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Ballistic radial energy transport in micron-scale plasmas under high energy density conditions. BENJAMIN BOWES, HANS LANGHOFF, MICHAEL DOWNER, FOCUS Center and Department of Physics, University of Texas at Austin, YASUHIKO SENTOKU, Department of Physics, University of Nevada, Reno, BIXUE HOU, JOHN NEES, FOCUS Center and Center for Ultrafast Optical Science, University of Michigan — In this work we apply fs microscopy to solid targets (Al, Cu) irradiated at relativistic intensity ($I_{pu} \geq 2 \times 10^{18}$ W/cm^2) by high-contrast (better than $1 : 10^{-10}$), obliquely-incident ($\theta_{pu}^{inc} = 45°$ and $70°$), P- and S-polarized pump pulses ($\lambda_{pu} = 0.8$ μm, 34 fs) focused to a *wavelength-scale* spot size ($w_0 = 0.8$ μm). Under these conditions, radiation and hot electrons are the dominant carriers of energy out of the initially photo-excited volume. The mean free paths governing both transport processes exceed the spot size w_0, opening the study of ballistic transport of energy into surrounding target material. Our fs microscopy experiment, with λ_{pu}^2 pump spot, is well-suited to observe the initial stages, and the radial dimension, of such non-local transport directly on any target material. The physics of this transport is relevant to fast ignition of laser fusion, to generation of ultrashort pulsed x-rays and relativistic proton and ion beams, and to astrophysics. Our interaction volume may be small enough that the entire experiment is amenable to large-scale particle-in-cell simulations.

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