MAGNETIZED DUSTY PLASMA WITH FERROMAGNETIC GRAINS AS A NEGATIVE REFRACTIVE MEDIUM IN A NARROW SHF BAND

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S u m m a r y

The paper is devoted to the analysis of high-frequency dispersion properties of a dusty plasma with ferromagnetic grains in a strong constant external magnetic field. The dispersion of the magnetic permeability of the magnetic subsystem along with the dispersion of the dielectric permittivity of the charged subsystem are taken into account. The dispersion of the magnetic permeability tensor is important only near the ferromagnetic resonance frequency of an individual grain ω_M that is related to the SHF range. Therefore, in such a plasma, one more typical frequency ω_M appears. The magnetic subsystem strongly interacts with the eigenwaves of the conventional magnetized electron-ion plasma and considerably affects their dispersion near this frequency.

In particular, the presence of ferromagnetic grains opens a transparency window in a magnetized dusty plasma with ferromagnetic grains in the vicinity of ω_M, $\omega \approx \omega_M < \Omega_e$ (electron plasma frequency) that does not exist in the conventional electron-ion magnetized plasma. The group and phase velocity of these new waves are opposite, and we can prescribe them a negative refraction index. Their group velocity is much smaller than the velocity of light.

We claim that the dusty plasma with ferromagnetic grains in a strong constant magnetic field can be related to the left-handed media or the negative refraction media in a narrow SHF band near the frequency of the grain ferromagnetic resonance.