P19

Plasma Radiative properties experiments at AWE

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X-ray spectra are pivotal in the diagnosis of plasma properties experiments. Of a particular interest in the high temperature plasma physics experiments at AWE is the diagnosis of the plasma temperature and density inferred from the K-shell emission line ratios, for example the He_β/Ly_β line ratios, and the Stark Broadening by modelling the sample material's X-ray emission spectrum [1]. Recently, K shell X-ray absorption spectra of low Z elements have been obtained from short pulse laser heated experiments conducted at the ORION high power laser at AWE [2,3,4]. We present the experimental K-shell absorption spectra obtained from such experiments using a potassium chloride (KCl) sample, as part of an experimental platform development for short pulse heated hot, dense absorption experiments [1]. AWE's Orion laser uses short pulses to induce resistive heating in multilayer foil targets. A transverse temperature gradient in the heating is exploited to produce a hot, dense gold layer that acts to backlight the KCl sample heated up to temperatures in excess of 300eV, at near solid density [1]. Theoretical models of both CH (assumed to be pure C) and KCl were used to generate synthetic spectra to compare to the KCl measurements [4]. Due to the high temperature of the KCL sample, assumption of local thermodynamic equilibrium (LTE) was investigated by using non-LTE models. AWE's average atom opacity code, CASSANDRA, was used to generate spectra assuming an LTE model and the atomic kinetics code, FLYCHK, was executed to generate a non-LTE model spectrum of KCl [5,6,7]. The KCl modelling accounted for possible gradients in the sample by combining model spectra at different temperatures.

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