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

A. REINHARD, T. CUBEL LIEBISCH, P. R. BERMAN, AND G. RAITHEL, *FOCUS Center & Michigan Center for Theoretical Physics, Department of Physics, University of Michigan, Ann Arbor, MI 48109*.

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.