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Michigan Institute for Plasma Science and Engineering

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Dr. Sarah Nelson

National Nuclear Security Administration

Lasers, Z Pinches, and Nuclear Weapons: The Importance of Plasma Physics to the NNSA

Since the cessation of explosive nuclear weapons testing in 1992, the U.S. Department of Energy's (DOE) National Nuclear Security Administration (NNSA) has relied on science-based stockpile stewardship to ensure the safety, security, and reliability of its nuclear deterrent. One aspect of that science basis is through an understanding of high-energy density (HED) physics phenomena, by conducting experiments at flagship National facilities such as Sandia National Laboratory's Z Machine and Z-Beamlet, University of Rochester's Omega Laser Facility and Omega EP, and Lawrence Livermore National Laboratory's National Ignition Facility (NIF). Data obtained on these facilities are not only used to understand fundamental HED physics, but are also used to validate theoretical models and simulations. NNSA's HED facilities are used for other measurements important to our nuclear deterrent and its modernization, such as an understanding of certain material properties such as strength and equation-of-state. My talk will focus on NNSA Defense Program's mission, the role of science-based stockpile stewardship through the Office of Stockpile Research, Technology, and Engineering, the scientific breadth of the Office of Experimental Sciences, and the HED science and facilities therein. Current efforts and future plans will be covered, as well as the role of university research and training.

About the Speaker: Dr. Sarah Nelson, a nuclear and radiochemist, is Deputy Director of the Office of Experimental Science for the NNSA Office of Defense Programs. Sarah earned her BS from U. California Santa Barbara and doctorate from U. California Berkeley studying odd-Z transactinide compound nucleus reactions including the discovery of the new isotope 260Bh. Prior to joining NNSA, Sarah was the Roger Batzel Fellow at Lawrence Livermore National Laboratory in nuclear chemistry diagnostic development for NIF and analysis of nuclear systems for domestic counterterrorism applications, co-discovering 14 new transactinide isotopes. Sarah also was selected as a Christine Mirzayan Science & Technology Policy Fellow of The National Academies in 2012. Prior to NNSA, Sarah was also with Pacific Northwest National Laboratory on assignment with the Defense Threat Reduction Agency. She has received numerous awards including the DTRA/US STRATCOM Center for Combatting Weapons of Mass Destruction Director's Award, LLNL's Excellence in Publication Award in Basic Science, and the Gordon Battelle Prize for Scientific Discovery.