

Assessment of High Energy Density (HED) Physics

Committee

Giulia Galli

Co-Chair

Giulia Galli is the Liew Family professor of Electronic Structure and Simulations in the Pritzker School of Molecular Engineering and Professor of Chemistry at the University of Chicago. She also holds a Senior Scientist position at Argonne National Laboratory, where she is the director of the Midwest Integrated Center for Computational Materials. Prior to joining UChicago, she was Professor of Chemistry and Physics at UC Davis (2005-2013) and the head of the Quantum Simulations group at the Lawrence Livermore National Laboratory (LLNL, 1998-2005). She holds a Ph.D. in Physics from the International School of Advanced Studies in Italy.

Raymond Jeanloz

Co-Chair

Raymond Jeanloz is a professor of Earth and Planetary Science and Astronomy at the University of California at Berkeley, and an Annenberg Distinguished Visiting Fellow at the Hoover Institution. In addition to his scientific research on the evolution of planetary interiors and properties of materials at high pressures, he works at the interface between science and policy in areas related to national and international security, resources and the environment, and education. He chairs the National Academy of Sciences Committee on International Security and Arms Control, is a member of the JASON group that provides technical advice to the US government; he has served on the Secretary of State's International Security Advisory Board, and is past chair of the National Research Council Board on Earth Sciences and Resources. He holds a PhD from the California Institute of Technology and was on the faculty at Harvard University before coming to UC Berkeley.

Felicie Albert

Member

FÉLICIE ALBERT is the deputy director of LLNL's High Energy Density Science Center and Jupiter Laser Facility, and a research scientist in LLNL's National Ignition Facility and Photon Science Directorate. Her areas of expertise include the generation and applications of novel sources of electrons, X rays, and gamma rays through laser-plasma interaction, laser-wakefield acceleration, and Compton scattering for applications in high energy density (HED) science and warm dense matter studies. She has conducted many experiments using high-intensity and high-energy lasers at various facilities around the world including the National Ignition Facility, the OMEGA Laser, and the LCLS X-ray free electron laser. She received the Presidential Early Career Award for Scientists and Engineers (PECASE) in 2019, and a 2016 Department of Energy (DOE) Early Career Research Program Award to develop new x-ray sources for HED science experiments. She received the 2017 American Physical Society's Division of Plasma Physics (APS-DPP) Katherine E. Weimer Award for outstanding contributions to plasma science research and the 2017 Edouard Fabre Prize for contributions to the physics of laser-produced plasmas. She is a senior member of the Optical Society of America, and a Fellow of the APS-DPP. She earned her Ph.D. in physics from Ecole Polytechnique, France. She is a member of the International Committee on Ultra Intense Lasers (ICUIL), served as chair of LaserNetUS in 2020-2022, and is on the organizing committee of the National Academy of Sciences' (NAS's) Annual Kavli Frontiers of Science Symposium.

David M. Ceperley

Member

David Ceperley is professor of physics at the University of Illinois Urbana Champaign. Early in his career he was employed at Lawrence Livermore National Laboratory. He was one of the developers of methods to simulate quantum many-body systems such as the electron gas, liquid helium and dense hydrogen. He is a member of the National Academy of Sciences. He previously served as a member of the NAS evaluation of NSF's Materials Research Centers.

