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Ion Beam Excited Alfven Wave Instability in Plasma with Dust Grains

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Abstract—*Alfven wave is the dominant low frequency transverse mode of magnetized plasma. The wave propagates along the magnetic field and displays a continuous spectrum. An ion beam propagating through plasma drives electromagnetic Alfven waves to instability via cyclotron interaction. We study the combined effect of the dust grains and a magnetic field on the growth rate of the Alfven wave instability in plasma. It is shown that the presence of charged dust grains and ion beam modify the dispersion relation of low frequency Alfven wave. The dust grain concentration and the fluctuating charge on dust grains reduce the frequency of the Alfven wave. Negatively charged dust grains stabilize the instability while positive dust grains enhance it. The damping rate of Alfven wave is reduced in the presence of ion beam. The dielectric constant and refractive index increase with an increase in dust grain number density. The value of maximum growth rate increases with an increase in unstable parallel wave number, unstable frequency and the beam density. An increase in the external static magnetic field increases the growth rate of the instability. The results of the proposed theory are applied to understand some of the experimental observations. Numerical calculations are done using the plasma parameters suitable for the earth's magnetosphere.*

Keywords*: Dispersion, cyclotron, refractive index, instability, frequency.*