NCU-GISS 國立中央大學太空科學研究所 Graduate Institute of Space Science

專題演講

MHD turbulence and plasma waves in solar wind, magnetosphere and interstellar medium

Speaker： **Dr. Kun-Han Lee**

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Time： 107 年 11 月 30 日 星期五 14:00

Place： 健雄館(科四館) S4-811 教室

摘 要/Abstract：

Interstellar scintillation of radio waves from pulsars reveals that the interstellar turbulence spectrum of electron density approximates the Kolmogorov power law from wavenumber $q = 10^{-18} m^{-1}$ to $10^{-6.5} \mathrm{m}^{-1}$. In the present study the interstellar turbulence spectrum of electron density is obtained for the first time from in situ observations of Voyager 1. The observed spectrum extends from $\lambda = 15\mathrm{AU} \approx 2.25\times10^{12}\mathrm{m}$ ($q = 4.4\times10^{-13}\mathrm{m}^{-1}$) to $\lambda = q^{-1}$ =50m ($q = 2\times10^{-2}\mathrm{m}^{-1}$), close to the Debye length. The measured spectrum covers part ($q = 4.4\times10^{-13}$-$10^{-6}\mathrm{m}^{-1}$) of the Kolmogorov inertial range as well as ion and electron kinetic scales ($q = 10^{-6}$-$2\times10^{-2}\mathrm{m}^{-1}$). The observed Kolmogorov inertial range shows a good agreement with earlier studies. Around the kinetic scales, a bulge of spectral intensity higher than the Kolmogorov spectrum is found. The enhanced kinetic range of spectrum may be caused by shocks of solar origin.

On the other hand, electromagnetic ion cyclotron (EMIC) waves are often observed in the magnetosphere and solar wind. We present a simulation study on the generation of EMIC waves in different ion cyclotron bands associated with fast magnetosonic shocks. In the magnetosphere, these shocks can be associated with either dynamic pressure enhancement or shocks in the solar wind and can lead to the formation of a “bunch” distribution of O+ ions in the perpendicular velocity phase space. The O+ bunch distribution can excite strong He+ EMIC waves and weak O+ and H+ waves. The dominant He+ EMIC waves show the presence of harmonics in the Fourier frequency spectrum or frequency modulations in the instantaneous frequency spectrum. In the solar wind, strong fast shocks are often observed. In the downstream region, the hydrogen H+ and helium ions He++ are strongly heated to high ion beta and high temperature anisotropy, leading to generation of EMIC and mirror mode waves. The EMIC waves in the simulations are found to grow both in the parallel and quasi-perpendicular directions. We also find coalescence of mirror waves as they drift with the plasma to further downstream region.

※歡迎聽講※

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