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Michigan Institute for Plasma Science and Engineering

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Room 1311 EECS

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A New Regime of HED Physics: Coupling High-Rep-Rate Lasers with Cognitive Simulation

As high-intensity short-pulse lasers that can operate at high-repetition-rate (HRR) (>10 Hz) come online around the world, the high-energy-density (HED) science they enable will experience a radical paradigm shift. The >10^3 increase in shot rate over today's shot-per-hour drivers translates into dramatically faster data acquisition and more experiments, and thus the potential to *significantly accelerate the advancement of HED science*. However, to fully realize the potential benefits of HRR facilities requires a fundamental shift in how they are operated, and in fact, how the experiments performed on them are designed and executed. Current energetic driver facilities depend on the ability to manually tune the lasers, the targets, the diagnostics settings, and more, between single shots or sets of shots through a manual feedback loop of data collection, data analysis, and optimization largely driven by experience and intuition. At 10 Hz, this paradigm is no longer sustainable as more complex data is collected more quickly than is possible to analyze manually. Simultaneously, on-the-fly optimization of experiments will become ever more crucial as higher repetition rates will lead to more deliberate inter-shot variations and the improved operational range to allow exploration over larger regions of phase space. Consequently, it is likely that the next generation of laser facilities will be limited not by their hardware but by our ability to use that hardware effectively. We will present the vision and ongoing work to realize a HRR framework for rapidly delivered optimal experiments coupled to cognitive simulation to provide new insights in HED science.

About the Speaker: Dr. Tammy Ma is the Advanced Photon Technologies Program Element Leader for High-Intensity Laser High Energy Density (HED) Science within NIF & Photon Sciences at the Lawrence Livermore National Lab. Her group pioneers use of the highest intensity lasers in the world to investigate novel high energy density states of matter, generate energetic beams of particles, study laboratory astrophysics, and explore fusion physics. Dr. Ma graduated with a B.S. from the California Institute of Technology, and received her M.S. and Ph.D. from the U of California at San Diego. She has authored or co-authored over 185 refereed journal publications, and currently sits on the Fusion Energy Sciences Advisory Committee (FESAC), providing advice to the U.S. DOE's Office of Science on issues related to fusion energy and plasma research. She is the recipient of the Presidential Early Career Award for Science and Engineering (PECASE), the APS Thomas H. Stix Award for her work in quantifying hydrodynamic instability mix in ICF implosions, and the DOE Early Career Research Award. She currently also serves as LLNL's Deputy Director for Laboratory Directed Research & Development (LDRD) Program.