

# Ultracold collision in the presence of synthetic spin-orbit coupling

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## Abstract:

We present an analytic description of ultracold collision between two spin- $\frac{1}{2}$  fermions with isotropic spin-orbit coupling of the Rashba type. We show that regardless of how weak the spin-orbit coupling may be, the ultracold collision at sufficiently low energies is significantly modified, including the ubiquitous Wigner threshold behavior. We further show that the particles are preferably scattered into the lower-energy helicity states due to the break of parity conservation, thus establishing interaction with spin-orbit coupling as one mechanism for the spontaneous emergence of handedness. The theory is applicable both to elementary spin- $\frac{1}{2}$  fermions such as electrons in condensed matter, and to spin- $\frac{1}{2}$  atoms such as  ${}^6\text{Li}$  in its ground hyperfine state.

## References:

1. Hao Duan, Li You, and Bo Gao. Ultracold collision in the presence of synthetic spin-orbit coupling (under review).