Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Destruction of a Magnetic Mirror-Trapped Hot Electron Ring by an Alfvén Wave[1] YUHOU WANG, WALTER GEKELMAN, PATRICK PRIBYL, UCLA Dept of Physics, KONSTANTINOS PAPADOPOULOS, Univ of Maryland, Dept of Physics — Highly energetic electrons produced naturally or artificially can be trapped in the earth's radiation belts for months, posing a danger to valuable space satellites. Concepts that can lead to mitigation of the radiation belts have drawn a great deal of interest. In this work, we demonstrated that a shear Alfvén wave can effectively de-trap energetic electrons confined by a magnetic mirror field.[2] The experiment is performed in a quiescent afterglow plasma in the Large Plasma Device (LaPD) at UCLA ($n_e = 0.1-1\times10^{12}/cm^3$, $T_e = 0.5eV$, $B_0 = 400-1600G$, $L = 18m$, and $diameter = 0.6m$). A hot electron ring (along with hard x-rays of energies up to 3 MeV) is generated by 2nd harmonic ECRH ($P = 25kW$, $\tau_{pulse} = 20-50ms$, $f = 2.45GHz$) and is trapped in a magnetic mirror field ($L = 3m$, $R_{mirror} = 1.1-4$). A shear Alfvén wave ($f \approx 0.5f_{ci}$, $B_{wave}/B_0 \approx 0.1\%$) is launched with a rotating magnetic field antenna with arbitrary polarity. The circularly polarized Alfvén wave is observed to dramatically scatter the trapped fast electrons out of the mirror within as little as 10 wave cycles. A collimated detector outside the vacuum vessel detects X-rays of E>100 keV. X-ray images are reconstructed from more than 1000 chord projections at each axial location by computed tomography. The de-trapped electrons are observed outside the mirror field region.

[1]Supported by ONR and performed at the Basic Plasma Science Facility.
[2]Y. Wang, W. Gekelman, P. Pribyl, and K. Papadopoulos, Phys. Rev. Lett. 108, 105002 (2012).

Yuhou Wang
UCLA Dept of Physics

Date submitted: 12 Jul 2012 Electronic form version 1.4