basic Research Needs for Solar Energy Utilization and Solid-State Lighting
2006 Honorary Chair, China International Forum on Solid-State Lighting
2002 Coordinated and edited comprehensive update to U.S. Solid-State Lighting LED Roadmap
2001 Led long-wavelength VCSEL R&D team at E2O Communications
2001 Member, Tecstar Corporation Science Advisory Board (99-)
2000 Chair, Materials Research Society Graduate Student Awards Committee (98-)
1992-9 Various technical program committees: MRS, AVS, NAMBE, EMC, OSA, SPIE
1998 Created and taught comprehensive course on Semiconductor Epitaxy at Natl Univ of Singapore
1997 Led multi-\$M partnerships between Sandia and HP, Motorola, Emcore, Hughes, TI (92-97)
1996 Catalyzed science-based epi capability at Sandia, leading to world-record VCSEL and other devices
1996 Fellow, American Physical Society
1995 Co-chair, Spring Materials Research Society Meeting (2,500 attendees)
1994 Sandia and Martin Marietta Author of Year and Martin Marietta Jefferson Cup Award
1993 Research monograph on Materials Fundamentals of Molecular Beam Epitaxy (Academic Press)
1993 Co-chair, MRS Symposium: Common Themes and Mechanisms of Epitaxial Growth
1990 Co-chair, MRS Symposium: Evolution of Thin-Film and Surface Microstructure
1987 Co-chair, SPIE Symposium on Lasers in Microlithography

Professional Societies:

Fellow: American Association for the Advancement of Science, American Physical Society
Senior Member: Institute of Electrical and Electronics Engineers
Member: American Economic Association, Human Behavior and Evolution Society, International Association for Energy Economics, Illuminating Engineering Society, American Psychological Association, Materials Research Society

B. BIOGRAPHICAL PROFILE

Jeff was born in 1955 and raised in Los Angeles, CA. He is a graduate of Stanford University (AB in Mathematics, MS in Electrical Engineering) and Harvard University (MS, PhD in Applied Physics). He is married and has two children.

Jeff is currently a Distinguished Member of Technical Staff at Sandia National Laboratories, and Chief Scientist of its Energy Frontier Research Center for Solid-State-Lighting Science. His career has spanned three phases, each lasting about a decade.

From 1981 to 1991, he was research staff, first at MIT-Lincoln Laboratory then at Sandia National Laboratories. During this phase, his focus was on research: of the 147 journal articles he has published, 98 stem from work during this phase, as does his research monograph "Materials Fundamentals of Molecular Beam Epitaxy."

From 1991 to 2001, he was a research manager: first of three closely related departments at Sandia National Laboratories, and then, on entrepreneurial leave, as Vice-President of R&D at E2O Communications, a U.S.-based pre-IPO fiber communications components company. During this phase of his career he built world-class teams and programs in the area of "smart" compound semiconductor epitaxy and devices for high-speed communications.

From 2001 to the present (2012), he returned to Sandia National Laboratories as research staff. During this phase, his focus was broader, working on white papers and reports with an aim to influence larger national and global research directions. He helped the DOE Office of Science and Office of Energy Efficiency and Renewable Energy coordinate workshops and roadmaps in various areas of energy science and technology. He was an early pioneer in solid-state lighting, a technology poised to transform how the world consumes 20% of its electricity and 6.5% of its primary energy. Along the way, he has outlined new and counterintuitive ways of thinking about the energy economics of lighting.

<http://www.sandia.gov/~jytsao/>.



C. PROFESSIONAL ACTIVITIES

1. Current Employment

2011-: Distinguished Member of Technical Staff, Sandia National Labs. Jeff is involved in a diversity of research activities including: energy science, technology and economics; complex adaptive systems; and the “science” of science.

2009-: Chief Scientist, Energy Frontier Research Center for Solid-State Lighting Science. Jeff provides scientific leadership and vision for this \$18M/ 5year DOE Office of Science project involving more than 20 Sandia staff and external partners.

2. Previous Employment

2001-2010: Principal Member of Technical Staff, Sandia National Labs. Led research and roadmapping activities involving integrated science, technology and economic modeling in solid-state lighting and other areas. Also explored network models of knowledge production – a new approach to the field of “evolutionary epistemology.”

2005-2007: Part-Time Detailee, DOE Office of Basic Energy Sciences. Coordinated two major workshops: one on solar energy utilization and one on solid-state lighting. The process Jeff helped put in place for the first workshop helped lay the foundation for subsequent Basic Research Needs workshops (ten all together) which in turn helped lay the foundation for the creation of DOE’s 46 Energy Frontier Research Centers, with anticipated funding of \$777M over the five years 2009-2014.

2000-2001: Vice-President, Research & Development, E2O Communications, a U.S.-based pre-IPO fiber communications components company. Built and led an R&D team to develop long-wavelength vertical-cavity surface-emitting laser (VCSEL) technology for uncooled 1-10Gbps short and intermediate-reach applications.

1991-2000: Manager, Semiconductor Materials/Process Departments 1144/1311/1126, Sandia National Laboratories. Championed new science-based approaches to epitaxial growth (e.g., in situ monitoring and process modeling/control), and catalyzed and oversaw many of Sandia's technology partnerships in compound semiconductor materials. He had the privilege of hiring and mentoring a series of world-class "growers," all of whom have gone on to outstanding careers as entrepreneurs, scientists, professors, or technologists.

1998-1999: Visiting Lecturer, Institute of Materials Research and Engineering, Singapore. Developed and gave a series of twelve lectures on compound semiconductor epitaxy that surveyed the entire field from science and technology all the way to applications.

1983-1991: Member of Technical Staff, Sandia National Labs. Participated in research activities aimed at unraveling fundamental aspects of ultrafast (laser quenched) and ultraslow (molecular beam epitaxy) crystal growth.

1981-1983: Member of Technical Staff, MIT-Lincoln Lab. Participated in research activities aimed at developing “laser microchemical” techniques for direct-write modification of surfaces for microelectronics technologies.

1980-1981: Consultant, Tachisto Lasers, Inc. Consulted on CO₂ laser designs.

1978-1981: Research Assistant and Teaching Fellow, Harvard University. Conducted PhD research, and was teaching assistant to undergraduate electronics laboratories.

3. Selected Projects and Responsibilities

2001-: Solid-State Lighting (Research)

During 2001-2012 Jeff returned to research, and began work in the area of solid-state lighting. He partnered with colleagues at Hewlett-Packard to co-author a seminal and globally influential white paper outlining the enormous energy-efficiency potential of solid-state lighting. The white paper catalyzed national R&D programs both in the US and abroad. He subsequently served as editor of DOE EERE's first comprehensive SSL technology roadmap, and of DOE BES' Basic Research Needs for Solid-State Lighting workshop report. Jeff has been a deep and visionary thinker in the area of solid-state lighting, is regularly invited to give talks, and in the past three years has given five conference keynote talks. He was one of the principal architects of Sandia's Energy Frontier Research Center for Solid-State Lighting Science, for which he currently serves as Chief Scientist. Recently, Jeff has turned his attention to the energy economics of lighting, and a recent series of three high-profile papers has led to prominent media coverage (e.g., the Economist, National Public Radio, and The New York Times).

