Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

A new simple exotic atom, H^{-+}: e^+ bound to H^- in an atomic state[1] I. GUEVARA, M. WEEL, M.C. GEORGE, E.A. HESSELS, C.H. STORRY[2], York Univ — A beam of H^- ions is directed along the axis of a solenoidal magnet winding. Within this magnet, cylindrical electrodes with applied potentials slow the ions to an energy of ~ 50 eV in a magnetic field of ~ 0.13 Tesla. This apparatus also acts as a charged particle trap. e^+ from a radioactive source are slowed in frozen neon, guided by magnetic fields and captured in this Surko-style accumulator with $\sim 10^7$ e^+ trapped and cooled for experiments. H^- ions are directed through these e+ producing long-lived H^{-+} atoms. H^{-+} is not bound in the charged particle trap and continues with the initial momentum of the H^- ion into a metal plate. Upon impact the e^+ quickly annihilates into back-to-back gammas. Detection of these coincident gammas indicates H^{-+} that traveled the 2 meter to the detector and indicates a survival time of $\sim 5\mu s$. Typically systems with antimatter bound to matter particles have short lifetimes (and hence wide transition widths) due annihilation. Rydberg states of H^{-+}, however, have the long radiative lifetimes of normal matter atoms because there is little overlap of the e^+ wavefunction with the core. The detected rates or H^{-+} are consistent with those expected for radiative recombination.

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Date submitted: 31 Jan 2014 Electronic form version 1.4