Gilbert Collins

Member

Gilbert 'Rip' W. Collins is Tracy Hyde Harris Professor of Mechanical Engineering and Physics and Astronomy, Associate Director for the Laboratory for Laser Energetics, and Director of the Center for Matter at Atomic Pressures, a Physics Frontier Center funded by NSF. He explores extreme states and processes of matter from thermonuclear burning plasma to dense quantum materials. From 1989 to 2016, he was with Lawrence Livermore National Laboratory, Livermore CA, USA, as a Staff Physicist (1989-1995), Group Leader for Hydrogen Research (1995-2005), Project leader for Implosions and Hydrodynamics (1997-2006), Group Leader for High Energy Density Shock Physics (2002-2016), Associate Division Leader for Physics (2011-2016), Director for the Center for High Energy Density Physics (2015-2016), and Distinguished Member of the Technical Staff (2014-2016). He received his Ph.D. in Physics from Ohio State University in 1989. He is working to develop a high energy density science curriculum, holds a visiting scientist position at Lawrence Livermore National Laboratory and visiting Professorships at The University of Edinburgh and Oxford University, UK. He has contributed to several decadal, Basic Research Needs, and Advisory Reports sponsored by NSF, Office of Science, and NNSA.

Franklin Dollar

Member

FRANKLIN J. DOLLAR is an associate professor in the Department of Physics and Astronomy and the associate dean of graduate studies in the School of Physical Sciences at the University of California, Irvine, and an enrolled member of the Dry Creek Band of Pomo Indians. His research interests involve laser plasma interactions with ultrafast laser systems, performing high-intensity laser experiments with near and above critical density plasmas for tabletop particle acceleration and the generation of soft and hard x-rays; and the simulation of such experiments using numerical modeling. He is involved with a variety of recruitment and retention efforts for underrepresented students in the science, technology, engineering, and mathematics (STEM) fields, with a particular focus on American Indians. He serves on numerous committees including the Department of Energy's LaserNetUS Scientific Advisory Board, the Fusion Energy Science Advisory Committee, and the executive steering committee for the University of California Leadership & Excellence Through Advanced Degrees program. He is a Kavli Fellow, a Sloan Research Fellow, and a Fellow of the American Physical Society. He is an awardee of the NSF CAREER award, the Tom Angell Faculty Mentorship Award, and the American Indian Science & Engineering Society's Most Promising Scientist Award.

Nathaniel J. Fisch

Member

Nathaniel J. Fisch is professor of astrophysical sciences in the Department of Astrophysical Sciences and director of the Program in Plasma Physics at Princeton University. He is also the associate director for academic affairs at the Princeton Plasma Physics Laboratory and an associated faculty in the Department of Mechanical and Aerospace Engineering at Princeton University. Dr. Fisch predicted new ways to control plasma, including methods of generating electrical current in plasma using electromagnetic waves. He also predicted plasma-based methods of achieving the next generation of laser intensities. His current research interests include plasma applications to nuclear fusion, lasers, propulsion, nuclear waste remediation, and astrophysics. Dr. Fisch is a recipient of a Guggenheim Fellowship, the American Physical Society (APS) Award for Excellence in Plasma Physics, the Department of Energy Bronze Medal for Outstanding Mentor, the Ernest Orlando Lawrence Award, the James Clerk Maxwell Prize for Plasma Physics, the European Physical Society Hannes Alfvén Prize, and the Fusion Power Associates Distinguished Career Award. He is a Fellow of the APS and the NASA Institute for Advanced Concepts. He earned his Ph.D. degree in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology. He served as a member on the Board of Physics and Astronomy and as chair of the APS Division of Plasma Physics.

Stephanie Hansen

Member

Stephanie Hansen is a Distinguished Member of the Technical Staff in the ICF target design group at Sandia National Laboratories, where she studies the atomic-scale behavior of atoms in extreme environments and develops atomic, spectroscopic, equation-of-state, and transport models to help predict and diagnose the behavior of high energy-density plasmas. She is the author and developer of the SCRAM non-LTE spectroscopic modeling code and MUZE, a self-consistent field code used for equation-of-state, scattering, and transport calculations. She received an Early Career grant from the Department of Energy's Office of Fusion Energy Sciences in 2014, was awarded the Presidential Early Career Award for Scientists and Engineers in 2017, and was elected a Fellow of the American Physical Society's Division of Plasma Physics in 2019. She holds degrees in Physics and Philosophy from the University of Nevada, Reno and has been a Visiting Associate Professor at Cornell University since 2012.

