Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Optical nonlinearity in Ar and N_2 near the ionization threshold[1]

J.K. WAHLSTRAND, Y.-H. CHENG, Y.-H. CHEN, H.M. MILCHBERG, University of Maryland — We directly measure the nonlinear optical response of argon and nitrogen in a thin gas target to laser intensities near the ionization threshold. These responses are fundamental to high intensity femtosecond filamentation. No instantaneous negative nonlinear refractive index is observed, nor is saturation, in contrast with a previous measurement [Loriot *et al.*, Opt. Express **17**, 13429 (2009)] and calculations [Bree et al., Phys. Rev. Lett. **106**, 183902 (2011)]. In addition, we are able to cleanly separate the electronic and rotational components of the nonlinear response in nitrogen. In both Ar and N_2, we observe the peak instantaneous index response scale linearly with the laser intensity until the point of ionization, whereupon it turns abruptly negative and $\sim$ constant, consistent with plasma generation. In addition, we show that the results of Loriot *et al.* are traceable to two-beam coupling via a plasma grating, and *not* nonlinearity saturation or negative response.

[1]This work is supported by the NSF, ONR, and DOE.

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Date submitted: 26 Jul 2011 Electronic form version 1.4