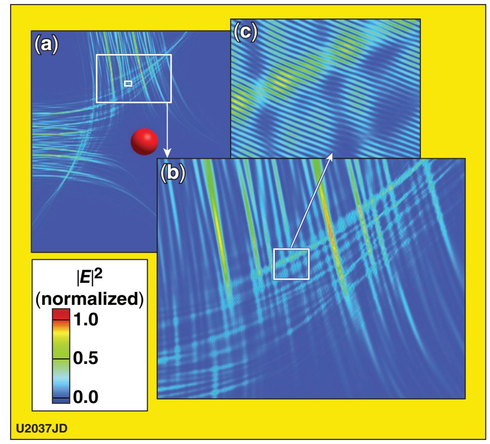
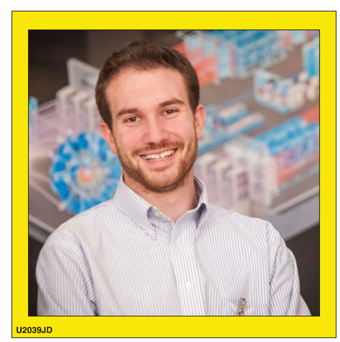


Figure 1. Successive zooms (indicated by the white boxes) of a 2-D *LPSE* calculation highlighting the range of scales involved in cross-beam energy transfer (CBET). The red circle shows the location of the critical density (above which electromagnetic waves are evanescent).

Cross-Beam Energy Transfer Modeling: The *LPSE* (laser-plasma simulation environment) code system[1] provides a framework of physics packages that can be assembled for particular laser–plasma interaction physics problems in inertial confinement fusion. A previous DOE Monthly report (July 2015) showcased the use of *LPSE* in the modeling and understanding of the two-plasmon–decay instability. *LPSE* has recently been extended to include a wave-based model of cross-beam energy transfer (CBET). CBET mitigation is required to achieve 100-Gbar hot-spot pressures on OMEGA because it reduces the ablation pressure in implosion experiments by up to 40%. The achievement of 100 Gbar on OMEGA is a critical part of the national Direct-Drive Program; therefore, a detailed understanding of the physics of CBET is required. Uncertainties in existing ray-based treatments of CBET[2–4] are related to wave phenomena that are not described by the geometric optics approximation, such as the determination of light intensity at caustics, the effects of laser speckle, polarization, and distributed polarization rotation. These uncertainties are removed by directly solving the Maxwell equations describing electromagnetic (EM) wave propagation in an inhomogeneous plasma together with equations describing the linearized, low-frequency, time-dependent ion-acoustic response of the plasma. The penalty for solving these equations directly is the numerical expense of resolving the spatial and temporal scales associated with the EM and ion-acoustic waves (IAW) (Fig. 1). In Fig. 1, two speckled laser beams enter a 2-D simulation domain from the left and upper boundaries, propagating inward [the simulation is subscale by approximately one order of magnitude in the linear dimension, while the laser wavelength is correct (0.351 μm)]. The speckles diminish in intensity (normalized electric-field intensity is shown) over several tens of microns as a result of inverse bremsstrahlung absorption and beam bending caused by refraction in the radially dependent plasma density distribution (not shown). In the first zoom [Fig. 1(b)], the intersection of laser speckles (of a few microns in transverse size) becomes more evident, while a second zoom [Fig. 1(c)] is required to see the submicron interference pattern (grating) that is responsible for CBET. LLE has shared the *LPSE* code with NRL who are using it to investigate mitigation strategies based on laser bandwidth.



Dr. Michael Rosenberg awarded the American Physical Society 2016 Marshall N. Rosenbluth Outstanding Doctoral Thesis Award: Dr. Michael Rosenberg, now a Research Associate at the Laboratory for Laser Energetics (LLE), earned his Ph.D. from the Massachusetts Institute of Technology as a member of the High-Energy-Density-Physics Group led by Dr. Richard Petrasso. His thesis work was based on experiments conducted at the Omega Laser Facility at LLE [conducted as part of the National Laser Users Facility (NLUF) program] and at the National Ignition Facility at LLNL. His award citation reads: "For first experimental demonstration of the importance of kinetic and multi-ion effects on fusion rates in a wide class of inertial confinement fusion implosions, and for use of proton diagnostics to unveil new features of magnetic reconnection in laser-generated plasmas." Dr. Rosenberg is currently leading experiments to understand laser–plasma interactions in long-scale-length plasmas relevant to direct-drive ICF.

Omega Facility Operations Summary: The Omega Laser Facility conducted 133 target shots in June with an average experimental effectiveness (EE) of 92.1% (the OMEGA laser had 90 shots and an EE of 94.4% and OMEGA EP had 43 shots and an EE of 87.2%). Three ICF experiments led by LLNL and LLE accounted for 16 target shots, while HED experiments led by LANL, LLNL, and LLE had 52 shots. NLUF experiments led by Princeton University and the University of Michigan had 28 shots and LBS experiments led by LLNL and LLE accounted for 37 target shots.

1. J. F. Myatt *et al*., J. Phys.: Conf. Ser. **717**, 012040 (2016); 2. I. V. Igumenshchev *et al*., Phys. Plasmas **17**, 122708 (2010); 3. I. V. Igumenshchev *et al*., Phys. Plasmas **19**, 056314 (2012); 4. A. K. Davis *et al*., Phys. Plasmas **23**, 056306 (2016).