Russell J. Hemley

Member

Russell J. Hemley holds the position of Distinguished Chair in the Natural Sciences and Professor of Physics and Chemistry at the University of Illinois at Chicago. His research explores the behavior of matter and materials in extreme environments, notably high pressures and temperatures, and has co-authored approximately 670 scientific publications. He received his B.A. from Wesleyan University, and M.A. and Ph.D. from Harvard University, all in chemistry. Previously, he worked at the Carnegie Institution and has held positions at Lawrence Livermore National Laboratory, Cornell University, and George Washington University. He is a Member of the National Academy of Sciences, Fellow of the American Academy of Arts and Sciences, Corresponding Fellow of the Royal Society of Edinburgh, Honoris Causa Professor of the Russian Academy of Sciences, and is a recipient of the Balzan Prize and Percy W. Bridgman Award, among other honors. He has directed national materials science centers funded by the DOE and DoD, and has served on numerous DOE, DoD, and Academy committees.

Carolyn Kuranz

Member

Carolyn C. Kuranz is an associate professor of plasma science and engineering in the Department of Nuclear Engineering and Radiological Sciences at the University of Michigan (UM). At UM, Dr. Kuranz has led experimental research in high-energy-density (HED) science at high-energy laser and pulsed power facilities. Her research interests include HED hydrodynamic instabilities, radiation hydrodynamics, and magnetized plasmas. She is the recipient of National Ignition Facility Photon Science Award, the American Astronomical Society Laboratory Astrophysics Division Early Career Award, and American Physical Society Fellowship. She earned her Ph. D in Applied physics from the University of Michigan. She served as a co-chair of the Fusion Energy Science Community Planning Process. Dr. Kuranz is also an ex officio member of the American Physical Society Division of Plasma Physics Executive Committee.

Charles F. McMillan

Member

CHARLES F. McMILLAN was the 10th director of Los Alamos National Laboratory and President of Los Alamos National Security, LLC, from June 2011 to December 2017. During his appointment, Dr. McMillan guided Los Alamos through continuing high levels of mission execution. He signed seven annual assessment reports to the president and Congress evaluating the Los Alamos-designed weapons in the stockpile. Under Dr. McMillan's leadership, the laboratory continued to innovate new techniques and tools to ensure that nation's deterrent remained safe, reliable, and effective. In retirement, Dr. McMillan continues to serve the national security enterprise on various boards and review committees. Prior to becoming laboratory director, Dr. McMillan served as the principal associate director for weapons programs. He was responsible for the science, technology, engineering, and infrastructure enabling the laboratory to fulfill its nuclear deterrent mission. Dr. McMillan directed research that supported the technical analysis necessary to ensure stockpile safety, security, and effectiveness. This included small-scale materials experiments through fully integrated hydrotests that provided essential modeling and simulation data necessary for validation in the absence of full-scale nuclear testing. Dr. McMillan has more than 30 years of scientific and leadership experience in weapons science, stockpile certification, experimental physics, and computational science. He began his career as an experimental physicist at LLNL in 1983, where he held a variety of research and management positions for two decades. He holds a doctorate in physics from MIT and a bachelor's degree in mathematics and physics from Washington Adventist University. He has earned two DOE Awards of Excellence for his work in developing an innovative holographic tool that enhanced the ability of scientists to predict nuclear performance. He is a frequent speaker on the vital role of national laboratories for the nation and the importance of STEM education in cultivating the talent necessary to sustaining that role in the future.

