

Joint seminar with NERS



Friday
February 7, 2014
4:00 pm
Room G906
(White Auditorium)
Cooley Building

Dr. Siegfried H. Glenzer

SLAC National Accelerator Laboratory

Exploring the Physical Properties of Matter in Extreme Conditions

One of the great challenges of this century is to determine if nuclear fusion of hydrogen isotopes can be demonstrated in the laboratory and developed into an unlimited carbon-free energy source. Recent experiments to achieve a burning plasma state at the National Ignition Facility have led to the important finding that a successful demonstration will require much improved understanding of the microscopic physics of dense plasmas. In this talk, we will present a new high-energy-density science program at SLAC aimed at pursuing discovery-class science of fusion plasmas. Here, we use the seeded LCLS (Linear Coherent Light Source) beam with x-ray pulses with the highest peak brightness available today. This capability allows us to measure plasmons in shock-compressed matter. For example, high-density aluminum has been compressed up to a mass density of 7 g cm^{-3} with a free electron density of $n_e = 4.7 \times 10^{23} \text{ cm}^{-3}$ and a temperature of 30,000 K. In these conditions, we visualize the density and pressure evolution by resolving correlations up to distances comparable to the atomic size of aluminum. Our data allow direct determination of pressure for validating models for thermodynamics at high pressure. We will show how LCLS data relate back to the design of ignition fusion experiments and will discuss future plans for the study of hot and dense matter.

About the Speaker: Siegfried Glenzer, a graduate of the Ruhr-Universität-Bochum, Germany, is the High-Energy-Density science program leader at SLAC National Accelerator Laboratory. He joined SLAC as a distinguished scientist in 2013 to build a new discovery-class program exploring matter in extreme conditions using high-power lasers and the world-class Linac Coherent Light Source x-ray beam. Before joining SLAC, he held the plasma physics group leader position at the Lawrence Livermore National Laboratory for 12 years, where he led the first inertial confinement fusion experiments on the National Ignition Facility. He has also been visiting lecturer at the University of California, Berkeley. He is the individual recipient of the American Physical Society "Excellence in Plasma Physics" Award (2003). In 2004, he won the Alexander-von-Humboldt senior research prize and spent a research and teaching year at the Universität Rostock and at the Deutsche Elektronen Synchrotron in Hamburg, Germany. Siegfried authored and co-authored more than 350 publications in refereed journals, published the textbook "Plasma Scattering of Electromagnetic Radiation" by D. H. Froula, S. H. Glenzer, N. C. Luhamn, Jr., J. Sheffield, 2nd ed. (Elsevier, 2010) and is a fellow of the American Physical Society.