Abstract Submitted
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Study of Rydberg blockade mediated optical non-linearity in thermal vapor[1] ARUP BHOWMICK, Senior Research Fellow, ASHOK MOHAPATRA, Reader-F — We demonstrate Rydberg blockade by coupling to Rydberg state via two-photon excitation in rubidium thermal vapor. The probe beam coupling to the $D2$ transition was blue detuned by 1.3 GHz and a coupling beam was scanned to excite the atoms to Rydberg state via two-photon transition ($5\mathrm{s}_{1/2} \longrightarrow n\mathrm{s}_{1/2}$). The dispersion of the probe beam is modified due to the 2-photon excitation and is measured using an optical heterodyne detection technique in the experiment. We have observed that the dispersion of the probe beam depends linearly on atomic vapor density while coupling to a Rydberg state with principal quantum number, $n = 30$. However, density dependent suppression of the dispersion is observed while coupling to the Rydberg state with $n = 60$. Since the dispersion of the probe beam due to 2-photon excitation depends on the Rydberg population, the density dependent suppression is explained by introducing the concept of blockade. The blockade radius is measured to be about 2.2 μm which is consistent with the scaling due to Doppler width of the 2-photon resonance in thermal vapor. Our result promises the realization of single photon source and strong single photon non-linearity based on Rydberg blockade in thermal vapor.

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