

Inference of electron density in the hot spot of NIF capsules from krypton helium- β Stark line shapes

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The dHIRES (DIM based high resolution) x-ray spectrometer measures Kr He α and He β spectra from NIF compressed capsules with 10-eV spectral and 30-ps temporal resolution. Theoretical calculations of the Stark-broadened line shape of the He β complex (unbroadened components: 3^3P_1 , 3^1P_1 , 3^1D_2) show monotonic variations with electron density of the line widths, line energies, and intensity of the peaks associated with the lower energy 3^3P_1 and higher energy 3^1D_2 lines relative to that associated with the main, central energy 3^1P_1 peak. Comparison of the measured Kr He β complex line profiles with the theoretical line shapes provides a measure of the time history of the electron density. Inferred electron densities in these preliminary investigations are in the range $(2 - 7) \times 10^{24} \text{ cm}^{-3}$ and show reasonable agreement with LASNEX predictions for two of the NIF shots. These theoretical predictions of line shapes and comparisons with measured spectra will be shown for some NIF shots with Kr-doped capsules.

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