Propagation features of acoustic-gravity waves in a medium with thermal misbalance

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The heating and cooling processes have a significant effect on MHD waves propagating in the solar corona. Their influence is traditionally described in the framework of the approach proposed by Field [1]. This model considers a homogeneous medium in which, in the stationary state, heating and cooling, which depend on the temperature and density of the medium, compensate each other. When a perturbation appears in the medium, a misbalance of heating and cooling occurs, which changes the dispersion properties of the MHD wave and leads to the appearance of so-called thermal instabilities of various types (or, conversely, to the appearance of a steady state). However, this approach does not take into account the plasma structurization observed in real media.

In the current work, the effects of thermal imbalance and gravitational stratification of the medium are taken into account simultaneously. In the case when the influence of heat conduction can be considered weak or the temperature profile with height is close to linear, the condition of thermal equilibrium (zero equality of the heat release function) must be fulfilled in each spherical layer, and the condition of hydrostatic equilibrium must also be fulfilled. Simultaneous fulfillment of these conditions means that the profile of thermodynamic parameters with height is determined by the type of heat loss function, namely by the zeros of the heat-loss function.

In this work, we have obtained the relationship between the altitude profile of temperature, density, and pressure as a function of the parameters of the heating and cooling functions given as power functions of density and temperature. This relationship also opens up the possibility of determining the parameters of an unknown heating function from the known altitude profiles of thermodynamic parameters. In addition, a change in the acoustic cut-off frequency in the heat-releasing medium was found, which is associated with a change in the phase velocity of acoustic wave propagation in media with thermal misbalance.

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References

1. G.B. Field, *ApJ* **1965**, 142, 531-567.