Abstract Submitted
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Positronium Cooling in Porous Silica Measured via Doppler Spectroscopy[1] TOMU HISAKADO, DAVID CASSIDY, UC Riverside, Dept. of Physics and Astronomy, ALLEN P. MILLS, HARRY W. K. TOM, UC Riverside, Dept of Physics and Astronomy — We have measured the kinetic energy of positronium (Ps) atoms emitted into vacuum from a porous silica film subsequent to positron bombardment, via the Doppler spread of the line width of the Ps 13S-23P transition. We find that the deeper in the target film that positrons are implanted the colder is the emitted Ps, an effect we attribute to cooling via collisions in the pores as the atoms diffuse back to the film surface. We observed a lower limit to the mean Ps kinetic energy associated with motion in the direction of the laser, $Ex = 42 \pm 3$ meV, that is consistent with conversion of the confinement energy of Ps in the 2.7 nm diameter pores to kinetic energy in vacuum. An implication is that a porous sample would need to be composed of pores greater than around 10 nm in diameter in order to produce thermal Ps in vacuum with temperatures less than 100K. By performing Doppler spectroscopy on intense pulses of Ps we have experimentally demonstrated the production of many excited state Ps atoms simultaneously, which could have numerous applications, including laser cooling and fundamental spectroscopic studies of Ps and the production of antihydrogen.

[1]NSF

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