Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Electromagnetically induced transparency involving Rydberg states in a Rb microcell JAMES SHAFFER, The University of Oklahoma, HAROLD KÜBLER, THOMAS BALUKTSIAN, ALEXI CHARNUKHA, CHRISTIAN URBAN, ROBERT LÖW, TILMAN PFAU, The University of Stuttgart — Small glass cells filled with Rb vapor are promising candidates for few photon nonlinear optics and quantum information processing using Rydberg states and the dipole blockade effect. Dipole blockade is a consequence of the strong interaction between two Rydberg atoms which can detune the Rydberg atom transition off resonance (pair excitation vs. single atom excitation). As a result of dipole blockade, only one Rydberg excitation is possible within a volume characterized by the blockade radius (typically a few microns), which is determined by the laser bandwidth and the Rydberg atom interaction strength. The effect is a nonlinear one that can be used as a tool to entangle atoms. Similar to atom entanglement, an atomic vapor confined on a length scale comparable to the blockade radius can be used like quantum wells (2D), quantum wires (1D) and quantum dots (0D) e.g. to realize a single photon source. We present measurements of electromagnetically induced transparency (EIT) in Rb vapor cells with thicknesses on the order of the blockade radius. We use the observed EIT to investigate the effects of the confinement in these vapor cells. The experiments show that coherent dynamics involving Rydberg states are possible in micro cells above room temperature.

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Date submitted: 27 Jan 2009 Electronic form version 1.4