Modulational excitation of density perturbations in dusty ionosphere

T.I. Morozova\textsuperscript{1,2}, S. I. Kopnin\textsuperscript{1,2} and S. I. Popel\textsuperscript{1,2}

\textsuperscript{1}Moscow Institute of Physics and Technology, Institutskiy per. 9, 141700, Dolgoprudny, Moscow Region, Russia

\textsuperscript{2}Institute for Dynamics of Geospheres RAS, Leninsky pr. 38, bldg. 1, 119334 Moscow, Russia

Recent investigations of ionosphere by electromagnetic waves with frequencies exceeding 1 GHz show the presence of density perturbations at the altitudes of 80 to 100 km. This range of altitudes corresponds often to the presence of dust having meteoritic origin \cite{1} or ice grains responsible for an appearance of Noctilucent Clouds or Polar Mesospheric Summer Echoes \cite{2}. Here, we study a possibility of excitation of density perturbations due to the development of the modulational instability in plasmas under the conditions of the dusty ionosphere. The specific feature of the dusty ionosphere is the presence of dust acoustic waves. We investigate modulational instability of broad spectra of electromagnetic and Langmuir waves with participation of low-frequency dust acoustic waves, determine the growth rates of the instability, its thresholds and conditions. We show that the modulational interaction \cite{3} can be responsible for an appearance in the ionosphere of the density perturbations of about 1 per cent with respect to the background density. This is in a good agreement with the data of observations.

T.I. Morozova acknowledges the financial support of the Dynasty Foundation and S.I. Kopnin acknowledges the financial support of the RF President Grant Council for support of young scientists and leading scientific schools (grant no. MK-3764.2013.2).

References

\cite{1} A. Yu. Dubinskii and S. I. Popel, JETP Letters 96, 21–26 (2012).

\cite{2} S.I. Kopnin, S.I. Popel, and M.Y. Yu, Phys. Plasmas 16, 063705 (2009), 7 pages.