Parametric instabilities of circularly polarized Alfven waves in plasmas with beam protons

Yasuhiro Nariyuki[1]; Tohru Hada[2]; Ken Tsubouchi[3]

[1] KNCT; [2] ESST, Kyushu Univ; [3] NICT

http://www.ee.kochi-ct.ac.jp/˜nariyuki/

In this presentation, we discuss the parametric instabilities of circularly-polarized Alfven waves in plasmas with proton beams by using the 1-D hybrid simulations. Even when the beams are stable, proton velocity distribution functions (VDFs) of both the beam and the core components are modified by parametric instabilities of Alfven waves in time.

According to the excitation of the broadband Alfven waves and longitudinal waves (ion sound waves) by the parametric instabilities, protons are diffused in the velocity space, resulting in the disappearance of the beam components. Such a drastic change of the proton VDFs significantly modifies the dispersion relation, which in turn quenches the parametric instabilities which are dominant in the initial stage. Subsequently, parametric instabilities at different wave numbers and frequencies are driven unstable and become dominant.

Parametric instabilities are also observed in a plasma with unstable beams. When left-hand polarized (LH-) Alfven wave is given, both backward propagating RH- and LH- Alfven waves are excited by the decay instabilities in our runs. As time elapses, phase coherent turbulence is generated by the modulational instabilities of LH- Alfven waves. Some of the beam protons are perpendicularly accelerated by cyclotron resonance with the primary wave. The results in the present paper give the basic knowledge to analyze the nature of solar wind Alfvenic turbulence.