2000-2001: Long-Wavelength VCSELs (Line Management and Entrepreneurship)

During 2000-2001 Jeff served as Vice-President of R&D at E2O Communications, Inc., a U.S.-based pre-IPO fiber communications components company. There, he built and led an R&D team to develop long-wavelength VCSEL technology for uncooled 1-10Gbps short and intermediate-reach applications. E2O and its technology were ultimately acquired by JDS Uniphase in 2004.

1991-2001: Science-Based Semiconductor Epitaxy (Line and Program Management)

During 1991-2000, Jeff was manager of various semiconductor materials research departments at Sandia National Laboratories. The common theme of these departments was Jeff's vision of "science-based semiconductor epitaxy," in which emerging scientific understanding of the fundamental thin-film, surface and gas-phase processes associated with epitaxy was harnessed to improve epitaxy technology and ultimately the advanced devices such epitaxy enables. Among the achievements of his and collaborating departments during this period were the first application of metal-organic chemical vapor deposition and real-time optical monitoring tools to fabrication of ultra-complex heterostructures such as vertical-cavity surface-emitting lasers (VCSELs), followed a few years later by Sandia's achievement of world-record-performing VCSELs. Sandia won much international recognition for this work, including an R&D 100 Award, and spawned a successful spin-off company, MODE, that was eventually acquired by Emcore Corporation. Moreover, many of the young staff he recruited and mentored during this period have gone on to make very significant accomplishments in their own right (e.g., Chair of EE Department at Yale University; VP of Photonic Integrated Circuit (PIC) Products, Infinera; Co-Founder and Executive VP, Tria Beauty; Co-Founder and President, MODE; CEO of Emcore Corporation). Jeff also developed many industrial partnerships during this period, including a highly successful \$10.5M partnership with Hewlett-Packard, programs with Motorola totaling ~\$8M, and a \$1M partnership with Emcore.

1984-1991: Fundamentals of Semiconductor Epitaxy (Research)

During 1984-1991, Jeff and his colleagues engaged in detailed studies of the science of semiconductor epitaxy, including: ultra-fast liquid-phase epitaxy via laser quenching; the stability and metastability of strained epitaxial films; and the interaction between chemistry and morphology during III-V molecular beam epitaxy. This period of work led to a series of papers that in the area of strained epitaxial films alone has accumulated 975 citations (indexed by the ISI Web of Science as of August, 2012), and to a 1993 research monograph "Materials Fundamentals of Molecular Beam Epitaxy" for which Jeff won Martin-Marietta's Jefferson Cup and Author of the Year corporate awards in 1994. The concept of "excess stress" developed by Jeff and his colleagues is now the standard way of understanding stability and metastability of the strained-semiconductor heterostructures now used widely in high-performance devices.

1981-1984: Laser Microchemistry (Research)

During 1981-1984, as a staff member at MIT-Lincoln Laboratory, Jeff contributed to the then-new field of laser microchemistry, in which thermal and photochemical processes are used for submicron direct-write deposition on, and etching of, semiconductor thin films. The group at MIT-Lincoln Laboratory became widely known in this area, publishing a series of papers that has accumulated 788 citations (indexed by the ISI Web of Science as of August, 2012).

4. Service to Professional Societies and Committees

Jeff has, especially recently, begun served on a number of science or technical advisory boards, including: for 3 DOE-sponsored Energy Frontier Research Centers (EFRCs), for the NSF Smart Lighting Center at Rensselaer Polytechnic Institute, and for Strategies in Light, the world's largest solid-state lighting conference and trade show.

He has also contributed to numerous government panels and roundtables on behalf of the DOE Office of Science and Office of Energy Efficiency and Renewable Energy, and coordinated on their behalf three workshops: one on solar energy and two on solid-state lighting.

Jeff has diverse interests, and is member of nine professional societies and Fellow of two (the American Association for the Advancement of Science and the American Physical Society). Over the years, he has chaired or co-chaired or served on program committees for numerous symposia. His favorite committee was the MRS Graduate Student Awards Committee, which he chaired for three years 1998-2000, and his largest conference responsibility was the Spring 1995 MRS Meeting (2,500 attendees), which he co-chaired.

Professional Awards, Accomplishments and Experience:

- 2010- Science Advisory Boards: RPI's Smart Lighting ERC; U Michigan's Solar/Thermal Energy Conversion EFRC; UCSB's Center for Energy Efficiency Materials EFRC; USC's Center for Energy Nanoscience EFRC; Strategies in Light Advisory Panel
- 2010-2011 Technical Advisory Board: Inari (Malaysia)
- 2009 Technical Advisory Board: Industrial Technology Research Institute (Taiwan)
- 2008- Invited Contributor: DOE-EERE annual SSL roundtables
- 2006 Honorary Chair, China International Forum on Solid-State Lighting
- 2005-7 Coordinator, DOE-SC workshops on Basic Research Needs for Solar Energy Utilization and Solid-State Lighting
- 2002 Coordinated and edited comprehensive update to U.S. Solid-State Lighting LED Roadmap
- 1999-2001 Member, Tecstar Corporation Science Advisory Board
- 1998-2000 Chair, Materials Research Society Graduate Student Awards Committee
- 1998 Created and taught comprehensive course on Semiconductor Epitaxy at Natl Univ of Singapore
- 1995 Co-chair, Spring Materials Research Society Meeting (2,500 attendees)
- 1993 Co-chair, MRS Symposium: Common Themes and Mechanisms of Epitaxial Growth
- 1992-9 Various technical program committees: MRS, AVS, NAMBE, EMC, OSA, SPIE
- 1990 Co-chair, MRS Symposium: Evolution of Thin-Film and Surface Microstructure
- 1987 Co-chair, SPIE Symposium on Lasers in Microlithography

Professional Societies:

- Fellow: American Association for the Advancement of Science, American Physical Society
- Member: American Economic Association, Human Behavior and Evolution Society, Institute of Electrical and Electronics Engineers, International Association for Energy Economics, Illumination Engineering Society, American Psychological Association, Materials Research Society

D. SELECTED PROFESSIONAL ACCOMPLISHMENTS

Jeff has: published 147 journal articles (with collectively over 3,000 Web-of-Science citations); been granted 9 U.S. patents; authored, co-authored or co-edited 5 books; and given 90 invited or plenary talks. His Web-of-Science H-index is 30. Below is a listing of: his 10 most cited journal articles; selected review articles or book chapters; selected authored or edited books; selected reports, white papers and websites; selected patents; selected plenary and invited presentations; and professional awards.

