IAEA FEC 2014

Contribution ID: **281** Type: **Poster**

Simulation Study of a New Kind of Energetic Particle Driven Geodesic Acoustic Mode

Tuesday 14 October 2014 08:30 (4 hours)

A new kind of energetic particle driven geodesic acoustic mode (EGAM), which has weak bulk plasma temperature dependence of frequency, has been found in the Large Helical Device (LHD) experiments. In this work, the new kind of EGAM is investigated with a hybrid simulation code for energetic particles and magnetohydrodynamics (MHD). It is demonstrated that the new EGAM in the simulation results has weak bulk plasma temperature dependence of frequency, which is in contrast to the traditional EGAM whose frequency is proportional to the square root of bulk plasma temperature. Three conditions are found to be important for the transition from the traditional EGAM to the new EGAM: 1) energetic particle pressure substantially higher than the bulk plasma pressure, 2) charge exchange time (tau_cx) sufficiently shorter than the slowing down time (tau_s) to create a bump-on-tail type distribution, and 3) bulk plasma density is low enough.
The energetic-particle distribution function is characterized by the tau_s = 8 s and tau_cx < 1 s. The energetic ion inertia term is added into the MHD momentum equation to simulate with energetic particle density comparable to the bulk plasma density. In addition, a Gaussian-type pitch angle distribution is assumed for the energetic ions. Linear growth properties of the new EGAM are investigated. It is found that the new EGAM frequency increases as the central value of the Gaussian pitch angle distribution decreases, where smaller pitch angle variable corresponds to higher parallel velocity and higher transit frequency. This indicates that the frequency of new EGAM is significantly affected by the energetic particle transit frequency, and the new EGAM is a kind of energetic particle mode (EPM) whose frequency is determined by the energetic particles. Furthermore, the frequency depends on energetic particle beta value (beta_h) and tau_cx. Growth rate of new EGAM increases as beta_h increases similarly with other energetic particle driven instabilities, but the frequency increases as beta_h increases. For higher beta_h, the effect of energetic particles is enhanced to make the frequency closer to the energetic-particle transit frequency. Moreover, shorter tau_cx causes higher growth rate and frequency, because more particles exist in the high-energy region of phase space.

Country or International Organisation

Japan

Paper Number

TH/P1-12

Primary author: Dr WANG, Hao (National Institute for Fusion Science)

Co-authors: Dr OSAKABE, Masaki (National Institute for Fusion Science); Dr TODO, Yasushi (National Institute for Fusion Science)

Presenter: Dr WANG, Hao (National Institute for Fusion Science)

Session Classification: Poster 1