

Abstract Submitted
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Investigation of Positron-CO scattering using Positronium Annihilation Ratio Spectroscopy¹ W.E. KAUPPILA, J.J. EDWARDS, E.G. MILLER, T.S. STEIN, E. SURDUTOVICH, Wayne State University — We are using the technique [1] of positronium annihilation ratio spectroscopy (PsARS) to study the annihilation of 6 - 13 eV positrons colliding with CO. In this method we detect in coincidence (a) two 511 keV annihilation gamma rays, and simultaneously (b) two 300 - 460 keV gamma rays from the three gamma decay of ortho-Ps. The ratio of these signals $R_{3\gamma/2\gamma}$ versus positron impact energy reveals anomalous behavior for CO when compared with other gases [1] suggesting that some other mechanism than Ps formation is contributing to positron annihilation at an energy about 1 eV above the Ps formation threshold of 7.2 eV. Recognizing that the threshold for electronic excitation by positron impact is located where the anomalous $R_{3\gamma/2\gamma}$ behavior occurs suggests that we may be observing an effect where the positron is electronically exciting CO and temporarily binding to the molecule in a resonance-like state from which the positron can annihilate with an electron producing an enhanced 511 keV coincidence signal consistent with our measurements. [1] W.E. Kauppila, E.G. Miller, H.F.M. Mohamed, K. Pipinos, T.S. Stein and E. Surdutovich, Phys. Rev. Lett. 93, 113401 (2004).

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