Jeff has been elected Fellow of the American Association for the Advancement of Science (2009) and the American Physical Society (1996). In recognition of his research in the science of semiconductor epitaxy and his research monograph "Fundamentals of Molecular Beam Epitaxy," he was awarded in 1994 the Sandia and Martin Marietta Author of the Year awards as well as the Martin Marietta Jefferson Cup award. In recognition of the impact of his research and management career on Sandia National Laboratories and its mission, particularly his influence on the development of solid-state lighting technology, in 2011 Jeff was named Distinguished Member of Technical Staff.

Most Cited 10 Journal Articles

1. RELAXATION OF STRAINED-LAYER SEMICONDUCTOR STRUCTURES VIA PLASTIC FLOW, B.W. Dodson, J. Y. Tsao, Applied Physics Letters **51**, 1325-1327 (1987); and Applied Physics Letters **53**, 1128 (1988). Citations = 432.
2. A REVIEW OF LASER MICROCHEMICAL PROCESSING, D.J. Ehrlich and J.Y. Tsao, Journal of Vacuum Science and Technology **B1**, 969 (1983). Citations = 298.
3. CRITICAL STRESSES FOR $\text{Si}_x\text{Ge}_{1-x}$ STRAINED-LAYER PLASTICITY, J.Y. Tsao, B.W. Dodson, S.T. Picraux, D.M. Cornelison, Physical Review Letters **59**, 2455 (1987). Citations = 151.
4. SOLID-STATE LIGHTING: LAMPS, CHIPS, AND MATERIALS FOR TOMORROW, J.Y. Tsao, IEEE Circuits & Devices Vol 20, No. 3, pp. 28-37 (May/June, 2004). Citations = 140.
5. RESEARCH CHALLENGES TO ULTRA-EFFICIENT INORGANIC SOLID-STATE LIGHTING, J.M. Phillips, M.E. Coltrin, M.H. Crawford, A.J. Fischer, M.R. Krames, R. Mueller-Mach, G.O. Mueller, Y. Ohno, L.E.S. Rohwer, J.A. Simmons, J.Y. Tsao, Laser and Photonics Reviews **1**, 307-333 (November, 2007). Citations = 129.
6. PARTITIONING OF ION-INDUCED SURFACE AND BULK DISPLACEMENTS, D.K. Brice, J.Y. Tsao, S.T. Picraux, Nuclear Instruments and Methods in Physics Research **B44**, 68-78 (1989). Citations = 100.
7. EXCESS STRESS AND THE STABILITY OF STRAINED HETEROSTRUCTURES, J.Y. Tsao, B.W. Dodson, Applied Physics Letters **53**, 848-850 (1988). Citations = 97.
8. SOLUTE TRAPPING: COMPARISON OF THEORY WITH EXPERIMENT, M.J. Aziz, J.Y. Tsao, M.O. Thompson, P.S. Peercy, C.W. White, Physical Review Letters **56**, 2489 (1986). Citations = 93.
9. LAYER-BY-LAYER SPUTTERING AND EPITAXY OF Si(100), P. Bedrossian, J. E. Houston, J.Y. Tsao, E. Chason, S.T. Picraux, Physical Review Letters **67**, 124-127 (1991). Citations = 66.
10. PHOTODEPOSITION OF Ti AND APPLICATION TO DIRECT WRITING OF Ti: LiNbO_3 WAVEGUIDES, J.Y. Tsao, R.A. Becker, D.J. Ehrlich, F.J. Leonberger, Applied Physics Letters **42**, 559 (1983). Citations = 63.

Selected Review Articles or Book Chapters

1. SOLID-STATE LIGHTING: TOWARD SMART AND ULTRA-EFFICIENT, J.Y. Tsao, M.H. Crawford, M.E. Coltrin, A.J. Fischer, D.D. Koleske, G.S. Subramania, G.T. Wang, J.J. Wierer, R.F. Karliceck, Jr., Advanced Optical Materials (accepted for publication June, 2014).
2. SOLID-STATE LIGHTING: AN ENERGY ECONOMICS PERSPECTIVE, Jeff Tsao, Harry Saunders, Randy Creighton, Mike Coltrin, Jerry Simmons, Journal of Physics D **43**, 354001 (2010).

3. SOLID-STATE LIGHTING: 'THE CASE' 10 YEARS AFTER AND FUTURE PROSPECTS, *Physica Status Solidi A – Applications and Materials Science* 208, 17-29 (January, 2011).
4. SOLID-STATE LIGHTING: AN INTEGRATED HUMAN FACTORS, TECHNOLOGY AND ECONOMIC PERSPECTIVE, J.Y. Tsao, M.E. Coltrin, M.H. Crawford, J.A. Simmons, *Proceedings of the IEEE* **98** (7), 1162-1179 (2010).
5. GALILEO'S STREAM: A FRAMEWORK FOR TECHNICAL KNOWLEDGE PRODUCTION, J.Y. Tsao, W.B. Gauster, K.W. Boyack, M.E. Coltrin, J.G. Turnley, *Research Policy* 37, 330-352 (March, 2008) (SAND 2006-7622J).
6. AlGaAs OMVPE IN A ROTATING-DISK REACTOR: THE ANATOMY OF A VCSEL, W.G. Breiland, M.E. Coltrin, J. R. Creighton, H.Q. Hou, H.K. Moffat and J.Y. Tsao, *Materials Science and Engineering Reports R24*, 241 (1999).
7. A REVIEW OF REFLECTION MASS SPECTROMETRY DURING III/V MBE, J.Y. Tsao, *Computational Materials Science* 6, 140 (1996).
8. STRUCTURAL RELAXATION IN METASTABLE STRAINED-LAYER SEMICONDUCTORS, B.W. Dodson and J.Y. Tsao, *Annual Reviews of Materials Science* 19, 419-437 (1989).
9. A REVIEW OF LASER MICROCHEMICAL PROCESSING, D.J. Ehrlich and J.Y. Tsao, *The Journal of Vacuum Science and Technology B1*, 969 (1983).

Selected Authored or Edited Books

1. COMPLEX SCIENCES (Revised Selected Papers from Second International Conference, COMPLEX 2012, Santa Fe, NM, USA), Kristin Glass, Richard Colbaugh, Paul Ormerod and Jeffrey Tsao, Eds. (Springer, 2013).
2. FUNDAMENTALS OF MOLECULAR BEAM EPITAXY, J.Y. Tsao (Academic Press, 1993).
3. EVOLUTION OF THIN-FILM AND SURFACE MICROSTRUCTURE, C.V. Thompson, J.Y. Tsao, D. J. Srolvitz, Eds., *Proceedings of the Fall 1990 Materials Research Society Meeting 202*, Boston, MA, 11/26-12/1/90.
4. LASERS IN MICROLITHOGRAPHY, D.J. Ehrlich, J.Y. Tsao and J.S. Batchelder, Eds., *Proceedings of SPIE, The International Society for Optical Engineering*, 774, Santa Clara, CA, 3/2-3/87.
5. LASER MICROFABRICATION: THIN FILM PROCESSES AND LITHOGRAPHY, D.J. Ehrlich and J.Y. Tsao, Eds. (Academic Press, NY, 1988).
6. VLSI ELECTRONICS: MICROSTRUCTURE SCIENCE, Vol. 7, D.J. Ehrlich and J.Y. Tsao, Academic, New York (1983).

