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Large numbers of cold positronium atoms created in laser-selected Rydberg states using resonant charge exchange . R. MCCONNELL, G. GABRIELSE[1], W. S. KOLTHAMMER, P. RICHERME, Harvard University, A. MULLERS, J. WALZ, Johannes Gutenberg-Universitat and Helmholtz, D. GRZONKA, W. OELERT, M. ZIELINSKI, Forschungzentrum Julich, D. FITZAKERLEY, M. C. GEORGE, E. A. HESSELS, C. H. STORRY, M. WEEL, York University — Lasers are used to control the production of highly excited positronium atoms (Ps*). The laser light excites Cs atoms to Rydberg states that have a large cross section for resonant charge-exchange collisions with trapped positrons. For each trial with 30 million trapped positrons, more than 700 000 of the created Ps* have trajectories near the axis of the apparatus, and are detected using Stark ionization. This number of Ps* is 500 times higher than realized in an earlier proof-of-principle demonstration [Phys. Lett. B 597, 257 (2004)]. A second charge exchange of these near-axis Ps* with trapped antiprotons could be used to produce cold antihydrogen, and this antihydrogen production is expected to be increased by a similar factor.

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