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Ionization Measurements in 30-fold Compressed, Near-Degenerate Plasmas

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A precise knowledge of ionization at given temperature and density is required to accurately model compressibility and heat capacity of materials at extreme conditions. We have developed an experimental platform for x-ray Thomson scattering (XRTS) measurements at the National Ignition Facility [1-3] to characterize the plasma conditions in plastic and beryllium capsules in implosion experiments near stagnation. Recently, we have demonstrated XRTS measurements from capsules that were compressed to 30 g/cm³ and inferred electron densities approaching 1025 cm⁻³, corresponding to a Fermi energy of 170 eV and pressures exceeding 1 Gbar. We will discuss recent results, which show significantly higher ionization than predicted by widely-used ionization models like Stewart & Pyatt.

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