Selected Reports, White Papers and Websites

1. [ART AND SCIENCE OF SCIENCE AND TECHNOLOGY: PROCEEDINGS OF THE FORUM AND ROUNDTABLE](#) (Sandia National Laboratories, Albuquerque, NM, June 5-7,2013; J.Y. Tsao, G. R. Emmanuel, T. Odumosu, A.R. Silva, V. Narayanamurti, G.J. Feist, G.W. Crabtree, C.M. Johnson, J.I. Lane, L. McNamara, S.T. Picraux, R.K. Sawyer, R.P. Schneider, C.D. Schunn and R. Sun; Science, Technology and Public Policy Program, Belfer Center for Science and International Affairs, Harvard Kennedy School, December, 2013).
2. [A CASE FOR SANDIA INVESTMENT IN COMPLEX ADAPTIVE SYSTEMS SCIENCE AND TECHNOLOGY](#), C.M. Johnson, G.A. Backus, T.J. Brown, R. Colbaugh, K.A. Jones, J.Y. Tsao; (May, 2012).
3. [A BRIEF HISTORY OF SANDIA NATIONAL LABORATORIES AND THE DEPARTMENT OF ENERGY'S OFFICE OF SCIENCE: INTERPLAY BETWEEN SCIENCE, TECHNOLOGY, AND MISSION](#); J.Y. Tsao, J.A. Simmons, S.S. Collis, A. McIlroy, S.M. Myers, S.T. Picraux, F.L. Vook; August, 2011.
4. [SOLAR FAQs](#), J.Y. Tsao, N. Lewis and G. Crabtree (report for Office of Basic Energy Sciences, March, 2006).
5. [FINAL REPORT ON GRAND CHALLENGE LDRD PROJECT: A REVOLUTION IN LIGHTING – BUILDING THE SCIENCE AND TECHNOLOGY BASE FOR ULTRA-EFFICIENT SOLID-STATE LIGHTING](#), Simmons, J. A., J. Y. Tsao, S. R. Kurtz, T. M. Bauer, R. J. Kaplar, W. W. Chow, E. D. Jones, K. E. Waldrip, S. R. Lee, A. J. Fischer, M. H. Crawford, K. W. Fullmer, B. L. Abrams, R. M. Biefeld, D. D. Koleske, A. A. Allerman, J. J. Figiel, R. J. Creighton,

M. E. Coltrin, K. C. Cross, C. C. Mitchell, T. M. Kerley, G. T. Wang, K. H. A. Bogart, C. H. Seager, J. M. Campbell, D. M. Follstaedt, M. P. Moran, A. K. Norman, A. F. Wright, S. M. Myers, N. A. Missert, R. G. Copeland, J. M. Gee, P. P. Provencio, J. P. Wilcoxon, S. Woessner, G. R. Hadley, J. R. Wendt, R. J. Shul, C. I. H. Ashby, L. E. S. Rohwer, D. R. Tallant, R. L. Simpson, H. K. Moffat, A. G. Salinger, R. P. Pawlowski, J. A. Emerson, S. G. Thoma, P. J. Cole, K. W. Boyack, R. Elliot, M. L. Garcia, A. Salamone, M. Allen, B. A. Burdick, N. M. Rahal, M. A. Monson, R. M. Gonzales, E. T. Southwell, A. E. Miksovic, A. O. Pinson, and M. J. Pinzon; SAND Report 2004-2365 (June, 2004).

6. [LIGHT EMITTING DIODES \(LEDS\) FOR GENERAL ILLUMINATION](#), J.Y. Tsao, Ed., OIDA Technology Roadmap (Optoelectronics Industry Development Association, October, 2002).
7. SANDIA SOLID-STATE LIGHTING WEBSITE (no longer active), D.M. Meister, J.Y. Tsao and A.E. Miksovic (2002).
8. [THE CASE FOR A NATIONAL RESEARCH PROGRAM ON SEMICONDUCTOR LIGHTING](#), R. Haitz, F. Kish, J.Y. Tsao and J.S. Nelson (white paper first presented publicly at the 1999 Optoelectronics Industry Development Association (OIDA) forum in Washington DC on October 6, 1999).

Selected Patents

1. MOLTEN-SALT-BASED GROWTH OF GROUP III NITRIDES, T.M. Kerley, J.Y. Tsao, K.E. Waldrip, U.S. Patent No. 7,435,297, Issued October 14, 2008.
2. ELECTRICALLY PUMPED LONG-WAVELENGTH VCSEL WITH AIR GAP DBR AND METHODS OF FABRICATION, C.L. Shieh, J.Y. Tsao, U.S. Patent No. 6,696,308, Issued 2004.
3. SEGMENTED-MIRROR VCSEL, J.Y. Tsao, C.L. Shieh, D. Dapkus, J. Yang, U.S. Patent No. 6,594,294, Issued July 15, 2003.
4. PHOTODETECTOR WITH ABSORBING REGION HAVING RESONANT PERIODIC ABSORPTION BETWEEN REFLECTORS, R.P. Bryan, G.R. Olbright, R.M. Brennan, J.Y. Tsao, U.S. Patent No. 5,389,797, Issued February 14, 1995.
5. REFLECTION MASS SPECTROMETRY TECHNIQUE FOR MONITORING AND CONTROLLING COMPOSITION DURING MOLECULAR BEAM EPITAXY, J.Y. Tsao, T.M. Brennan and B.E. Hammons, U.S. Patent No. 5,171,399, Issued December 5, 1992.
6. SURFACE ACOUSTIC WAVE DEVICES AND METHOD OF MANUFACTURE THEREOF, V.S. Dolat, D.J. Ehrlich and J.Y. Tsao, U.S. Patent No. 4,672,254, Issued June, 1987.

