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Rydberg atom interactions in high density samples KELLY YOUNGE, AARON REINHARD, University of Michigan, THOMAS POHL, ITAMP, Harvard-Smithsonian Center for Astrophysics, Cambridge, Massachusetts, PAUL BERMAN, GEORG RAITHEL, University of Michigan — We present a study of state mixing and counting statistics of ^{85}Rb Rydberg atoms in small, high density samples. The atoms are collected in an optical dipole trap, excited into Rydberg states with 100ns laser pulses, and then immediately ionized with an electric-field ramp. At sufficiently high density, the electrostatic interaction between the atoms allows population of atomic states that would not be populated by direct photo-excitation alone. The percentage of atoms quasi-instantaneously excited into these product states is measured for sample densities up to approximately $3 \times 10^{11}\mathrm{cm}^{-3}$. The experiments are performed for target states with principal quantum numbers near n=43, where a Foerster resonance enhances the state-mixing ratios. The large amount of instantaneous mixing can be explained only within the context of a many-body theory. We have also studied statistical distributions of Rydberg atoms in small ensembles, where an electric field is used to tune the collisional interaction into resonance. Probability distributions for the number of Rydberg excitations are clearly sub-Poissonian, indicating a blockade of Rydberg atom excitation.

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