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Proposed Laboratory Simulation of Galactic Positron In-Flight Annihilation in Atomic Hydrogen

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Positron annihilation at 511 keV coming from the direction of the Galactic Center could be occurring in a variety of different ways. One channel, in-flignt annihilation, occurs by charge exchange approximately below 100 eV as positrons slow by inelastic collisions from keV energies. The characteristic Doppler broadened line width and shape is of interest in comparing to galactic gamma ray data from the SPI/Integral telescope.[1] Laboratory experiments in the 1980's simulated annihilation in-flignt in molecular hydrogen and helium.[2] However, the laboratory simulation in atomic hydrogen, proposed here, has only been done with Monte Carlo methods to date. There is a discrepancy of a factor of two in the present laboratory measurements of the positron-atomic hydrogen impact ionization cross section, which affects the predicted in-flight annihilation line-width appreciably. Thus, laboratory measurements of in-flight positron annihilation in atomic hydrogen will be useful at this time to accurately predict this possible component of the Doppler broadened 511 keV annihilation radiation from the Galactic Center.
[1.] E. Churazov, S. Sazonov, S. Tsygankov, R. Sunyaev, D. Varshalovich, 2010, Mon. Not. R. Astron. Soc. 411, 1727.
[2.] B. L. Brown, M. Leventhal, A.P. Mills, & D.A. Gidley, 1984, Phys. Rev. Lett. 53, 2347.

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