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Michigan Institute for
Plasma Science and Engineering

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3:30 pm
Room 1005 EECS

Dr. Ronnie Shepherd

Lawrence Livermore National Lab.

Extremely Difficult, Hard to Validate, Painful to Analyze (but Exciting!): Experiments Studying Radiation and Heat Transport of Laboratory Plasmas at Near Astrophysical Conditions

For generations humans have looked to the stars and wondered how they work. The nuclear furnace burns, energy is generated, heat moves around, and radiation escapes. This all works seemlessly. Scientist have worked for many years on theories that describe the detailed plasma physics associated with the energy production and loss mechanism of stellar interiors but until recently experimental platforms to test this physics were not available. As one would expect, understanding this physics also provides important information for accurate simulations of Inertial Confinement Fusion (ICF) implosions. In this presentation, experiments are presented that test two important physics effects in plasmas approaching astrophysical conditions. The first is a campaign to understand radiation emission and absorption in high density, high temperature plasmas. These experiments are performed at densities $\geq$2 g/cc and electron temperatures $\geq$500 eV. This platform has also been used to test the effects of high density matter on bound states. The second experiment is in the early stages of development and is designed to understand heat transport in high density plasmas. A design scope and preliminary experiments will be discussed.

About the Speaker: Dr. Ronnie Shepherd is a senior experimental physicist in the High Energy Density Physics section at Lawrence Livermore National Laboratory where he has been for the past 28 years. He has performed research in areas from x-ray lasers to shock heating on pulse power, long-pulse laser facilities (e.g., Nova and Omega, Orion), and short pulse laser facilities (e.g., Titan, LULI, Rutherford, Orion, LCLS). This research has been driven by a desire to understand stellar interiors. His current research focuses on energy transport, opacity and ionization in dense plasmas and as part of the CIMARRON project (a collaboration between theory and experiment to understand detailed physics of dense plasmas), Dr. Shepherd was a co-recipient of the 2012 Director's Science and Technology Award. He is now the lead physicist in a research effort to study emission opacities in dense matter using short pulse laser generated plasmas. Dr. Shepherd received his BSE, MSE and Ph. D. from NERS at the University of Michigan.