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The effect of energy and angular momentum gaps in cold and ultracold collisions of H_2 molecules SAMANTHA FONSECA DOS SANTOS, BALAKRISHNAN NADUVALATH, Department of Chemistry, University of Nevada Las Vegas, STEPHEN LEPP, Department of Physics, University of Nevada Las Vegas, GOULVEN QUÉMÉNER, JILA, University of Colorado, Boulder, ROBERT C. FORREY, Department of Physics, Penn State University, Berks Campus, PHILLIP STANCIL, Department of Physics and Astronomy and the Center for Simulational Physics, The University of Georgia, Athens — We present a full quantum mechanical treatment of collisions between distinguishable (ortho-para) and indistinguishable (ortho-ortho) H_2 molecules over a wide range of energies and for different initial rovibrational levels of the molecules. For the indistinguishable case, it has been found that a quasi-resonant rotation-rotation (QRRR) transfer that involves the least energy and angular momentum gaps dominates at cold and ultracold temperatures. For the distinguishable case for which exchange of rotational energy between the two molecules is not allowed, a quasi-resonant vibration-vibration (QRVV) transfer dominates inelastic collisions, albeit with less efficiency. When inelastic collisions are dominated by a QRRR or QRVV transition, calculations using a reduced basis set involving only the quasiresonant channel yield nearly identical results as the full basis set calculation, leading to dramatic savings in computational cost.

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