Abstract Submitted
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Positron-molecule annihilation, Feshbach resonances and bound states[1] J.A. YOUNG, C.M. SURKO, University of California, San Diego — Positron-matter interactions are unique as the positron has no exchange interaction with electrons, is repelled by nuclei, can form positronium and can annihilate with electrons. Using monoenergetic positrons from a trap-based beam, we have been able to measure the first energy-resolved, positron-on-molecule annihilation spectra below the positronium formation threshold [1,2]. Strong peaks in annihilation rate are observed at energies just below the vibrational modes of various molecules. These peaks are due to vibrational Feshbach resonances (VFR) and provide evidence of positron-molecule binding. In alkanes, the binding energy grows linearly and the annihilation rate exponentially with molecular size. In this paper, the properties of these VFR are further explored. The dependence on target morphology is studied for the ring hydrocarbons, benzene, cyclohexane and cyclopropane. A comparison is presented of positron-annihilation and infrared-absorption spectra. Finally, evidence is presented for a second, "positronically excited" bound state in largest alkane molecules studied.

[1] S. J. Gilbert, *et al.*, *Phys. Rev. Lett.*, **88**, 043201 (2002).
[2] L. D. Barnes, *et al.*, *Phys. Rev. A* **67**, 032706 (2003).

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