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Guiding of an intense, femtosecond laser pulse in a discharge-produced capillary plasma TAKESHI HIGASHIGUCHI, TSUKASA OHSHIMA, MASAFUMI HIKITA, KUN LI, NOBORU YUGAMI, Utsunomiya University —
Guiding of an intense laser pulse is supported today's advanced technology such as laser wakefield acceleration, x-ray lasers, high-order-harmonic generation, and inverse Compton scattering. The laser-matter interaction length of a focused laser pulse is fundamentally limited by diffraction to the order of the Rayleigh length, and is further restricted by ionization-induced refraction. We developed a plasma waveguide for propagating intense laser pulse by use of a capillary discharge plasma. The alumina capillary had a diameter of 300 μm and a length of 10 mm. For present work, the discharge peak voltage and current were 30 kV and 500 A with a pulse width of 100 ns (FWHM), respectively. An electron density and a time-integrated electron temperature were evaluated to be of the order of 10^{18} cm^{-3} and a few eV, respectively. The guiding experiments used the laser pulse of the central wavelength of 800 nm from a CPA Ti:sapphire laser with a pulse width of 130 fs (FWHM). A peak intensity of the laser pulse was 1×10^{16} W/cm^2 with a spot diameter of 30 μm (FWHM) in vacuum. We demonstrated guiding of a laser pulse over length of up to 10 mm, which corresponded to 10 times the measured Rayleigh length.

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