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Millimeter-scale laser channeling in underdense argon plasma diagnosed with Kα x-ray imaging* N.L. KUGLAND, C.G. CONSTANTIN, University of California Los Angeles, T. DOEPPNER, A. KEMP, L. DIVOL, S.H. GLENZER, Lawrence Livermore National Laboratory, C. NIEMANN, University of California Los Angeles — Two-dimensional x-ray imaging of Kα self-emission from laser-irradiated Ar gas jets has been used to study laser channeling and fast electron transport over millimeter-scale distances. We irradiated high density (10^{20} cm^{-3} atomic density) supersonic Ar gas jets with an ultra-high intensity (10^{19} W/cm^2), high power (100 TW class) 800 nm laser. Kα fluorescence reveals a millimeter-scale laser channel, oriented along the laser axis, which ends in a forward-directed spray of fast electrons. K-shell x-ray spectroscopy diagnoses a spatially averaged mean ionization state of 6 ± 1 during the Kα emission, implying an electron density of 0.5 n_c. Study of this system can help understand the initial stage of the hole-boring approach to fast ignition, during which an intense laser pulse must propagate through a mm-scale moderately underdense plasma. *This work was performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344. Additional support was provided by LDRD grant 08-LW-004 and the DOE Plasma Physics Junior Faculty Award Program.

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