Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Direct measurement of the plasma density of a femtosecond laser induced-filament in air YU-HSIN CHEN, SANJAY VARMA, THOMAS ANTONSEN, HOWARD MILCHBERG, University of Maryland, College Park, INSTITUTE FOR RESEARCH IN ELECTRONICS AND APPLIED PHYSICS TEAM — The long-range filamentary propagation of an intense femtosecond laser pulse in atmosphere [1] results from the interplay between laser-induced plasma and nonlinear optical response of air molecules. To study the filamentation process in detail, it is crucial to determine the electron density in the transversely confined filament (typical diameter < 100 μm), which is a challenging task due to the weak ionization (n_e $\sim 10^{14}$-10^{16} cm^{-3}). The previously developed techniques, for example, longitudinal spectral interferometry [2], shadowgraphy and optical diffraction [3], electron conductivity [4], and fluorescence spectroscopy [5] can only give crude estimations because they are either lack of spatial resolution or heavily model-dependent. Here we present the direct, radially and axially space-resolved measurement of electron density along an optical filament extending over $\sim$1 m in air.

[1] A. Braun et al., Opt. Lett. 20, 73(1995).
[2] B. La Fontaine et al., Phys. Plasmas 6, 1615 (1999).
[3] S. Tzortzakis et al., Opt. Commun. 181,123 (2000).
[4] R. P. Fischer et al., IEEE Trans. Plasma Sci. 35, 1430 (2007).
[5] J. Bernhardt et al., Opt. Commun. 281, 1268 (2008).

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Date submitted: 26 Jul 2011 Electronic form version 1.4