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Resonant enhancement of state-mixing and ionizing collisions in Rb Rydberg states¹ AARON REINHARD, TARA CUBEL LIEBISCH, PAUL BERMAN, GEORG RAITHEL, The University of Michigan — In rubidium Rydberg states, the binary collision $2 \times nD_{5/2} \rightarrow (n-2)F_{7/2} + (n+2)P_{3/2}$ is nearly resonant in the vicinity of $n = 43$. As a result, over a short range of n centered around $n \approx 43$ the two-particle interaction potential is quite large and turns from repulsive to attractive. This behavior has interesting consequences for the rates of Penning-ionizing and state-changing collisions in Rydberg-atom gases and for Rydberg-excitation blockades. In this talk, we report the use of state-selective field ionization to investigate the effect of this resonance on coherent excitation of mixed two-particle states, state-mixing collisions, and Penning-ionization. In particular, we excite superpositions of the two-particle states $2 \times nD_{5/2}$ and $(n-2)F_{7/2} + (n+2)P_{3/2}$ and show that the cross section for subsequent state-changing collisions is a strong function of n near $n = 43$. We find that the dynamics of state-mixing collisions and the evolution of the Rydberg gas to a cold plasma depend sensitively on the sign of the interaction potential, and thus on n near the resonance. We compare these results with cases where the atoms are initially excited into states of different ℓ and j .

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