On the electron whistler dispersion law in total continuous frequency domain above the ion cut-off frequency in a multi-ion dusty plasma

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A simple quantitatively correct electron whistler dispersion law valid in a total continuous frequency domain above the ion cut-off frequency in multy-ion dusty plasma is presented. Under the typical conditions of magnetospheric plasma with an essential difference between the gyrofrequency values of lightest and other more heavy ions it corresponds to the upper root of the biquadratic equation derived. In this case the resultant contribution of all the ions to the dispersion law is expressed by means of the lower hybrid resonance frequency (LHR), the highest ion cut-off frequency and the relative content of the lightest ion. Thus the only one additional background plasma parameter as the relative content of the lightest ion should be provided in addition to those ones (including electron gyro- and plasma frequencies) which can be determined using wide band wave receivers. The features of the electron whistler dispersion equation near the highest ion cut-off frequency is analyzed for cold plasma with several light ions and several electronegative ions or electronegative dust grains. In this case to fit well the electron whistler dispersion law the set of an external plasma parameters should be expanded by the relative content of all the lightest ions of comparable gyrofrequencies and the electrons' relative content. The effects of possible essential increase of the highest ion cut-off frequency in plasma space regions enriched by negative heavy particles and accompanying variation of the LHR and electron plasma frequency values is discussed in application to the possible spectra features of the registered low frequency whistler waves. In more high frequency domain the new dispersion law naturally reduces to the modified whistler dispersion law, valid in a plasma with finite ratio of electron gyro- to plasma frequency while the wave frequency is much less than the electron plasma frequency.