

Abstract Submitted
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Zero-energy resonances of hydrogen diatom isotopologues: tuning quasis resonant transitions in vibration space¹ BENHUI YANG, University of Georgia, R. FORREY, Penn State University, P. STANCIL, University of Georgia, S. FONSECA DOS SANTOS, N. BALAKRISHNAN, University of Nevada Las Vegas — Highly efficient and specific energy transfer mechanisms that involve rotation-rotation (RR), vibration-vibration (VV), and vibration-rotation (VR) exchange in diatomic molecules are examined theoretically in ultracold H₂, D₂, and HD self-collisions as a function of initial vibrational level v . From unique full-dimensional inelastic scattering calculations, the three quasis resonant (QR) mechanisms, QRRR, QRVV, and QRVR, are found to operate for all vibrational levels and yield complex scattering lengths which vary smoothly with v . Exceptions to this trend occur at select high values of v where the scattering lengths are modulated by orders of magnitude corresponding to the location of an s -wave zero-energy resonance in “vibration space.” The quasis resonant mechanisms, which are not very sensitive to the details of the interaction potential, generally control the final distribution of molecular states for any given initial distribution. The zero-energy resonances are more sensitive to the potential and may be used to vibrationally “tune” the interaction strength, similar to methods which vary applied external fields.

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