Laboratory investigation of energetic electron pitch angle scattering by whistler waves**

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Cyclotron resonance of whistler waves with electrons, leading to pitch angle diffusion into the loss cone, is thought to be an important mechanism for depleting energetic electron populations in the radiation belts (see, for example, the classic work of C. F. Kennel and H. E. Petschek, "Limit on stably trapped particle fluxes," J. Geophys. Res. 71, 1, 1966). Laboratory experiments in progress in the Space Physics Simulation Chamber (SPSC) at the U. S. Naval Research Laboratory (NRL) are attempting to observe and characterize this process. A pulsed RF plasma source developed specifically for these experiments produces high ionization fraction plasmas at densities near $10^{10}/cm^3$ in half mirror, full mirror, and uniform magnetic field geometries. Whistlers are driven by a helicon antenna, separate from that used for the plasma source, and interact in a 3m uniform field region with an energetic electron beam. The beam can be steered magnetically to adjust the pitch angle, and can be operated in CW or pulsed mode at up to 5keV and 80mA. Results of gridded-energy analyzer measurements of the energetic electron populations, and their dependence as the RF frequency of the whistler waves driven in the plasma is scanned through the Doppler shifted cyclotron resonance frequency, will be reported. To our knowledge, this process in its fundamental form has not previously been observed in the laboratory, although its existence is essential in many laboratory applications such as electron cyclotron resonant heating of tokamak plasmas.
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