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POLYCHROMATIC TOMOGRAPHY OF HIGH ENERGY DENSITY PLASMAS

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We discuss the observation and analysis of spectrally resolved core image data from argon-doped, deuterium-filled low-adiabat OMEGA direct-drive implosions. The core image data were recorded simultaneously along three quasi-orthogonal lines of sight (LOS) using three identical, gated Multi-Monochromatic x-ray Imagers (MMI). The argon x-ray emission is primarily emitted at the collapse of the implosion, thus its spectrum provides a spectroscopic signature of the state of the imploded core. For each LOS, a set of space-resolved argon emission spectra can be extracted from the spectrally resolved core image data recorded with the MMI instruments. A multi-objective search and reconstruction method, which consists of a Pareto genetic algorithm followed up by a fine-tuning technique, finds the three dimensional electron temperature and density spatial distributions that yield the best simultaneous and self-consistent fits to all the extracted space-resolved spectra recorded along the three LOS. The resultant temperature and density spatial structures are shown in a tomographic fashion and discussed. The case of illustration is an implosion core plasma but the ideas are general and can be applied to other high-energy density plasmas.

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