Demonstration of Loss Cone Induced Quasi-Longitudinal (QL) Whistlers in Large Laboratory Plasma of LVPD

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Abstract

Whistler turbulence observed in earth's magnetosphere has free energy source lies in energetic electrons, electron beams, anisotropies in temperature and electron distribution function, density gradients, loss cone etc. and is responsible for the precipitation of energetic electrons into the ionosphere. This has been observed that when pole bound electrons get trapped in the earth's magnetic field and suffers loss cone instability, which results in the excitation of Quasi-Longitudinal (QL) whistlers at large oblique angles.

We report experimental observation of loss cone driven Quasi-Longitudinal (QL) whistlers in a laboratory plasma excited by the reflected electrons from a magnetic mirror. The QL whistler propagate highly obliquely ($\theta = \tan^{-1}(k_\perp / k_\parallel) \approx 87^0$) in a broad band of $40kHz < f \leq 80\,kHz$ with $k_\perp \sim 1.4\,cm^{-1}$ and $k_\parallel \sim 0.06 cm^{-1}$ respectively. It exhibits strong correlation between density and magnetic field fluctuations ($C_{n_e,B_z} = -0.9$), and interestingly it shows a continuous variation of wave polarization with frequency. We have compared experimental observations with numerical results obtained from the theoretical models of Sharma et al. [1], Olga et al. [2] and Quasi Longitudinal (QL) whistlers by Henry G. Booker et al., [3] and found a good agreement between them. This is probably first laboratory demonstration of QL whistlers and detailed results on it will be presented in the conference [4].

References

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