## Abstract Submitted for the DAMOP15 Meeting of The American Physical Society

Nonlinear susceptibility past the limits of perturbation theory<sup>1</sup> ANDREW SPOTT, ANDREAS BECKER, AGNIESZKA JARON-BECKER, Jila and the University of Colorado, Boulder — Understanding the accuracy and domain of the nonlinear index of refraction is a critical step toward understanding filamentation in the propagation of high intensity laser light. We have examined the nonperturbative limit of the nonlinear susceptibility of hydrogen by comparing ab initio calculations of the susceptibility with perturbative calculations performed within the same theoretical framework. To this end, we have studied the susceptibility at the driving frequency for a pulse [1], and the susceptibility for third- and fifth-harmonic generation [2]. Our results show that the perturbative series is no longer applicable at approximately 10<sup>13</sup> W/cm<sup>2</sup>. Instead, accurate models of hydrogen within this regime must be determined through a nonperturbative treatment of the field and the atom.

- [1] A. Spott, A. Jaron-Becker and A. Becker, Phys. Rev. A 90, 013426 (2014);
- [2] A. Spott, A. Becker, and A. Jaron-Becker, Phys. Rev. A (in press).

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