Selected Recent Plenary and Invited Presentations

1. J.Y. Tsao, The Next Semiconductor Revolution: This Time It's Lighting!, International Energy Agency, Paris, France, June 7, 2007, Paris, France.
2. J.Y. Tsao; Solid-State Lighting: Science, Technology and Economic Perspectives; Workshop on the Research Frontiers of Solid State Lighting; December 1, 2009; Nanyang Technological University, Singapore; Invited.
3. J.Y. Tsao; (Lighting) and Solid-State Lighting: Science, Technology and Economic Perspectives; SPIE Photonics West 2010 OPTO Symposium; January 26, 2010; San Francisco, CA; Plenary.
4. J.Y. Tsao; Solid-State Lighting: The III-V Epi "Killer App"; 15th International Conference on Metal Organic Vapor Phase Epitaxy (ICMOVPE-XV); May 24, 2010; Lake Tahoe, CA; Plenary.
5. J.Y. Tsao; (Lighting) and Solid-State Lighting: Science, Technology and Economic Perspectives; SPIE Optics+Photonics; August 1, 2010; San Diego, CA; Plenary.
6. J.Y. Tsao, H.D. Saunders, J.R. Creighton, M.E. Coltrin, J.A. Simmons; Lighting Technologies, Costs, and Energy Demand: Global Developments to 2030; Research Seminar; September 28, 2010; World Bank, Washington DC; Invited.

7. J.Y. Tsao; Solid-State Lighting: It's also about Human Productivity; Corning Stookey Award Ceremony; October 13, 2010; Corning, NY; Keynote.
8. J.Y. Tsao; Solid-State Lighting: It's also about Human Productivity; International Electron Devices and Materials Symposium (IEDMS 2010); November 18, 2010; Chungli, Taiwan; Plenary.
9. J.Y. Tsao, M.E. Coltrin, J.A. Simmons, M.H. Crawford, A. Armstrong, A. J. Fischer, E. A. Shaner, G.T. Wang, J.E. Martin, "Sandia's Energy Frontier Research Center (EFRC) for Solid-State Lighting Science," Sandia National Laboratories Physical, Chemical and Nano Sciences Colloquium, Albuquerque, NM, 13 April 2011; Invited.
10. J.Y. Tsao; Perspectives on Ultra-Efficient Solid-State Lighting: Characteristics, Economics, Approaches; Nobel Symposium on Nanoscale Energy Converters; August 12-16, 2012; Örenäs Castle, Sweden; Invited.
11. J.Y. Tsao; Solid-State Lighting: Characteristics, Benefits, Approaches; North American Molecular Beam Epitaxy Conference; Banff, Canada; October 6-12, 2013; Invited.

Professional Awards

- | | |
|---------|---|
| 2013 | Asian American Engineer of the Year |
| 2013 | Senior Member, IEEE |
| 2012 | Sandia National Laboratories Entrepreneurial Spirit Award |
| 2011 | Distinguished Member of Technical Staff, Sandia National Laboratories |
| 2009 | Fellow, American Association for the Advancement of Science |
| 2007-08 | Sandia National Labs Employee Recognition Awards: Individual Technical Excellence (2007); Team (2008) |
| 1996 | Fellow, American Physical Society |
| 1994 | Sandia and Martin Marietta Author of Year and Martin Marietta Jefferson Cup Award |

E. COMMUNITY SERVICE

Jeff has been a steady volunteer at local schools and community organizations, with some of his activities listed below. Among his more recent and enjoyable activities, he volunteered at the local hands-on Explora science museum, helping develop an exhibit that has been used not just at the Explora but subsequently at other venues.

Selected Education and Outreach Presentations and Activities

- 2012 Mentor to four high school (rising senior) summer interns.
- 2011 03 21 Lecture on “Solid-State Lighting” to undergraduate technical writing class at the University of New Mexico, Albuquerque, NM.
- 2011-2012 Advised two students from Wilmette Junior High School (in Illinois) on their entry in the 2012 ExploraVision program/competition sponsored by Toshiba and the National Science Teachers Association (NSTA).
- 2010 03 31 Academy Lecture on “The Next Semiconductor Revolution: This Time It’s Lighting!” at the Albuquerque Academy, Albuquerque, NM.
- 2010-2012 Volunteer developer and staffer of solid-state lighting exhibits at Sandia’s Take Your Daughters and Sons to Work Days.
- 2009-2010 Volunteer scientist in the Explora Museum’s Portal to the Public program. Helped develop an exhibit on “Making White Light from Two or Three Colors”, with four “showings” at the Explora to the public and young children, and subsequent showings at other venues (e.g., March 4, 2010 at the Math, Science and Technology Showcase at Vista Grande Elementary School; July 16-20, 2012 at the Hands-On Learning in Smart Lighting for pre-college students at UNM Engineering; and at several Sandia Take Your Daughters and Sons to Work Days.
- 2008 03 14 Lecture on “Some Simple Physics of Global Warming” to a high school physics class at the Bosque School, Albuquerque, NM.
- 2008 Advised a Yale freshman on a “nanotech” article he wrote for the Yale Globalist.
- 2005 10 26 Lecture on “The Next Semiconductor Revolution: This Time It’s Lighting!” to OASIS (a nationwide organization for continued lifelong learning for people age 50+), Albuquerque, NM.
- 2005 07 03 Lecture on “The Next Semiconductor Revolution: This Time It’s Lighting!” at Leisure World (an independent living retirement community), Seal Beach, CA.
- 2005 04 16 Lecture on “Solid-State Lighting: Lamps, Chips and Materials for Tomorrow” for the Association of Chinese American Engineers and Scientists, Albuquerque, NM.
- 2003-2005 Parent volunteer for the Albuquerque Boy Choir, Albuquerque, NM.
- 2003 Mentor to one high school (rising senior) summer intern.
- 2002 Editor of Applause! Performing arts column for the Bosque Blue, the newsletter of the Bosque School, Albuquerque, NM.
- 2000-2012 Parent volunteer at local schools (Manzano Day School, Bosque School, Albuquerque Academy), Albuquerque, NM.
- 1998 Fall On sabbatical, gave a series of 12 evening lectures on “Semiconductor Epitaxy: Science, Technology and Applications” to students and continuing-education industrial scientists at the Institute of Materials Research and Engineering and the National University of Singapore, Singapore.

- 1996 10 Lecture on "Careers in Science and Technology at National Laboratories" given at the American Vacuum Society Meeting, Philadelphia, PA.
- 1996 07 Lecture on "Careers at Sandia" at the Asian Leadership Outreach Committee workshop, Albuquerque, NM.
- 1992-2012 Ongoing sponsor, with Sylvia Tsao (his wife), of annual Evan J. Tsao Memorial Award for "Best Exhibit in Environmental Science" at the annual NM Regional Science & Engineering Fair.
- 1992-2000 Volunteer judge at annual NM Regional Science & Engineering Fair

F. PUBLICATIONS, PATENTS AND PRESENTATIONS

Articles, Reports and White Papers

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3. J.Y. Tsao, J.A. Simmons, S.S. Collis, A. McIlroy, S.M. Myers, S.T. Picraux, F.L. Vook; A Brief History of Sandia National Laboratories and the Department of Energy's Office of Science: Interplay between Science, Technology, and Mission; October 2011; SAND 2011-5462.
4. Curtis M. Johnson, George A. Backus, Theresa J. Brown, Richard Colbaugh, Katherine A. Jones, Jeffrey Y. Tsao; A Case for Sandia Investment in Complex Adaptive Systems Science and Technology; May, 2012; SAND 2012-3320.
5. [ART AND SCIENCE OF SCIENCE AND TECHNOLOGY: PROCEEDINGS OF THE FORUM AND ROUNDTABLE](#) (Sandia National Laboratories, Albuquerque, NM, June 5-7,2013; J.Y. Tsao, G. R. Emmanuel, T. Odumosu, A.R. Silva, V. Narayanamurti, G.J. Feist, G.W. Crabtree, C.M. Johnson, J.I. Lane, L. McNamara, S.T. Picraux, R.K. Sawyer, R.P. Schneider, C.D. Schunn and R. Sun; Science, Technology and Public Policy Program, Belfer Center for Science and International Affairs, Harvard Kennedy School, December, 2013.

