Two-dimensional space- and spectrally-resolved X-ray emission images from OMEGA implosion experiments relevant for shock-ignition

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Shock-ignition (SI) [1] is a promising, alternative ICF direct-drive approach expected to achieve ignition using only a third of the driver energy needed in the conventional hot spot scheme. Here we discuss first measurements of two-dimensional space- and spectrally-resolved X-ray emission images from a series of Ar-doped implosion experiments directly-driven at OMEGA by a low-adiabat laser pulse shape with a sharp intensity spike at the end, thus meeting the specifications of SI design. Targets consisted of thick-wall CH microballoons filled with D_2 and a tracer amount of Ar for diagnostic purposes. A collection of two-dimensional narrow- and broad-band images and space-resolved spectra were obtained from an array of gated, spectrally resolved pinhole images recorded by a multi-monochromatic X-ray imager (MMI) [2]. Observed spectra cover a photon energy range from ~3500 eV to 4300 eV and show line transitions in H-, He- and Li-like argon ions. The argon line spectrum is primarily emitted at the collapse of the implosion and provides a spectroscopic signature of the state of the implosion core. Time-correlation and consistency between MMI data and independent time-resolved but space-integrated spectroscopic measurements [3] will be shown. An assessment of the information provided by MMI for extracting temperature and density maps of the core [4] in SI implosions -including the attenuation effect in the spectra due to the thick shell [3,5]- will be discussed.

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