Abstract Submitted
for the DPP06 Meeting of
The American Physical Society

Single-shot time resolved measurement of molecular alignment in laser-irradiated gases: application to 'self-channeled' plasma columns
SANJAY VARMA, YU-HSIN CHEN, University of Maryland, ILYA ALEXEEV, Advanced Technologies and Applications, RAPHAEL MOON, U.S. Army Edgewood Chemical and Biological Center, HOWARD MILCHBERG, University of Maryland — Gases irradiated by high intensity laser fields exhibit nonlinear refractive index change. In monatomic gases the nonlinearity solely results from the near-instantaneous motion of bound electrons, whereas in polyatomic gases, there is an additional, delayed nonlinearity due to the relatively slow motion of the nuclei. We use Single-shot Supercontinuum Spectral Interferometry [1] to temporally resolve the refractive index change and observe the alignment and relaxation of diatomic gases irradiated by sub-picosecond laser pulses. We examine the dependence of the nonlinearity on gas species and pressure, as well as on pump laser energy and pulse duration. This nonlinearity plays a large role in the 'self-channeling'[2] of intense femtosecond laser pulses through the atmosphere. [1] K.Y. Kim, I. Alexeev, and H.M. Milchberg, Appl. Phys. Lett. 81, 4124 (2002). [2] I. Alexeev, A.Ting, D.F.Gordon, E.Briscope, J.R.Penano, R.F.Hubbard, and P.Sprangle, Appl. Phys. Lett. 84, 4080 (2004).

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Date submitted: 21 Jul 2006 Electronic form version 1.4