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9. The U.S. "LEDs for General Illumination 2002" Roadmap, J.Y. Tsao, Laser Focus World pp. S11-S14 (May, 2003).
10. SOLID-STATE LIGHTING: LAMP TARGETS AND IMPLICATIONS FOR THE SEMICONDUCTOR CHIP, J.Y. Tsao, IEEE Circuits & Devices Vol 20, No. 3, pp. 28-37 (May/June, 2004).
11. SEMICONDUCTOR LIGHT SOURCES MOVE FROM THE IR TO THE VISIBLE AND UV, Jeff Tsao, Mary Crawford, Jess Wilcoxon and Jerry Simmons, Photonics Spectra (January, 2005).
12. BEYOND THE VACUUM TUBE: LIGHTING SOLUTIONS FOR THE 21ST CENTURY, J.A. Simmons, M.E. Coltrin and J.Y. Tsao, Optics and Photonics News, June, 2007 (SAND 2007-2465).
13. RESEARCH CHALLENGES TO ULTRA-EFFICIENT INORGANIC SOLID-STATE LIGHTING, J.M. Phillips, M.E. Coltrin, M.H. Crawford, A.J. Fischer, M.R. Krames, R. Mueller-Mach, G.O. Mueller, Y. Ohno, L.E.S. Rohwer, J.A. Simmons, J.Y. Tsao, Laser and Photonics Reviews 1, 307-333 (November, 2007) (SAND 2007-5470J).
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26. SOLID-STATE LIGHTING: TOWARD SMART AND ULTRA-EFFICIENT, J.Y. Tsao, M.H. Crawford, M.E. Coltrin, A.J. Fischer, D.D. Koleske, G.S. Subramania, G.T. Wang, J.J. Wierer, R.F. Karlicek, Jr., Advanced Optical Materials (accepted for publication June, 2014).

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Rapid Solidification

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17. SiGe STRAINED HETEROSTRUCTURES: WHAT'S STABLE, WHAT ISN'T, AND BY HOW MUCH?, J.Y. Tsao, 4th International Conference on Modulated Semiconductor Structures, University of Michigan, Ann Arbor, MI (17-21 July 1989).
18. REFLECTION MASS SPECTROMETRY DURING III/V MBE, J.Y. Tsao, T.M. Brennan and B.E. Hammons, 1989 Spring MRS Meeting, San Francisco, CA (16-20 April 1989).
19. REFLECTION MASS SPECTROMETRY, III/V MBE, AND ADSORBATE-INDUCED PHASE TRANSITIONS, J.Y. Tsao, T.M. Brennan and B.E. Hammons, 38th Annual AVS Symposium & Topical Conference, Seattle, WA (11-15 November 1991).

20. PHASE DIAGRAMS IN HETEROEPITAXY: FROM ORDERED ADSORBATES TO PSEUDOMORPHIC FILMS TO BULK CRYSTALS, J.Y. Tsao, 1992 Spring MRS Meeting, San Francisco, CA (27 April - 1 May 1992).
21. MISFIT ACCOMMODATION IN STRAINED THIN FILMS, J.Y. Tsao, 1992 Fall MRS Meeting, Boston, MA, (20 November - 4 December 1992).
22. MATERIALS ISSUES IN MOLECULAR BEAM EPITAXY, J.Y. Tsao, 1994 Spring MRS Meeting, San Francisco, CA (4-8 April 1994).
23. COMPOUND SEMICONDUCTOR MATERIALS AT SANDIA NATIONAL LABORATORIES, J.Y. Tsao, Colloquium at UC San Diego, San Diego, CA (November, 1995).
24. A REVIEW OF REFLECTION MASS SPECTROMETRY DURING III/V MBE, J.Y. Tsao, Virtual MBE Workshop, Hughes Research Labs, Malibu, CA (January, 1996).
25. CAREERS AT SANDIA, J.Y. Tsao, Asian Leadership Outreach Committee workshop, Albuquerque, NM (July, 1997).
26. SCIENCE-BASED COMPOUND SEMICONDUCTOR MANUFACTURING, J.Y. Tsao, Colloquium at University of Texas, Austin, TX (September 1996).
27. CAREERS IN SCIENCE AND TECHNOLOGY AT NATIONAL LABORATORIES, J.Y. Tsao, 1996 American Vacuum Society Meeting, Philadelphia, PA (14-18 October 1996).
28. SCIENCE-BASED COMPOUND SEMICONDUCTOR MANUFACTURING, J.Y. Tsao, Colloquium at University of Texas, El Paso, TX (November, 1996).
29. FRONTIERS IN SEMICONDUCTORS, J.Y. Tsao, New Year's Renaissance Weekend, Hilton Head, SC (January, 1997).
30. INFORMATION TOOLS IN SCIENCE, J.Y. Tsao, New Year's Renaissance Weekend, Hilton Head, SC (January, 1997).
31. III-V EPITAXY: SCIENCE, TECHNOLOGY, APPLICATION, J.Y. Tsao, 1997 Fall MRS Meeting, Boston, MA (December, 1997).
32. SEMICONDUCTOR EPITAXY: SCIENCE, TECHNOLOGY AND APPLICATIONS, J.Y. Tsao, a series of 12 lectures given at the Institute of Materials Research and Engineering, the National University of Singapore (August - November, 1998).
33. FRONTIERS IN COMPOUND SEMICONDUCTOR EPITAXY, J.Y. Tsao, Colloquium at Harvard University, Cambridge, MA (February, 2000).
34. FRONTIERS IN COMPOUND SEMICONDUCTOR OPTOELECTRONICS: LIGHTING FOR ILLUMINATION AND COMMUNICATION, J.Y. Tsao, Colloquium at the Ioffe Institute, St. Petersburg, Russia (January, 2001).
35. FRONTIERS IN COMPOUND SEMICONDUCTOR OPTOELECTRONICS: LIGHTING FOR ILLUMINATION AND COMMUNICATION, J.Y. Tsao, Colloquia at Industrial Technology and Research Institute, Epistar, and Visual Photonics Epitaxy Corporation, Hsinchu, Taiwan (March, 2001).
36. THE SECOND REVOLUTION IN FIBER-OPTIC COMMUNICATIONS, J.Y. Tsao, Spring Renaissance Weekend, Charleston, SC (March, 2001).
37. The U. S. Solid-State Lighting Roadmap: Targets and Technical Challenges, J.Y. Tsao, Seminar at University of Michigan, Ann Arbor, MI (11 October, 2002).
38. The U. S. Solid-State Lighting Roadmap: Targets and Technical Challenges, J.Y. Tsao, 2002 OIDA Annual Forum, Washington, DC (20 November, 2002).
39. Science and Technology Challenges in Solid-State Lighting, J.Y. Tsao, Workshop on Selective, Patterned and Self-Assembled Growth in Nanostructures, Hong Kong, China (6-8 January, 2003).

