Abstract Submitted
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The observation of the dipole-dipole interaction by Ramsey method[1] HYUNWOOK PARK, THOMAS GALLAGHER, University of Virginia — Previously, we reported a line broadening technique to quantitatively measure the dipole-dipole interaction in Rb Rydberg atoms[1]. As an alternative and more sensitive way, Ramsey interferometry is employed. Two identical microwave(MW) pulses, which are 200ns-long and separated by 300ns, are applied to Rb *ns* Rydberg atoms to drive ns-$np_{1/2}$ transitions (n=33, 36, 39, and 41). As the MW frequency is swept through the resonance, Ramsey fringes with different contrast are observed depending on the atomic density. The dipole-dipole interaction washes out the fringe contrast at high atomic density, while isolated atoms produce 100% contrast Ramsey fringes. The interesting result is that the loss of the contrast as a function of the atomic density is not a linear process. The contrast drops rapidly with increasing density but it stops decreasing once it reaches at a certain non-zero contrast (Extremely high atomic density never completely destroys the contrast.). It turns out that the zero-shift dipole-dipole energy levels play a significant role in maintaining the contrast, even at very high atomic density. A simple model, based on the dipole-dipole interaction [1], reproduces the Ramsey lineshape including the surviving contrast at high density.

[1] Dipole-dipole broadening of Rb ns-np microwave transition, H Park et al. Phys. Rev. A 84, 022704 (2011).

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