Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

keV-energy x-rays from a low-pressure, low-power, low-field, capacitively coupled 27-MHz hydrogen plasma source[1] PETER JANDOVITZ, CHARLES SWANSON, JACKSON MATTEUCCI, S.A. COHEN, Princeton Plasma Physics Laboratory — We report on the unexpected observation of 0.9–5 keV x-rays coming from a cool (bulk $T_e \sim 4$ eV), tenuous ($n_e \sim 10^{10}$ cm^{-3}) 5-cm-diameter hydrogen plasma column generated in a tandem high-mirror-ratio mirror machine by an external, capacitively-coupled RF (27 MHz) antenna operating at low power, 20–500 W. The x-rays, measured with an Amptek XR-100CR detector, are evidence of energetic electrons that have not been seen previously in experiment or theory in similar plasmas. In the neutral H_2 gas pressure range of 0.4 to 1.5 mT, the x-ray emissivity increased with decreasing pressure. No x-rays were observed when operating with argon (or 30/70 argon/hydrogen mixtures) at similar powers and pressures in either capacitively-coupled or helicon modes. X-ray count rate smoothly increased as mirror ratio increased and reached a broad maximum near 80 G, central field. Time-dependent emissivity with pulsed RF power and spatial profiles over a limited axial range have been measured. Possible heating mechanisms, including Fermi acceleration, cyclotron resonance, double layers, and sheaths, are being considered.

[1]This work was supported by DOE contract DE-AC02-09CH11466.

Peter Jandovitz
Princeton Plasma Physics Laboratory

Date submitted: 24 Jul 2015 Electronic form version 1.4