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Optical Guiding in Meter-scale Plasma Waveguides[1] BO MIAO, LINUS FEDER, JARON SHROCK, ANDREW GOFFIN, HOWARD MILCHBERG, University of Maryland, College Park — Laser plasma accelerators are capable of generating multi-GeV electron beams. Increasing the electron beam energy further requires optical guiding in a plasma channel with low plasma density ($N_e \simeq 10^{17} cm^{-3}$) on axis [1,2]. Here we report a new highly tunable technique for generating meter-scale low density plasma waveguides [3]. Plasma waveguides are imprinted in hydrogen gas by optical field ionization induced by two time-separated Bessel beam pulses: The first pulse, a J_0 beam, generates the core of the waveguide, while the delayed second pulse, here a J_8 or J_{16} beam, generates the waveguide cladding. We present plasma density profiles characterized by interferometry, and demonstrate guiding of intense laser pulses over hundreds of Rayleigh lengths with on axis plasma densities as low as $N_e \approx 5 \times 10^{16} cm^{-3}$. [1] Gonsalves, A. J., et al. Physical review letters 122.8 (2019): 084801. [2] Shalloo, R. J., et al. Physical Review Accelerators and Beams 22.4 (2019): 041302. [3] Miao, B., et al. arXiv preprint arXiv:2005.14389 (2020).

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