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Scattering resonances in a low-dimensional Rashba-Dresselhaus spin-orbit coupled quantum gas[1] SU-JU WANG, D. BLUME, Department of Physics and Astronomy Washington State University — Confinement-induced resonances allow for the tuning of the effective one-dimensional coupling constant. When the scattering state associated with the ground transverse mode is brought into resonance with the bound state attached to the energetically excited transverse modes, the atoms interact through an infinitely strong repulsion. This provides a route to realize the Tonks-Girardeau gas. On the other hand, the realization of synthetic gauge fields in cold atomic systems has attracted a lot of attention. For instance, bound-state formation is found to be significantly modified in the presence of spin-orbit coupling in three dimensions. This motivates us to study ultracold collisions between two Rashba-Dresselhaus spin-orbit coupled atoms in a quasi-one-dimensional geometry. We develop a multi-channel scattering formalism that accounts for the external transverse confinement and the spin-orbit coupling terms. The interplay between these two single-particle terms is shown to give rise to new scattering resonances. In particular, it is analyzed what happens when the scattering energy crosses the various scattering thresholds that arise from the single-particle confinement and the spin-orbit coupling.

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