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Controlling the stereodynamics of cold molecular collisions[1]
MASATO MORITA, Univ of Nevada - Las Vegas, QIAN YAO, CHANGJIAN XIE, HUA GUO, University of New Mexico, N. BALAKRISHNAN, Univ of Nevada - Las Vegas — We report explicit quantum calculations of stereodynamic control of rotational transitions in cold molecular collisions by taking H_2+HCl as an illustrative example. It is found that low-energy resonances in the rotational quenching cross sections of HCl due to collisions with para-H_2 can be significantly enhanced or suppressed by controlling the orientation of the HCl molecule against the initial relative velocity vector between the collision partners. Remarkably, the stereodynamic control is possible even when multiple (overlapping) shape-resonances exist within a relatively narrow energy range, indicating that such control is not limited to an isolated shape resonance. We demonstrate a striking case where two overlapping resonance can be switched off simultaneously by tuning stereodynamics. Such promising controllability of resonances originates from the significant initial helicity dependence of the cross section as well as of the strong angular distribution of the scattered HCl molecule.

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