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Study of surface current confinement in high-intensity laser interactions with wire targets A. MAKSIMCHUK, P. BELANCOURT, M.J.-E. MANUEL, L. WILLINGALE, A.G.R. THOMAS, R.P. DRAKE, K. KRUSHELNICK, University of Michigan, Ann Arbor, A.V. BRANTOV, V. YU. BYCHENKOV, Lebedev Physics Institute, Moscow, Russia — Understanding surface electron current generation and propagation is increasingly important for fast-ignition fusion research. From the interaction of a 400 fs, 20 TW laser pulse focused to intensity up to $4x10^{19}$ W/cm^{2}on tungsten wire, we observed a highly collimated, hollow electron beam with a charge of several nC and electron energies greater than 1 MeV. The beam was confined and guided along the wires of different diameters to a distance of 40 cm. Simultaneous measurements of electron beams at both ends of the wire show symmetrical images for 0 degree angle of incidence for s- and p-laser polarizations. The measured electron spectrum extended to 4 MeV; the spatial structure for different components of the spectrum confirmed the production of a hollow electron beam and demonstrated a better confinement of the lower energy electrons. Electron beam radiography of a solid object was performed and showed spatial resolution better than several hundred microns. The experimental results were interpreted taking into account the generated electric and magnetic fields near the surface of the wire, which are the result of strong charge separation during the laser-plasma interaction. Test particle simulations shows that these fields provide the crucial conditions for collimating and confining the laser-produced hollow electron beams along the wire.

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