THE EFFECT OF OXYGEN IONS ON THE DISPERSION PROPERTIES OF KINETIC ALFVÉN WAVES IN THE MAGNETOSPHERE

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Abstract:

Kinetic Alfvén Waves (KAWs) are right-hand polarized Alfvénic waves that propagate at quasi perpendicular wavenormal angles when the perpendicular wavelength becomes of the order of the scale of the protons' gyroradius. These waves are particularly relevant for the study of space plasmas, as it has been suggested that they play a key role in several kinetic processes, such as the energy transfer from larger scales towards smaller, electron scale [1]. These waves have mostly been studied in ideal, proton-electron plasmas. Space plasmas are, however, constituted of a varied range of particle populations, some of them being significant enough to be neglected. Since the dispersion relation for oblique waves in a collisionless plasma depends on the different ion density and plasma beta of the different species, here we present a study focused on the analysis of the dependence of the dispersion relation of KAWs on the mentioned parameters. To do so, we consider the magnetospheric environment, where the plasma is mostly composed of electrons, protons, and oxygen ions with different concentrations relative to protons. Previous studies have suggested that the inclusion of heavy ions on the dispersion relation may allow the propagation of KAWs at lower wavenormal angles as in the simpler electron-proton plasma case [2]. Here we present an extensive study of the dispersion relation of oblique Alfvénic waves and other parameters, such as polarization, compressibility, and magnetic helicity, for a magnetospheric type plasma in order to better understand the transition from left-hand polarized Alfvén-cyclotron waves to the KAW mode in this environment.

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References:

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