Sekazi K. Mtingwa

Member

SEKAZI K. MTINGWA is an administrative judge with the U.S. Nuclear Regulatory Commission. He also is a principal partner at TriSEED Consultants, LLC, in Hillsborough, North Carolina, which provides consulting services in STEM, education, and economic development. Dr. Mtingwa played an important role in the design and construction of accelerator systems at Fermilab that were used in the discovery of the top quark. He co-founded the National Society of Black Physicists and the National Society of Hispanic Physicists. Internationally, he co-founded a number of organizations, including the African Laser Centre, which is a network of over 30 laser laboratories throughout Africa and for which he wrote the Strategy and Business Plan; African Physical Society; Mwalimu Julius K. Nyerere University of Agriculture and Technology in Tanzania, for which he contributed to the design; African Institute for Mathematical Sciences in Ghana; African Light Source Foundation, for which he served as the deputy chair; Lightsources for Africa, the Americas, Asia, Middle East, and Pacific, which seeks to enhance synchrotron light source and crystallography sciences in developing countries, for which he chairs the Executive Committee; and African Review of Physics. He chaired the writing of the Strategic Plan for South Africa's synchrotron light source user community, resulting in South Africa becoming an associate member in 2013 of the European Synchrotron Radiation Facility. Dr. Mtingwa serves as the president of the Interdisciplinary Consortium for Research and Educational Access in Science and Engineering, which seeks to increase the utilization of research facilities at the national laboratories by faculty and students from African-, Latino-, and Native-American Serving Institutions. He is associate member and former chair of the International Union of Pure and Applied Physics C13 Commission on Physics for Development. Dr. Mtingwa retired as a professor of physics at North Carolina A&T State University, and spent several years as the Martin Luther King, Jr. Visiting Professor of Physics and Senior Lecturer at MIT. He is a Fellow of the APS, the American Association for the Advancement of Science, and the National Society of Black Physicists. Dr. Mtingwa is the co-recipient with Anton Piwinski of the Deutsches Elektronen-synchrotron and James Bjorken of Stanford University of the APS 2017 Robert R. Wilson Prize for Achievement in the Physics of Particle Accelerators for the detailed theoretical description of intrabeam scattering. This phenomenon sets ultimate limitations on the performance of a wide class of accelerators, including synchrotron light sources, electron damping rings, and hadron colliders. Their work played a crucial role in the discovery of the top quark at Fermilab and the Higgs boson at CERN's Large Hadron Collider. By receiving the Wilson Prize, Dr. Mtingwa became the first African American to be awarded an APS prize, which is the society's highest category of honors. Dr. Mtingwa received the 2015 Distinguished Service Award from the American Nuclear Society for chairing a 2008 APS study on 21st-century nuclear workforce needs. That study was an important influence leading to the DOE's decision to allocate 20 percent of its nuclear fuel cycle research and development budget to university programs. For his work on mentoring generations of students, faculty, and administrators, Dr. Mtingwa received the 2017 U.S. Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring. Dr. Mtingwa earned a Ph.D. in physics from Princeton University in 1976.

Donna T. Strickland

Member

Donna Strickland received her B. Eng. Degree in Engineering Physics, from McMaster University in 1981. She graduated from the University of Rochester in 1989 with a Ph.D. in Optics. From 1988 to 1991, Dr. Strickland was a research associate at the National Research Council of Canada. From 1991 to 1992, she was a physicist with the laser division of Lawrence Livermore National Laboratory. In 1992, she became a member of the technical staff of Princeton's Advanced Technology Center for Photonics and Opto-electronic Materials. Dr. Strickland joined the physics department of the University of Waterloo as an assistant professor in January 1997. She was promoted to Full Professor in 2018. Her current research interests include ultrafast laser development and nonlinear optics.

Along with her PhD supervisor, Dr. Gerard Mourou, Donna Strickland shared half the 2018 Nobel Prize in physics for inventing Chirped Pulse Amplification (CPA), which made it possible to amplify ultra-short pulses to unprecedented levels. Donna Strickland is a Companion of the Order of Canada. She is an Honourary Fellow of the Canadian Academy of Engineering and a Fellow of the Royal Society of Canada. She is also a Fellow of the Royal Society, an Honourary Fellow of the Institute of Physics (UK) and an international member of the National Academy of Sciences (USA).