Laboratory investigation of nonlinear whistler wave processes*

Bill Amatucci, Erik Tejero, Chris Crabtree, Dave Blackwell, and Guru Ganguli
Plasma Physics Division, Naval Research Laboratory, Washington, DC 20375

Nonlinear interactions involving whistler wave turbulence result from processes such as wave-particle interactions in the radiation belts and instabilities in sharp magnetospheric boundary layers. Given sufficient whistler energy density, nonlinear scattering off background thermal electrons substantially changes the wave vector direction and energy flux, while inducing a small frequency shift [*Crabtree*, *Phys. Plasmas* **19**, 032903 (2012)]. In the magnetosphere, boundary layers often have highly sheared plasma flows and lower hybrid turbulence. Nonlinear scattering of primarily electrostatic lower hybrid waves into electromagnetic whistler modes is being investigated in the Naval Research Laboratory's Space Physics Simulation Chamber under conditions scaled to match the respective environments. The specific nonlinear process being examined is the scattering of the transversely propagating, primarily electrostatic, lower hybrid wave into a more parallel propagating electromagnetic whistler mode. Lower hybrid waves are generated directly by antennas or self-consistently from sheared cross-magnetic field flows with scale length less than an ion gyroradius via the Electron-Ion Hybrid Instability [*Ganguli*, *Phys. Fluids* **31**, 2753 (1988)), *Amatucci*, *Phys. Plasmas* **10**, 1963 (2003)]. Sufficiently large amplitude lower hybrid waves have been observed to convert into whistler modes by scattering from thermal electrons. The plasma response as a function of transmitted lower hybrid wave amplitude is monitored with magnetic loop antennas. Details of the observed wave spectra and mode characteristics will be presented.

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