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Experimental investigation of the transition between relativistic transparency propagation and hole boring in critical surface motion during relativistic laser-plasma interactions[1] CRAIG WAGNER, ANDREW YANDOW, GILLISS DYER, TOMA TONCIAN, ALEXEY AREFIEV, TAO WANG, HERNAN QUEVEDO, REBECCA ROYCROFT, GRIFFIN GLENN, HAILEY VAN HOORN, BJORN MANUEL HEGELICH, TODD DITMIRE, University of Texas at Austin — An experimental investigation of the transition between relativistic transparency (RT) and hole boring (HB) dominated motion of the electron critical surface during intense laser-plasma interactions is presented. The recession velocity of the critical surface away from the incident laser pulse is measured by imaging second and third harmonic light created during the laser-plasma interaction to bulk spectrometers and measuring spectral shifts due to the surface motion for each shot. Observing differences between the $4n_c$ and $9n_c$ surface motions is useful for diagnosing the physics of the laser-plasma interaction. Experimental results and simulations show that for intensities near $10^{20}\mathrm{W}/cm^2$ and laser pulse duration shorter than 200fs HB plays little role in critical surface movement when a realistic preplasma is present. The dominant cause of critical surface motion appears to be controlled by preplasma density profile and the intensity time rate of change of the laser pulse. Data from experiments at pulse lengths consistent with the transition between RT and HB dominance will be presented.

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Craig Wagner
University of Texas at Austin

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