Abstract Submitted
for the SES16 Meeting of
The American Physical Society

Dipole-dipole Resonance Line Shapes in a Cold Rydberg Gas[1] B. G. RICHARDS, R. R. JONES, The University of Virginia — We have explored the dipole-dipole mediated, resonant energy transfer reaction $32p_{3/2}+32p_{3/2} \rightarrow 32s+33s$ in an ensemble of cold ^{85}Rb Rydberg atoms. Stark tuning is used to measure the population transfer probability as a function of the total electronic energy difference between the initial and final atom-pair states over a range of Rydberg densities of $2\times10^8 \leq \rho \leq 4\times10^9$ cm^{-3}. The observed line shapes provide information on the role of beyond nearest-neighbor interactions, the range of the Rydberg atom separations, atom motion, and the electric field inhomogeneity in the sample. For short interaction times, the line-widths increase approximately linearly with Rydberg atom density and are in agreement with expectations from a two-body, nearest-neighbor interaction model. At low densities, Gaussian line shapes are observed due to electric field inhomogeneities, providing an upper limit for the field variation across the sample. At higher densities, non-Lorentzian, cusp-like line shapes characterized by sharp central peaks and broad wings reflect the random distribution of inter-atomic distances within the magneto-optical trap (MOT).

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Date submitted: 05 Oct 2016 Electronic form version 1.4