A Comparison of Plasma Conditions Inferred from Optical Thomson Scattering Measurements and X-ray Spectroscopy

E.V. Marley[1]*, G. Swadling[1], C.Bruulsema[1], E. R. Toro[2], J. Katz[3], E. Folsom[1]

[1]Lawrence Livermore National Laboratory
[2]Stanford University, Department of Mechanical Engineering
[3]Laboratory For Laser Energetics University of Rochester

The K-shell emission of low- and mid-Z elements are commonly used in HED plasma experiments to infer the plasma conditions. A study has been done utilizing simultaneous x-ray spectroscopy and Optical Thomson Scattering (OTS) measurements to compare the electron temperature inferred from the ion acoustic wave (IAW) feature and from fitting the measured x-ray spectra with atomic kinetics codes. A buried layer platform was used to create uniform non-local thermodynamic equilibrium plasmas (ne $\sim$ few $10^{21}/\mathrm{cm}^3$, Te $\sim$0.8 — 1.2 keV) for this study. The target was a 250 μm diameter, 200 nm thick dot buried between two 1000 μm diameter, 5 μm thick beryllium foils. Lasers heat the target from both sides for 3ns. The density was inferred using both the electron plasma wave EPW feature as well as the size of the emitting volume measured with time resolved x-ray imaging. Two different target materials were used for the study: titanium and copper. The K-shell emission of the titanium and the K- and L-shell emission of the copper were measured time resolved. The comparison of the plasma conditions inferred from fitting the x-ray spectra with different atomic kinetic codes and the OTS measurements will be discussed.

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*E-mail: marley2@llnl.gov