40. The U. S. Solid-State Lighting Roadmap: Targets and Technical Challenges, J.Y. Tsao, 2003 International Conference on Compound Semiconductor Manufacturing Technology, Scottsdale, AZ (19-22 May, 2003).
41. Solid State Lighting: the Promise and the Challenges, J.Y. Tsao, Harvard University, Cambridge, MA (28 May, 2003).
42. Solid State Lighting: the Promise and the Challenges, J.Y. Tsao, Yale University, New Haven, CT (29 May, 2003).
43. The U. S. Solid-State Lighting Roadmap: Targets and Technical Challenges, J.Y. Tsao, J.M. Gee and J.A. Simmons, SPIE International Symposium on Solid State Lighting, San Diego, CA (7 August, 2003).
44. Solid-State Lighting: The Promise and the Materials Challenges, J.Y. Tsao, 2004 American Vacuum Society Annual Meeting, Baltimore, MD (24-28 November, 2003).
45. Tsao, J. Y., Solid-State Lighting: Lamps, Chips and Materials for Tomorrow, 3M Solid-State Lighting Workshop, 11/10/04, Minneapolis, MN (invited).
46. Tsao, J. Y., K. W. Boyack, M. E. Coltrin, J. G. Turnley, W. B. Gauster, Interactive Knowledge Production in Science, Technology and Engineering, 3M Colloquium, 11/11/04, Minneapolis, MN (invited).
47. Tsao, J. Y, Solid-State Lighting: Lamps, Chips and Materials for Tomorrow, 2005 Conference on Lasers and Electro-Optics, 5/22-27/05, Baltimore, MD (invited).
48. Tsao, J. Y., Solid-State Lighting: Lamps, Chips and Materials for Tomorrow, 2005 International Forum on Solid-State Lighting, 4/12-15/05, Xiamen, P. R. China (invited).
49. Tsao, J. Y., K. W. Boyack, M. E. Coltrin, J. G. Turnley, W. B. Gauster, Galileo's Stream: A New Framework for Technical Knowledge Production, Seminar at Basic Energy Sciences, 3/15/05, Germantown, MD.
50. Tsao, J. Y., Solid-State Lighting: Lamps, Chips and Materials for Tomorrow, Association of Chinese American Engineers and Scientists, 4/16/05, Albuquerque, NM (invited).
51. Tsao, J. Y., The Inorganic Solid State Lighting Roadmap: "Take One" and "Take Two", 2005 NAE Regional Meeting: Solid State Lighting, the Next Revolution in Lighting, 5/19/05, Albuquerque, NM (invited).
52. **Tsao, J. Y.**, *The Next Semiconductor Revolution: This Time It's Lighting!*, Seal Beach Leisure World, 7/3/05, Seal Beach, CA (invited).
53. Solid-State Lighting: The Potential and the Challenges, J.Y. Tsao, Institute of Materials Research and Engineering (IMRE), Singapore (2 August, 2005).
54. Tsao, J. Y., K. W. Boyack, M. E. Coltrin, J. G. Turnley, W. B. Gauster, Galileo's Stream: A "Systems" View of Technical Knowledge Production, Seminar at Centre for Management of Science and Technology (CMOST) - National University of Singapore, 8/5/05, Singapore (invited).
55. **Tsao, J. Y.**, *The Next Semiconductor Revolution: This Time It's Lighting!*, Albuquerque OASIS, 10/26/05, Albuquerque, NM (invited).
56. **Tsao, J. Y.**, *The Inorganic Solid State Lighting Roadmap: "Take One" and "Take Two"*, IES Monthly Lunch Meeting—Lighting Research and Programs at Sandia National Laboratories, 1/10/06, Albuquerque, NM (invited).
57. **M. Huey, Tsao, J. Y.**, K. W. Boyack, *SSL R&D in Key Countries: Investments, Patents, and Publications*, Next Generation Lighting Initiative Alliance and the DOE Office of Energy Efficiency and Renewable Energy, 1/17/06, Washington, DC (invited).
58. **Tsao, J. Y.**, *Solar FAQs and Global Renewable Energy*, Briefing for Department of Energy, 4/25/06, Gaithersburg, MD (invited).

