Benchmarking of spectral line-shapes as diagnostics of dense plasma electron density

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The development of short-pulse heated buried layer experiments has allowed the study of dense plasma spectra at high temperatures. Electron temperatures in excess of 1keV have been demonstrated and electron densities up to 10^{24}/cc. A feature of such dense plasma is the Stark broadening of line profiles, which can be used to infer plasma properties such as electron density. This method has been widely used in capsule experiments to infer plasma conditions in the range 10^{23} -10^{25} /cc. However, the theory of line-broadening has been tested against alternative methods of obtaining the plasma conditions only at much lower densities in low Z materials; up to 10^{19}/cc. The experiments described here obtain the plasma density from fitting line shapes and via an alternative method. In the alternative method the buried layer sample plasma conditions constrain the possible material density and the ionization, inferred from emission line ratios, allows electron density to be inferred without fitting line-shapes for cases in excess of 10^{23} /cc electron density. The methods are compared and the uncertainties in the plasma conditions are discussed.