DPP15-2015-000831

Abstract for an Invited Paper
for the DPP15 Meeting of
the American Physical Society

Analyzing non-LTE Kr plasmas produced in high energy density experiments: from the Z machine to the National Ignition Facility[1]

ARATI DASGUPTA, Plasma Physics Division, Naval Research Laboratory, Washington DC 20375

Designing high fluence photon sources above 10 keV are a challenge for High Energy Density plasmas. This has motivated radiation source development investigations of Kr with K-shell energies around 13 keV. Recent pulsed power driven gas-puff experiments on the refurbished Z machine at Sandia have produced intense X-rays in the multi-keV photon energy range. K-shell radiative yields and efficiencies are very high for Ar, but rapidly decrease for higher atomic number (Z_A) elements such as Kr. It has been suggested that an optimum exists corresponding to a trade-off between the increase of photon energy for higher Z_A elements and the corresponding fall off in radiative power. However the conversion efficiency on NIF, where the drive, energy deposition process, and target dynamics are different, does not fall off with higher Z_A as rapidly as on Z. We have developed detailed atomic structure and collisional data for the full K-, L- and partial M-shell of Kr using the Flexible Atomic Code (FAC). Our non-LTE atomic model includes all collisional and recombination processes, including state-specific dielectronic recombination (DR), that significantly affect ionization balance and spectra of Kr plasmas at the temperatures and densities of concern. The model couples ionization physics, radiation production and transport, and magnetohydrodynamics. In this talk, I will give a detailed description of the model and discuss 1D Kr simulations employing a multifrequency radiation transport scheme. Synthetic K- and L-shell spectra will be compared with available experimental data. This talk will analyze experimental data indicative of the differences between Z and NIF experimental data and discuss how they affect the K-shell radiative output of Kr plasma.

[1]Work supported by DOE/NNSA