X-ray Spectroscopy and Atomic Physics of Relevance to Inertial Confinement Fusion

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In inertial confinement fusion [1], laser energy is converted into an x-radiation drive in a high-Z cavity (“hohlraum”). The resulting thermal (~300 eV) x-rays heat a thin spherical shell of low Z material which ablates and, through a rocket-effect, drives the DT fuel inside to high enough temperature and density for fusion to occur. Many physical processes are involved in this integrated experiment, and benchmarking models for these physical processes or measuring plasma conditions is important for understanding and interpreting results. We use x-ray spectroscopy to better understand both hohlraum physics and capsule physics. We study the non-Local Thermodynamic Equilibrium (NLTE) physics [2] of the laser deposition region with surrogate experiments (on uniform plasmas) at the OMEGA laser [3]. We study conditions inside the capsule with high-resolution time-resolved x-ray spectroscopy [4] plus time-integrated continuum measurements [5] of Kr-doped fuel [6]. Current experimental results and comparison to atomic physics models will be presented.

References

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* *This work was performed under the auspices of the U.S. Department of Energy by LLNS, LLC, under Contract No. DE-AC52- 07NA27344.*