Experiments on the scattering of fast electrons by Alfvén waves

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High energy ions and electrons with anisotropic distribution functions can be trapped in the earth's radiation belts for months, which pose a danger for satellites. An electron population with large $\frac{\vec{v}_\perp}{v_\parallel}$ and was introduced in the afterglow of the background LAPD plasma, that is after the main discharge is terminated and the density and electron temperature are low. ($n \simeq 2\times 10^{11} cm^{-3}, T_e = 0.25eV, B = 1kG, L = 17m, dia = 60cm$) The magnetic field was tailored to have a local minimum such that microwaves at 2.45 GHz and resonated with the plasma at an axial and radial location where $f = f_{UH}$. A small (2 cm diameter) electron hot spot was generated at this location. Shear Alfvén waves (f = 192 kHz) launched by an orthogonal loop antenna [1], with magnitude $\delta B_{wave} \approx 2G$ destroyed the hot spot within 10 cycles. The hot spot returns when the Alfven wave is shut off. Space-time evolution of the plasma density, flow and electron will be presented. The mechanism of the electron de-trapping is under investigation.

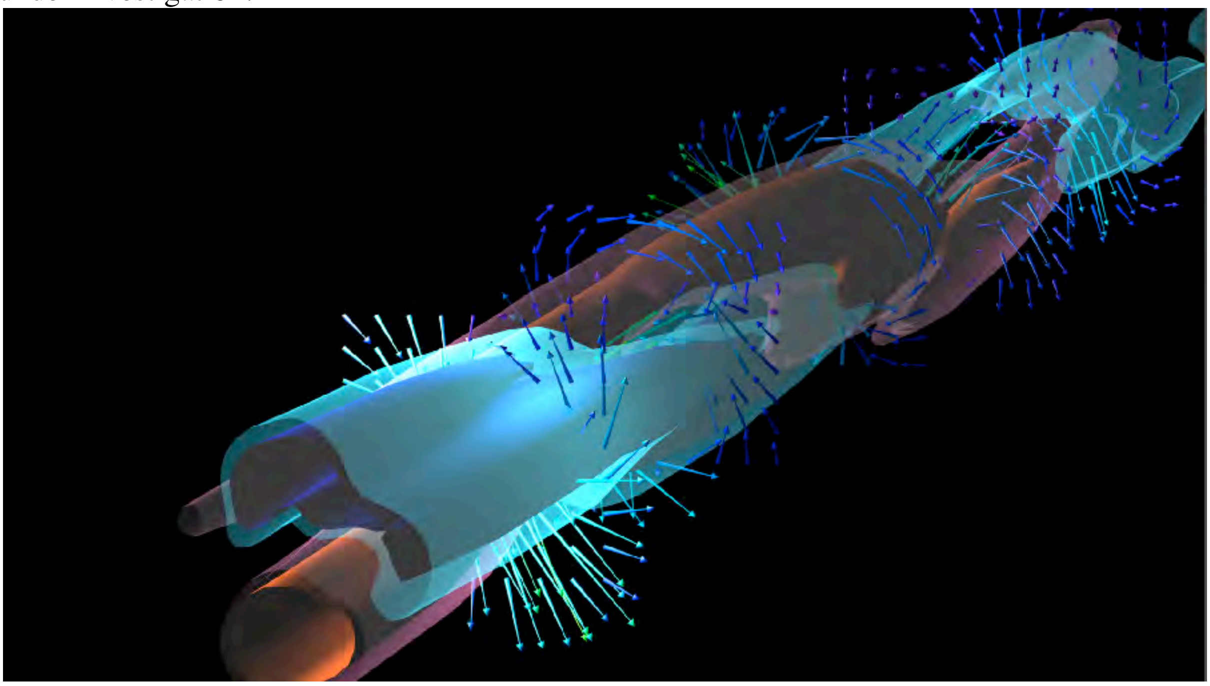

Figure. Isosurfaces of axial current jz, and magnetic field of a shear Alfvén wave used to disrupt the electron hot spot. The transverse extent of the wave is 20 cm and axial wavelength. The lighter and darker currents are helical and of opposite signs.

[1] A. Gigliotti, W. Gekelman, P. Pribyl, S. Vincena, A. Karavaev, X. Shao, A.S. Sharma, D. Papadopoulis, "Generation of Ploarized Shear Alfvén Waves by a Rotating Magnetic Field Source", accepted for publication Phys. Plasmas, Aug. 2009