Shock-Timing Measurements in Directly Driven Spherical ICF Targets

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Shock velocity and timing measurements in spherical cryogenic-deuterium targets are used to optimize direct-drive implosions

- Timing of multiple shocks is critical to the performance of inertial confinement fusion targets
- Multiple spherical shocks are measured in cryogenic-deuterium targets
- Ramp compression of deuterium targets is difficult with continuous pulses; tuning discrete shock waves is easier
- Multiple-pulse experiments are correctly modeled
- Hydrodynamics of ablator–fuel interaction in cryogenic targets must be properly modeled
Shock velocity and timing are readily measured in transparent targets using optical diagnostics.
The timing of multiple convergent shocks is studied using cryogenic spheres with re-entrant cones
Three spherically convergent shocks were observed in directly-driven cryogenic spherical targets.
The temporal features in self-emission data confirm shock-timing observed in VISAR data.
The VISAR signal abruptly ends at high deuterium shock velocities (~70 μm/ns); likely due to a radiative precursor.
Similar ramped pulses can produce different “compression” waves; deuterium easily “shocks up”
The time delay of shock coalescence has a threshold-like dependence on the first picket energy.
Warm Targets

Shock-velocity comparison for warm CH spheres shows good agreement between simulations and experimental data.
Shock-timing in warm CH targets does not exhibit dependence on pulse energy

Behavior in cryogenic targets may result from rarefactions created at ablator-fuel interface.
Simulations agree with measured shock velocity and timing for direct-drive cryogenic targets.
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