DPP13-2013-000726

Abstract for an Invited Paper
for the DPP13 Meeting of
the American Physical Society

The Z Astrophysical Plasma Properties Collaboration[1]

GREGORY ROCHAU, Sandia National Laboratories

The Z Facility at Sandia National Laboratories provides near-thermal, MJ-class x-ray sources that emit at powers up to 0.3 PW. This capability enables precise benchmark experiments of fundamental material properties in radiation heated matter at conditions previously unattainable in the laboratory. Experiments on Z can produce uniform, long-lived, and large plasmas at conditions that span volumes up to 100 cm^3, temperatures from 1-200 eV, and electron densities from 1E16-23 cm^{-3}. These unique characteristics and the ability to radiatively heat multiple experiments in a single shot have led to a new effort called the Z Astrophysical Plasma Properties (ZAPP) collaboration. This collaboration includes four national laboratories (SNL, LANL, LLNL, and CEA) and three universities (UT-Austin, UN-Reno, and Ohio State) and has been enabled by recent support from the NNSA in fundamental High Energy Density science. The focus of the ZAPP collaboration is to reproduce the radiation and material characteristics of astrophysical plasmas as closely as possible in the laboratory and use detailed spectral measurements to strengthen models for atoms in plasmas. Specific issues under investigation include the LTE opacity of iron at stellar-interior conditions, H-Balmer line shapes in white dwarf photospheres, photoionization around active galactic nuclei, and the efficiency of resonant Auger destruction in black-hole accretion disks. Each of these issues can be simultaneously studied with high precision by acquiring up to 59 individual spectra on a single Z shot. We present the challenges, opportunities, and initial results from ZAPP experiments on Z.

[1]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.