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Electron cooling and accumulation of 4×10^9 positrons in a system for longterm storage of antihydrogen atoms D.W. FITZAKERLEY, M.C. GEORGE, E.A. HESSELS, C.H. STORRY, M. WEEL, Department of Physics and Astronomy, York University, Toronto, Ontario M3J 1P3, Canada, D. GRZONKA, W. OELERT, Forschungszentrum Jülich GmbH, 52425, Jülich, Germany, G. GABRIELSE, W.S. KOLTHAMMER, R. MCCONNELL, P. RICHERME, Department of Physics, Harvard University, Cambridge, MA, 02138, U.S.A., A. MÜLLERS, J. WALZ, Institut für Physik, Johannes Gutenberg-Universität and Helmholtz Institut Mainz, D-55099, Germany, ATRAP COLLABORATION — For antihydrogen ($\overline{\mathrm{H}}$) production, trapping and spectroscopic measurements, large numbers of positrons (e^+) and antiprotons are required. These antimatter particles are captured, cooled and manipulated in extremely-high vacuum within our Penning-Ioffe trap system to ensure long lifetimes before annihilation with background gas, as required for precision experiments with antimatter atoms. Our ATRAP collaboration has accumulated up to 4×10^9 positrons (e^+) in our Penning-Ioffe trap apparatus which can be maintained at a temperature of 1.2 K and at a pressure below 6×10^{-17} Torr. Realizing this extremely low pressure is particularly challenging given that the Penning-Ioffe trap apparatus is continuously open to the room-temperature e^+ accumulator where Ne and N_2 gasses are used to slow and capture the e^+ that originate from radioactive decay of ^{22}Na. This low temperature and vacuum pressure should allow for $\overline{\mathrm{H}}$ storage times of over 1 year, sufficient time for high-precision tests of antimatter gravity and of CPT invariance.

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