

Abstract Submitted
for the DAMOP06 Meeting of
The American Physical Society

Observation of positronium formation with inner orbital electrons for O₂, CO₂, C₂H₂, and N₂O using PsARS¹ J.J. EDWARDS, W.E. KAUPPILA, E.G. MILLER, T.S. STEIN, E. SURDUTOVICH, Wayne State University — We are investigating ortho- and para-positronium (Ps) formation for positrons interacting with simple gas molecules in a gas scattering cell using Ps annihilation ratio spectroscopy (PsARS)[1]. These measurements involve the detection of two gamma rays in coincidence for energy windows (a) centered at 511 keV resulting from the decay of short-lived (0.1 ns) para-Ps and the destruction of longer-lived (0.1 μ s) ortho-Ps at the scattering cell walls, and (b) from 300 to 460 keV resulting from the three gamma decay of ortho-Ps. By taking the ratios of these signals versus positron impact energy we find we are able to compare the resulting curves with that obtained for argon as a reference. These comparisons reveal departures from the argon curve at well defined energies and are interpreted as Ps formation with inner orbital electrons. The fractions of the overall Ps formation cross-section due to inner orbital electrons are estimated to be as high as 30% for O₂, 25% for CO₂, 15% for N₂O and 5% for C₂H₂ near their respective threshold energies. [1] W.E. Kauppila, E.G. Miller, H.F.M. Mohamed, K. Pipinos, T.S. Stein, E. Surdutovich, Phys. Rev. Lett. 93, 113401 (2004).

¹Research supported by NSF Grant PHY 99-88093.

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Date submitted: 31 Jan 2006

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