

RESONANT ENHANCEMENT OF STATE-MIXING AND IONIZING COLLISIONS IN COLD RYDBERG-ATOM GASES

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Collisions of cold Rydberg atoms are investigated. In rubidium Rydberg states, the binary collision $2 \times |nD_{5/2}\rangle \leftrightarrow |(n-2)F_{7/2}\rangle + |(n+2)P_{3/2}\rangle$ is nearly resonant in the vicinity of $n = 43$. As a result, over a short range of n centered around $n = 43$ the two-particle interaction potential is quite large and turns from repulsive to attractive. We use 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. We find that the dynamics of state-mixing and Penning-ionizing collisions 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 .