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Cold antihydrogen production in the ATRAP2 apparatus
JONATHAN WRUBEL, G. GABRIELSE, P. LAROCHELLE, D. LE SAGE, B. LEVITT, W.S. KOLTHAMMER, R. MCCONNELL, P. RICHERME, A. SPECK, Harvard University, M.C. GEORGE, D. GRZONKA, W. OELERT, T. SEFZICK, Z. ZHANG, Forschungszentrum Julich GmbH, A. CAREW, D. COMEAU, E.A. HESSELS, C.H. STORRY, M. WEEL, York University, J. WALZ, Institut fur Physik, Mainz, ATRAP COLLABORATION — We have developed a new ATRAP2 experimental platform, which has succeeded in producing thousands of anthydrogen ($\bar{\mathrm{H}}$) atoms in a combined Penning-Ioffe trap. The Penning trap provides confinement for charged particles and the quadrupole Ioffe trap provides a neutral atom trap for $\bar{\mathrm{H}}$ atoms. Up to 78,000 antiprotons ($\bar{\mathrm{p}}$) are trapped and cooled to 7K in a 1T bias field with every ejection from CERNs Antiproton Decelerator. At the same time 5×10^6 positrons (e^+) are loaded. Several shots are stacked and adiabatically transferred into neighboring electrodes in the center of the quadrupole Ioffe trap. Fine control in the Penning trap is provided by 37 individually rf and dc biased gold-plated copper cylinders. The Ioffe trap is ramped to full field and the $\bar{\mathrm{p}}$ are coaxed to interact with the e^+. As the $\bar{\mathrm{p}}$ are cooled by the e^+, $\bar{\mathrm{H}}$ atoms are formed that may be trapped by the Ioffe trap. The apparatus includes MnF_2 windows in the Ioffe trap to transmit Lyman-α radiation into the production space, which is needed for future laser cooling and precision spectroscopy of $\bar{\mathrm{H}}$.

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