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Vibrational Feshbach Resonance Mechanism for Positron Annihilation on Molecules

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Thanks to a concerted experimental [1,2] and theoretical [3,4] effort, the hypothesis of the role of molecular vibrational Feshbach resonances in providing enhanced positron annihilation rates in molecules [5], has largely been confirmed and accepted. Recent experiments have provided a wealth of information on the two crucial aspects of the resonant annihilation mechanism, namely the positron-molecule binding, and its coupling to the vibrational degrees of freedom. In small molecules with simple vibrational spectra of infrared-active modes (e.g., methyl halides), resonant annihilation is described remarkably well by a theory [4] which contains only one free parameter, the positron binding energy. Application of this theory to other molecules highlights the role of overtones and combinations (methanol), as well as infrared-inactive vibrational excitations (acetylene, ethylene, etc.). In this talk I will review current theoretical understanding of positron-molecule resonant annihilation and discuss some outstanding questions for future research.

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