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A Computational Study of X-ray Emissions from Laser-Irradiated Under-dense High-Z X-ray Sources[1] JEFFREY COLVIN, MARK MAY, KEVIN FOURNIER, STEPHEN MOON, HOWARD SCOTT, Lawrence Livermore National Laboratory — We generate x-rays from plasmas that are not in local thermodynamic equilibrium (LTE). We first discuss simulations of the x-ray spectral emissions from laser-irradiated very low-density Ge-doped aerogel targets using a 2D radiation-hydrodynamics code incorporating a modern Detailed Configuration Accounting atomic model in non-LTE. We present the details of the computational model and show that, for the ∼2 keV long-scale-length sub-critical-density plasmas created in experiments at the Omega laser facility, the simulations get both the measured Ge L-shell emission (∼1-1.5 keV) and the measured Ge K-shell emission (∼10-11 keV) about right, but only by properly accounting for non-local thermal conduction. The older average-atom atomic model is shown to be inadequate for these non-LTE plasmas. We then use the preferred model in the design of larger-scale experiments planned for the National Ignition Facility, in which we will use 350 kJ of laser beam energy to heat a mixture of Ar and Xe gas to peak temperatures > 5 keV. We predict 20% x-ray conversion efficiency into Ar K-shell and Xe L-shell emission.

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