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**Effects of inhomogeneity at stagnation in 3D simulations of ICF implosions**

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The stagnation phase of an ICF implosion is characterized by a hotspot and dense fuel layer that are spatially and temporally inhomogeneous. Perturbation growth during the implosion results in significant asymmetry at stagnation while the hotspot size, density and temperature change rapidly, even in non-igniting capsules. Diagnosing these inhomogeneities is necessary to increase yield in ICF experiments. In this work, 3D radiation hydrodynamic simulations of perturbed indirect drive ICF capsules are carried out using the CHIMERA code. During the stagnation phase a suite of novel and computationally efficient simulation tools are used to produce synthetic time-resolved neutron spectra and images. These tools allow a detailed study of the effects of hotspot inhomogeneities on diagnostic signals. Results show that the burn-averaged ion temperature drops rapidly during thermonuclear burn as the hotspot evolves from a localised, shock-heated region to a more massive, non-uniform plasma. Primary DD and DT neutron spectra show that there is significant residual bulk fluid motion at stagnation, complicating the measurement of ion temperature. Different perturbation modes cause different levels of anisotropic spectra shifts and broadening. However, in all cases the discrepancies between the DD and DT spectra are a reliable indicator of residual motion at stagnation. The simulations are used to examine the relationship between neutron scattering and areal density ($\rho$R). Three measures of areal density are simulated: downscattered neutron ratio, attenuated primary neutron yield and nT backscatter edge. Each of these diagnoses the magnitude and anisotropy of the $\rho$R with varying success, with accuracy decreasing for higher mode perturbations. Contributions to the neutron energy spectra from T+T reactions, secondary DT reactions and deuteron break-up are also evaluated.