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Quasi-resonant transitions in ultracold collisions of hydrogen isotope dimers: zero-energy resonances in vibration space[1] B.H. YANG, P.C. STANCIL, University of Georgia, R.C. FORREY, Penn State University, S. FONSECA DOS SANTOS, N. BALAKRISHNAN, University of Nevada Las Vegas —

The quasi-resonant rotation-rotation (QRRR) mechanism is studied theoretically in ultracold H_2, D_2, and HD self-collisions as a function of initial vibrational level v. In the QRRR mechanism, the collision partners swap internal rotational excitation resulting in large cross sections and scattering lengths. The efficiency of the QRRR mechanism is a consequence of conservation of total system internal rotational angular momentum and near conservation of internal energy. Extending to high vibrational excitation, we find that the QRRR mechanism identified for $H_2(v=1)$+$H_2(v'=0)$ by Quéméner *et al.* [1] persists with scattering lengths, both real and imaginary, varying smoothly with v. However, exceptions occur at select high values of v where the scattering lengths are enhanced by orders of magnitude corresponding to the location of a zero-energy resonance in "vibration space." Similar trends are seen for D_2 and HD self-collisions. If the QRRR mechanism operates in other ultracold dimer-dimer collision systems, then vibrational excitation may be used to "tune" the interaction strength similar to methods which use external fields or theoretical variation of the reduced mass.

[1] G. Quéméner et al., *Phys. Rev.* A **77**, 030704(R) (2008).

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Phillip Stancil
University of Georgia

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