TRANSFORMATIVE DIAGNOSTICS FOR HIGH ENERGY DENSITY SCIENCE

G.A. Rochau[1], J.D. Kilkenny[2], S. Batha[3], P.M. Bell[4], D. Bradley[4], E.M. Campbell[1], J.A. Frenje[5], D.H. Froula[6], H.W. Herrmann[3], T.J. Hilsabeck[2], W.W. Hsing[4], J.P. Knauer[6], J.A. Koch[7], R.J. Leeper[3], R.E. Merrill[3], R.D. Petrasso[5], J.L. Porter[1], T.C. Sangster[6], J. Weaver[8]
[1]Sandia National Laboratories, Albuquerque, NM, USA
[2]General Atomics, La Jolla, CA, USA
[3]Los Alamos National Laboratories, Los Alamos, NM, USA
[4]Lawrence Livermore National Laboratories, Livermore, CA, USA
[5]Massachusetts Institute of Technology, Cambridge, MA, USA
[6]University of Rochester, Rochester, NY, USA
[7]National Security Technologies, NV, USA
[8]Naval Research Laboratory, DC, USA
garocha@sandia.gov

Significant opportunity exists in a wide range of topics in High Energy Density (HED) Science resulting from the major investments made in facilities and simulations over the last decade. Taking full advantage of this opportunity requires a new generation of diagnostic capabilities with significantly enhanced precision and resolution in time, space and spectral coverage. With the support of the US National Nuclear Security Administration, the HED experimental community has developed a national diagnostics strategy intended to identify and exploit a suite of new technologies that will significantly enhance the experimental capabilities at the major HED facilities in the US; NIF, Z, and Omega. Central to this strategy are a group of innovative diagnostics that represent major national efforts with the potential to transform experimental capability for the most critical science needs across the complex. These transformative diagnostics include the capability to record multiple frames of x-ray imaging/spectroscopy data along a single line-of-sight with <10 ps temporal resolution over a wide range of photon energies and <5 micron spatial resolution, measure the localized plasma conditions in a >1 MJ hohlraum, visualize a fusion burn wave in three-dimensions, time-resolve the spectrum of fusion products from ICF plasmas, and time-resolve the phase change in materials compressed to multi-Mbar pressures. We present the need, the potential, and the development path for these promising new diagnostic technologies for HED science. Sandia is a multi-program laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.