Development of New Beam Configurations for OMEGA To Achieve Highly Uniform Indirect Drive Implosions With Cubic Symmetry

Wu, Edward (School: Pittsford Sutherland High School)

In light of the recent demonstration of breakeven on the National Ignition Facility (NIF) using indirect drive, interest in future indirect drive facilities has increased. A promising approach is the spherical hohlraum with six laser entrance holes (LEHs), which has cubic symmetry and potentially better uniformity than the cylindrical hohlraum (two LEHs) used on the NIF. While the 60-beam OMEGA laser is primarily a direct drive fusion facility, configurations using a 48-beam subset are proposed that would offer the unique capability of performing highly uniform experiments with a six-LEH hohlraum. Several configurations are possible because beams can be directed into more than one LEH. Using the 3-D code LORE, simulations yielded irradiation nonuniformities on the capsule as low as 0.13% (rms) at a high albedo. In addition, the hohlraum radius was varied to investigate the tradeoff between obtaining good uniformity and achieving a high radiation temperature. Beam pointing adjustments were implemented to ensure no beam leakage in designs with small hohlraum radius, demonstrating practicality. Future laser systems based on the OMEGA geometry and designed for direct drive could use these configurations to provide a versatile indirect drive capability.

Awards Won:

Third Award of $1,000

Patent and Trademark Office Society: Second Award of $500