Abstract Submitted
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Van der Waals interaction in the cold Rydberg gas[1] JIANING HAN, THOMAS GALLAGHER, University of Virginia — The two photon microwave transitions between Rb ns and $(n+1)s$ states exhibit density dependent frequency shifts and broadenings far in excess of what would be expected from the small difference in their van der Waals coefficients. We attribute the large shifts to the fact that what we observe is transitions not in isolated atoms, but predominantly in pairs of atoms, specifically, the $nsns$ to $ns(n+1)s$ transitions. The latter states have a strong dipole dipole coupling the nearly degenerate $np_{3/2}np_{3/2}$ state. Over the range of n we have studied the $ns(n+1)s$ state passes through the resonance with the $np_{3/2}np_{3/2}$ state, reversing the sign of the asymmetry. The resonance occurs at n=38, where the spectrum is very different, and we attribute at least part of the difference to the fact that in this case many body effects must be taken into account. Similar observations have been made for the ns to $(n+2)s$ transitions. The observed spectra can in almost all cases be fit to a lineshape model based on the density distribution in the trap and the calculated van der Waals coefficients.

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