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Guiding of high-energy electrons in high-intensity-laser interactions with wire targets through surface wave excitation A. MAKSIMCHUK, P. BELANCOURT, P. KORDELL, M.J.-E. MANUEL, L. WILLINGALE, A.G.R. THOMAS, R.P. DRAKE, K. KRUSHELNICK, University of Michigan, A. BRANTOV, V.YU. BYCHENKOV, Lebedev Physics Institute, Moscow, Russia — Experiments investigating the interaction of an ultra-short pulse laser (intensity of up to $2x10^{19}$ W/cm^2) with thin metal wires of different diameter, length and conductivity at different angles of incidence were performed. The generation of a highly collimated electron beam with a charge of several nC, electron energies in the range of 1-7 MeV and efficiency of few percents were demonstrated. The beam was confined and guided along a thinnest wire of 15 microns to a distance of 130 cm. The spatial structure for different components of the spectrum demonstrated a better confinement of the lower energy electrons. The experimental results were interpreted through the generation of a strong Sommerfeld surface wave propagating along the wire with phase velocity close to c, which is produced due to electron expulsion from the focal region and generation of magnetic fields near the surface of the wire during the laser-plasma interaction. 2D PIC simulation combined with test particle simulations shows that Sommerfeld surface wave provides the crucial conditions for collimating and confining the laser-produced electron beams along the wire.

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