Panel on Review of In-house Laboratory Independent Research in Physics at the Army's Research, Development, and Engineering Centers

Committee

C. Kumar N. Patel

Chair

C. KUMAR N. PATEL, NAS/NAE, is the founder, president, and chief executive officer of Pranalytica, Incorporated, a Santa Monica based company that is the leader in quantum cascade laser technology for defense and homeland security applications. He is also professor of physics and astronomy, electrical engineering, and chemistry at the University of California, Los Angeles (UCLA). Previously, he served as vice chancellor for research at UCLA. Prior to joining UCLA, he was the executive director of the Research, Materials Science, Engineering and Academic Affairs Division at AT&T Bell Laboratories, where he began his career by carrying out research in the field of gas lasers. He is the inventor of the carbon dioxide and many other molecular gas lasers that ushered in the era of high-power sources of coherent optical radiation. Dr. Patel was awarded the National Medal of Science for his invention of the carbon dioxide laser. His other awards include the Ballantine Medal of the Franklin Institute, the Zworykin Award of the National Academy of Engineering, the Lamme Medal of the Institute of Electronic and Electrical Engineers, the Texas Instruments Foundation Founders Prize, and many more. Dr. Patel holds a B.E. in telecommunications from the College of Engineering in Poona, India, and received his M.S. and Ph.D. in electrical engineering from Stanford University.

Iain D. Boyd

Member

IAIN D. BOYD is the James E. Knott professor of engineering at the University of Michigan. His research interests involve the development and application of physical models and computational methods for analysis of nonequilibrium gas and plasma dynamics processes. Previously, he worked for four years at NASA Ames Research Center in the areas of aerothermodynamics and space propulsion also led an Air Force study on high energy lasers. Dr. Boyd was a faculty member in mechanical and aerospace engineering at Cornell University for six years. He joined the University of Michigan in 1999. He has authored over 200 journal articles, more than 300 conference papers, and recently published a book entitled Nonequilibrium Gas Dynamics and Molecular Simulation. Dr. Boyd is a fellow of the American Institute for Aeronautics and Astronautics (AIAA), and has received the 1998 AIAA Lawrence Sperry Award, and the 2018 AIAA Thermophysics Award. He is also a fellow of the American Physical Society and a Fellow of the Royal Aeronautical Society. Dr. Boyd serves on the editorial boards of the Journal of Thermophysics and Heat Transfer and Physical Review Fluids. Dr. Boyd was a member of the Air Force Scientific Advisory Board (AFSAB) and served as the vice chair of the board for three years. He earned a Ph.D. in aeronautics and astronautics from the University of Southampton in England.

Dennis K. Killinger

Member

DENNIS K. KILLINGER is distinguished university professor emeritus at the University of South Florida (USF). Dr. Killinger is an internationally recognized expert in laser remote sensing, differential-absorption lidar (DIAL), laser spectral transmission of the atmospheric, and the use of lasers as spectroscopic sensors of remote chemicals and constituents. His accomplishments include the first observation and detailed theoretical study of the limitations to the accuracy of DIAL/LIDAR light detection and ranging remote sensing due to atmospheric turbulence; the DIAL/LIDAR remote sensing of carbon monoxide, nitric oxide, and ammonia gas plumes given off by remote vehicles; first direct comparison of heterodyne and direct detection lidar returns; the first demonstration of the limitation of telescope size for coherent LIDAR and the increased S/N through the use of coherent summation of multi-detector coherent arrays, and more recently the laser induced fluorescence detection of trace organics and plasticizers (BPA) in drinking water at the parts-per-trillion level. He was a program manager at Lincoln Laboratory during the 1980s and led the team in the development and use of tunable carbon dioxide, titanium sapphire (Ti:S), and Co:MgF2 lasers and DIAL/LIDAR systems for the remote sensing of trace gas plumes in the atmosphere. Since 1987, he has been a professor at the University of South Florida and past director of the Lidar Remote Sensing laboratory developing new tunable laser sources and integrating their use into DIAL and lidar remote sensing of atmospheric gases. His group developed the first smoothly tunable, narrow linewidth Ho:YLF laser near 2 microns wavelength and its use in the first remote sensing of CO2 and water vapor in the atmosphere using this technique. In addition, he developed and licensed the HITRAN-PC © software package that is used widely to predict the high-resolution absorption and transmission of laser and lidar beams through the atmosphere. Dr. Killinger has authored over 200 papers and research reports, holds eight research patents on laser spectroscopic applications, and has been PI/Co-PI on over 15 million dollars in grants at USF. Dr. Killinger is a past associate editor of Applied Optics and Optics Letters, was the lead co-author writing the Chapter on Atmospheric Optics in the OSA Handbook of Optics, and recently wrote the History of Laser Remote Sensing, Laser Radar, and Lidar for the Optical Society of America (OSA) Century of Optics compilation. He is a fellow of the OSA, the Photonics Society (SPIE), the American Association for the Advancement of Science (AAAS), the National Academy of Inventors (NAI), and senior member of Institute of Electrical and Electronics Engineers (IEEE). He earned a B.A. in physics from the University of Iowa, an M.S. in physics from DePauw University, and a Ph.D. in Physics from the University of Michigan.

Pierre Meystre

Member

PIERRE MEYSTRE is Regents Professor Emeritus of Physics and Optical Sciences and holds the chair of Quantum Optics at the University of Arizona. Dr. Meystre's research interests include theoretical quantum optics, nonlinear optics, cavity quantum electrodynamics, ultracold atoms and molecules, and atom optics. Prior to coming to Arizona, Dr. Meystre was a staff scientist at the Max-Planck-Institute for Quantum Optics. He is a fellow of the American Physical Society, the Optical Society of America, and the American Association for the Advancement of Science. Dr. Meystre obtained his physics diploma and Ph.D. from the Swiss Federal Institute of Technology in Lausanne.

Shaul Mukamel

Member

SHAUL MUKAMEL, NAS, is a distinguished professor of chemistry and of physics and astronomy in the Department of Chemistry and Department of Physics and Astronomy at the University of California, Irvine. Dr. Mukamel's laboratory is interested in the design of novel ultrafast multidimensional coherent optical spectroscopies for probing and controlling electronic and vibrational dynamics in large molecules in the condensed phase; spectroscopy with quantum optical fields utilizing the quantum nature of optical fields, and photon entanglement to achieve temporal and spectral resolutions not possible with classical light; attosecond nonlinear x-ray spectroscopy of molecules; many-body theory of molecular nanostructures, chromophore aggregates and semiconductor nanoparticles; long range electron transfer, energy funneling, and collective nonlinear optical response of biological light harvesting complexes; photon statistics in single molecule spectroscopy; and the development of a density matrix framework based on "Liouville space pathways" for the design and interpretation of ultrafast spectroscopic signals. He had employed these techniques to study energy and electron transfer in photosynthetic complexes, excitons in semiconductor nanostructures and the secondary structure of proteins. Dr. Mukamel earned a B.Sc., MSc, and Ph.D. in physics from Tel Aviv University.