

Abstract Submitted
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Ortho- and Para-Positronium Formation Measurements for Positron Scattering by C₂H₂ and CH₄* J. EDWARDS, D. DUONG, W. E. KAUPPILA, E. G. MILLER, T. S. STEIN, E. SURDUTOVICH, Wayne State University — We are investigating ortho- and para-positronium formation for positrons interacting with C₂H₂ and CH₄ in a gas scattering cell. These measurements involve the detection of two γ rays in coincidence for energy windows (1) centered at 511 keV resulting from the decay of short-lived (0.1 ns) para-Ps and the destruction of longer-lived (0.1 ms) ortho-Ps at the scattering cell walls, and (2) from 300 to 460 keV resulting from the three gamma decay of ortho-Ps.¹ By taking the ratios of these signals versus positron impact energy we find that near the Ps formation threshold the $3\gamma/2\gamma$ ratios have their largest values of about 1.6, which is where Ps has its lowest kinetic energy and ortho-Ps decays without breakup at the cell walls. Comparing these ratios with ones obtained for Ar¹ reveal interesting differences, which include the formation of Ps with inner orbital electrons. The threshold we observe for forming Ps with CH₄ is consistent with this being an adiabatic ionization process, as opposed to a vertical ionization process.

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¹W.E. Kauppila et al. Phys. Rev. Lett. 93, 113401 (2004).

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