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Hyperfine state-to-state ultracold atom-dimer reaction in a magnetic field

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In the ultracold region, the quantum mechanics principle governs a collision reaction process. The investigation of the ultracold state-to-state collision reaction will provide a deeper understanding of both quantum mechanics and chemical reaction. We present a multichannel finite-range three-body scattering theoretical model used for investigating the magnetically tuned atom-dimer collision reaction on the level of hyperfine state-to-state resolution. We take the Li-Li₂ system as an example to calculate the atom-dimer scattering length and dimer relaxation rate steered by a magnetic field. We find that the two-body p-wave interaction has a significant influence on the atom-dimer collision reaction in the three hyperfine channels and a new universality in the atom-dimer collision reaction, i.e., the universality of deep dimer product.

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