
Relativistic Effects on Excitation of Oblique Whistler Waves in Dusty Plasma

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Abstract

Whistler waves excited by energetic electrons are often observed in the outer Earth's radiation belts or in the inner Jupiter's magnetosphere. In this paper, we examine the whistler waves propagating at an angle to the external magnetic field, generated by relativistic electron beam. When an electron beam is launched into a dusty plasma, it excites these modes at moderate to high beam energies. The excitation of the high phase velocity mode requires higher beam energies. The frequency and the growth rate of the unstable wave increase with the relative density of negatively charged dust grains. The unstable wave frequency is below the non-relativistic electron cyclotron frequency but above the ion cyclotron frequency. The maximum value of growth rate increases with the beam density and is proportional to the square root of beam density. These results should shed light on mechanisms of whistler wave excitation in space plasmas where relativistic electrons are present.

References

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