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In-Flight Shell Breakup in Direct-Drive DT Cryogenic Implosions[1] RAHUL SHAH, S.X. HU, I.V. IGUMENSHCHEV, J. BALTAZAR, D. CAO, C.J. FORREST, V.N. GONCHAROV, V. GOPALASWAMY, D. PATEL, W. THEOBALD, S.P. REGAN, Laboratory for Laser Energetics, F. PHILIPPE, CEA — In laser-driven cryogenic spherical implosions, the density of the imploding DT shell during deceleration determines its dynamic pressure and consequently the hot-spot stagnation pressure. Hydrodynamic instability growth during the acceleration phase will decompress the shell, thereby compromising performance. Relaxed density profiles which result from decompressed shells will increase early hot-spot x-ray emission, thus providing an experimental signature for DT cryogenic implosions. We present the use of time-resolved images to characterize the onset of hot-spot emission and infer in-flight decompression at the start of deceleration in direct-drive DT cryogenic implosions. The hot-spot emission is observed to begin at a larger shell radius as compared to a 1-D radiation-hydrodynamic implosion model. A 3-D radiation-hydrodynamic code that includes a model for laser-speckle induced perturbations agrees with observation when imprint growth is severe. However, discrepancies of the emission onset between measurement and models persist even when the imprint is predicted to be minor and its inclusion in the model does not account for the observation. An inverse dependence of the emission discrepancy with implosion stability suggests the presence of additional hydrodynamic perturbations in the direct-drive DT cryogenic implosions.

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