Analysis and simulation of ablative Richtmyer-Meshkov direct drive experiments performed on the OMEGA laser facility

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Rayleigh-Taylor instability (RTI) understanding is of critical interest in Inertial Confinement Fusion because it causes shell disruption and fuel mixing during target implosion which is one of the main limitations to reach ignition. Initial perturbations of the ablation front arise from target roughness and, in direct drive, from the imprint of laser inhomogeneities. These perturbations evolve and may be amplified by hydrodynamic instabilities. Ablative Richtmyer-Meshkov instability (RMI), which seeds the RTI, takes place during the shock transit and usually makes the perturbations oscillate; ablative RTI appears after shock breakout during the acceleration phase and amplifies the perturbations in linear, then nonlinear regime. In this talk, we will present the analysis of a set of direct drive experiments performed on the OMEGA laser facility at a laser drive intensity of $5 \times 10^{13}$ W/cm². Planar CH targets of different thicknesses were directly driven by laser beams, with or without phase plates inducing laser imprint conditions. An X-ray framing camera (XRFC) was used to diagnose the ablative RMI and RTI. The case of 2D modulations with spacial wavelengths of 30, 70 and 120 µm imprinted on target by laser beams using special 2D phase plates was studied. Experimental growth of modulations coming from the analysis of X-ray radiography will be presented and compared with 2D simulations performed with CHIC, the CELIA’s hydrodynamic radiative code [1].