

Abstract Submitted
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Evidence of Positron Annihilation at Electronic Excitation Threshold for N_2 * E.G. MILLER, J.J. EDWARDS, W.E. KAUPPILA, T.S. STEIN, E. SURDUTOVICH, Wayne State University — We are investigating Positronium (Ps) formation for < 20 eV positrons interacting with N_2 in a gas scattering cell. The technique [1] of Ps annihilation ratio spectroscopy (PsARS) is used to obtain the ratios of coincidence signals for two of the three gamma rays ($S_{3\gamma}$) in the photon energy window 300 to 460 keV resulting from ortho-Ps decay to that for two 511 keV gamma rays ($S_{2\gamma}$) arising from para-Ps decay and other processes. By comparing these ratios of $S_{3\gamma}/S_{2\gamma}$ for N_2 to those for Ar it is found that N_2 exhibits strikingly anomalous behavior near and below the Ps formation threshold. Typically, this ratio remains constant within 2 eV above the Ps threshold. For N_2 , this ratio decreases to zero at the threshold and an $S_{2\gamma}$ signal remains for an energy of ~ 0.3 eV below. Since N_2 has an electronic excitation threshold for positron impact that opens up at ~ 0.3 eV below the Ps threshold, the present results strongly suggest that the incident positron is electronically exciting N_2 and then binding to the excited N_2 in a temporary resonance-like state from which the bound positron annihilates with a molecular electron. *Research supported by NSF Grant PHY 99-88093.

[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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