

Abstract Submitted
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Deuteration studies of resonant positron annihilation on hydrocarbon molecules¹ J.R. DANIELSON, J.J. GOSSELIN, C.M. SURKO, University of California, San Diego — Annihilation on molecules is enhanced by positron attachment to the molecule via the excitation of vibrational Feshbach resonances (VFR).^{2,3} While there is now a quantitative theory of mode-based VFR in small molecules,⁴ a number of open questions remain. We discuss experiments to address these outstanding issues using partial deuteration of hydrocarbons to change the vibrational mode frequencies without changing the electronic structure or positron binding energy. One topic is the observation of combination- and overtone-mode VFR in small molecules (e.g., C₂H₂, C₂H₄, NH₃, and methanol).⁵ Another is that the large increase in annihilation in larger molecules appears to proceed by intramolecular vibrational energy redistribution (IVR), resulting in annihilation rates $\propto N^4$, where N is the number of atoms in the molecule². Partial deuteration of butane is used to explore the origin of this dependence. Deuterium-substitution experiments with ethane and cyclopropane to study the transition to IVR will also be discussed.

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James Danielson
UCSD

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