Abstract Submitted
for the DAMOP05 Meeting of
The American Physical Society

Sixth-Order Dynamic Hyperpolarizability of Hydrogen Rydberg Levels[1] N. L. MANAKOV, S. I. MARMO, E. A. PRONIN, Voronezh State University, Russia, ANTHONY F. STARACE, University of Nebraska - Lincoln — The sixth-order dynamic hyperpolarizability, $\gamma^{(6)}(\omega)$, determines the third-order laser intensity I corrections, $\Delta E_n^{(6)} \sim \gamma^{(6)} I^3$, to the usual Stark-effect, $\Delta E_n^{(2)} \sim \alpha I$, of an atomic level $|E_n\rangle$. The corrections $\Delta E_n^{(2)}$, $\Delta E_n^{(4)}$, and $\Delta E_n^{(6)}$ can be used to estimate the behavior of perturbation theory (PT) series with increasing intensity, and their imaginary parts allow one to estimate the threshold intensity of atomic level stabilization. For numerical calculations of 6th order PT matrix elements for $\gamma^{(6)}$, we generalize the method of Sturmian expansions of the Coulomb Green's function having two arbitrary parameters (suggested in [1] for calculations of $\Delta E_n^{(4)} \sim \gamma^{(4)} I^2$). Numerical calculations of $\gamma^{(6)}$ for $n \leq 10$ and linear laser polarization were carried out over a wide interval of frequencies, from $\hbar\omega \sim 0.1|E_n|$ up to $\hbar\omega \sim 10|E_n|$. In the high-frequency limit, all circular states (with $l = |m| = n - 1$) clearly show the onset of stabilization. Our result for the $5g$-state is in reasonable agreement with experiments [2] for Ne. [1] N. L. Manakov et al., Sov. Phys. JETP **98**, 254 (2004). [2] N. J. van Drutten et al., PRA **55**, 622 (1997).

[1]Supported in part by RFBR Grant 04-02-16350 and NSF Grant PHY-0300665.

Nikolai L. Manakov
Voronezh State University, Russia

Date submitted: 28 Jan 2005 Electronic form version 1.4