X-ray characterization of picosecond, dense and hot plasmas

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To constrain theoretical and numerical models on the x-ray emissivity and opacity of hot, dense matter (~ solid density, and temperature ~ keV), we have carried out several laser-plasma interaction experiments at the LULI2000 laser facility. Hydrogen-like and Helium-like x-ray emission of buried Al/Ti layers in thin (~ 4 μm) solid foils was resolved spatially and temporally on different instruments. We prove that the buried layers are heated up to a 1.5 keV temperature, while keeping a density close to solid, when irradiated by a relativistic, 1 ps, 50 J laser beam focused to a 10 μm focal spot. We detail the temporal and spatial characteristics of the observed x-ray emission, and compare to atomic models in order to estimate the plasma temperature, density, and size.