Abstract Submitted
for the GEC07 Meeting of
The American Physical Society

Doppler broadening of atomic-hydrogen lines in DC and capacitively coupled RF plasmas KAMRAN AKHTAR, Blacklight Power Inc., J.E. SCHARER, UW-Madison, R.L. MILLS, Blacklight Power Inc. — The extraordinary broadening of Balmer lines of hydrogen admixed with Ar or He as opposed to Xe in DC glow and capacitively coupled rf discharges is studied over a wide range of pressure and gas compositions. High-resolution optical emission spectroscopy is performed parallel to (end-on) and perpendicular (side-on) to the electrode axis along with Langmuir probe measurements of plasma density and electron temperature for the RF capacitive discharge case. A broad and symmetric (Gaussian) Balmer emission line corresponding to 20-60 eV hydrogen atom temperatures is observed in Ar/H_2 and He/H_2 plasmas. Energy is transferred selectively to hydrogen atoms whereas the atoms of admixed He and Ar gases remain cold (<0.5 eV). In the field acceleration model [e.g., Cvetanovic et. al. J. App. Phys., Vol. 97, 033302-1, 2005] there apparently is no preferred species to which energy is coupled and according to the model one should observe enhanced temperatures of hydrogen and helium atoms in He/H_2 discharges where the atomic mass is more comparable (4:1). We also briefly examine the experimental results using the Resonance Transfer Model of hydrogen heating [Mills et. al *IEEE Trans. Plasma Sci.,* 31, 338, 2003] as the source of broadening.

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Date submitted: 15 Jun 2007 Electronic form version 1.4