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8.28 Multi-dimensional reconstruction of spatial profiles of plasma conditions in laser-driven ICF implosions

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We present multi-dimensional reconstruction of spatial profiles of plasma conditions by analyzing spectrally resolved x-ray image data obtained from OMEGA direct-drive ICF implosions. The targets were spherical plastic shells filled with varying D2-Ar relative and total gas pressures, similar to previous recent experiments [1]. Argon K-shell spectral features were observed primarily between the time of first-shock convergence and slightly before neutron bang time, using a time- and space-integrated spectrometer, streaked crystal spectrometer, and up to three gated multi-monochromatic x-ray imagers (MMI) fielded along quasi-orthogonal lines of sight. The spectrally resolved MMI data were processed to obtain spatially resolved spectra. A non-LTE Ar theoretical spectral database was computed via the Los Alamos Suite of Atomic Codes and used in conjunction with a spectroscopic-quality radiation-transport model. A multi-objective optimization technique [2] is used to extract 3D spatial profiles of plasma conditions (ne, Te, nD, and nAr) in the core. A synthetic-data case is also presented to verify the accuracy of the multi-objective optimization technique.
[1] S. C. Hsu et al., EPL 115, 65001 (2016).
[2] T. Nagayama et al., Phys. Plasmas 19, 082705 (2012). LA-UR-18-20222.

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