59. **Fischer, A. J., J. Y. Tsao, W. W. Chow, M. H. Crawford, M. Weckwerth, *Potential Implications of High-Power Lasers on Solid-State Lighting*, Photonics Applications Systems Technologies (PhAST) 2006, 5/22-25/06, Long Beach, CA (invited).**
60. Solid-State Lighting: A Case Study in Science and Technology Evolution, J.Y. Tsao, China International Forum on Solid-State Lighting (CIFSSL), Shenzhen, China (12-14 July, 2006).
61. SAND 2007-4125 P. J.Y. Tsao, The Next Semiconductor Revolution: This Time It's Lighting!, International Energy Agency, Paris, France, 6/7/2007, Paris, France.
62. Tsao, J.Y., *The World's Appetite for Light*, Sandia National Laboratories Journal Club Presentation (December 12, 2007) Albuquerque, NM.
63. Tsao, J.Y. *Some Simple Physics of Global Warming*, Bosque School Physics Class (March 14, 2008) Albuquerque, NM. SAND 2008-2255P.
64. J.Y. Tsao, Ultra-Efficient Solid-State Lighting: Performance Frontier, Progress, Challenges, IEEE LEOS Optoelectronic Packaging Manufacturing and Reliability Conference (November 12, 2008) Newport Beach, CA. SAND 2008-7752P.
65. J.Y. Tsao, Characteristics of Ideal Solid-State-Light Sources for General Illumination, SPIE Photonics West (January 29, 2009) Santa Clara, CA. SAND 2009-1447C.
66. J.Y. Tsao, P. Waide, The World's Appetite for Light, Strategies in Light (February 19, 2009) Santa Clara, CA. SAND 2009-1446C.
67. J.Y. Tsao, Solid-State Lighting, American Physical Society March Meeting Special Workshop on Opportunities in Energy Research (March 15, 2009) Pittsburgh, PA. SAND 2009-1674C.
68. J.Y. Tsao, Solid-State Lighting: a Technology and Economics Perspective, Industrial Technology Research Institute Technical Advisory Board Meeting (March 23, 2009) Hsinchu, Taiwan. SAND 2009-1681C.
69. J.Y. Tsao, Solid-State Lighting: Progress and Challenges, Quantum Optics Summer School (August 3, 2009) Jackson Hole, WY.
70. J.Y. Tsao; (Lighting) and Solid-State Lighting; MIT Tech Talk for Sandia recruiting trip; October 21, 2009; Cambridge, MA; Invited.
71. J.Y. Tsao, M.E. Coltrin, J.A. Simmons; Thoughts for EERE SSL LED Roundtable; Department of Energy Office of Energy Efficiency and Renewable Energy Solid-State Lighting Roundtable; November 3, 2009; Washington, DC; Invited.
72. J.Y. Tsao; Solid-State Lighting: Science, Technology and Economic Perspectives; Workshop on the Research Frontiers of Solid State Lighting; December 1, 2009; Nanyang Technological University, Singapore; Invited.
73. J.Y. Tsao; (Lighting) and Solid-State Lighting: Science, Technology and Economic Perspectives; SPIE Photonics West 2010 OPTO Symposium; January 26, 2010; San Francisco, CA; Plenary.
74. J.Y. Tsao; The Next Semiconductor Revolution: This Time It's Lighting!; Academy Lecture; March 31, 2010; Albuquerque Academy, Albuquerque, NM; Invited.
75. J.Y. Tsao; Solid-State Lighting: The III-V Epi "Killer App"; 15th International Conference on Metal Organic Vapor Phase Epitaxy (ICMOVPE-XV); May 24, 2010; Lake Tahoe, CA; Plenary.
76. J.Y. Tsao; Solid-State Lighting: The III-V Epi "Killer App"; 37th Annual Spring Symposium on "White-Light LEDs for Automotive and General Lighting Applications" of the Michigan Chapter of the American Vacuum Society; May 26, 2010; University of Michigan, Ann Arbor, MI; Invited.
77. J.Y. Tsao; Solid-State Lighting: Science, Technology and Economic Perspectives; Center for Energy Nanoscience and Technology Distinguished Lecture Series; June 14, 2010; University of Southern California, Los Angeles, CA; Invited.

78. J.Y. Tsao; (Lighting) and Solid-State Lighting: Science, Technology and Economic Perspectives; SPIE Optics+Photonics; August 1, 2010; San Diego, CA; Plenary.
79. J.Y. Tsao, H.D. Saunders, J.R. Creighton, M.E. Coltrin, J.A. Simmons; Lighting Technologies, Costs, and Energy Demand: Global Developments to 2030; Research Seminar; September 28, 2010; World Bank, Washington DC; Invited.
80. J.Y. Tsao; Solid-State Lighting: It's also about Human Productivity; Corning Stookey Award Ceremony; October 13, 2010; Corning, NY; Keynote.
81. J.Y. Tsao, M.E. Coltrin, J.A. Simmons; Thoughts for EERE SSL LED Roundtable; Department of Energy Office of Energy Efficiency and Renewable Energy Solid-State Lighting Roundtable; November 10, 2010; Washington, DC; Invited.
82. J.Y. Tsao; Solid-State Lighting: It's also about Human Productivity; Taiwan Semiconductor Manufacturing Corporation; November 17, 2010; Hsinchu, Taiwan; Invited.
83. J.Y. Tsao; Solid-State Lighting: It's also about Human Productivity; International Electron Devices and Materials Symposium (IEDMS 2010); November 18, 2010; ChungLi, Taiwan; Plenary.
84. J.Y. Tsao, M.E. Coltrin, M.H. Crawford, J.J. Wierer, J.A. Simmons, "Four Challenges for Solid-State Lighting", 2011 EERE SSL Workshop, San Diego CA, 1-3 February 2011.
85. J.Y. Tsao, "III-V compound semiconductors: where electrons and photons meet," Renaissance Weekend, Laguna Niguel CA, 19 February 2011.
86. J.Y. Tsao, M.E. Coltrin, J.A. Simmons, M.H. Crawford, A. Armstrong, A. J. Fischer, E. A. Shaner, G.T. Wang, J.E. Martin, "Sandia's Energy Frontier Research Center (EFRC) for Solid-State Lighting Science," Sandia National Laboratories Physical, Chemical and Nano Sciences Colloquium, Albuquerque, NM, 13 April 2011.
87. J.Y. Tsao; Lighting, Energy Consumption, Human Productivity; Energy Efficiency Policies and the Rebound Effect Workshop (sponsored by the Center for Climate and Energy Decision Making); June 26-27, 2011; Washington, DC.
88. J.Y. Tsao; Perspectives on Ultra-Efficient Solid-State Lighting: Characteristics, Economics, Approaches; Lecture at LG Innotek; June 26, 2012; Paju, Korea; Invited.
89. J.Y. Tsao; Perspectives on Ultra-Efficient Solid-State Lighting: Characteristics, Economics, Approaches; International LED and Green Lighting Expo; June 26-29, 2012; Kintex, Korea; Invited.
90. J.Y. Tsao; Perspectives on Ultra-Efficient Solid-State Lighting: Characteristics, Economics, Approaches; Nobel Symposium on Nanoscale Energy Converters; August 12-16, 2012; Örenäs Castle, Sweden; Invited.
91. J.Y. Tsao; Perspectives on Ultra-Efficient Solid-State Lighting: Characteristics, Economics, Approaches; IEEE Photonics Society and OSE Seminar; October 10, 2012; University of New Mexico, Albuquerque, NM; Invited.
92. J.Y. Tsao; Perspectives on Ultra-Efficient Solid-State Lighting: Characteristics, Economics, Approaches; Materials Science and Engineering Colloquium; November 2, 2012; Boston University; Invited.
93. J.Y. Tsao; Perspectives on Ultra-Efficient Solid-State Lighting: Characteristics, Economics, Approaches; June 26, 2013; Nagoya University; Invited.
94. J.Y. Tsao; Perspectives on Ultra-Efficient Solid-State Lighting: Characteristics, Economics, Approaches; Materials Science and Engineering Colloquium; October 10, 2013; North American MBE Conference; Banff; Invited.
95. J.Y. Tsao; Solid-State Lighting: Towards Smart and Ultra-Efficient; Institute for Energy Efficiency Seminar; February 12, 2014; UC Santa Barbara; Invited.
96. J.Y. Tsao; Solid-State Lighting: Towards Smart and Ultra-Efficient; March 28, 2014; McGill University; Invited.