Cut-off wavenumber of Alfvén waves in partially ionized plasmas of the Solar Atmosphere

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Abstract

Alfvén (fast) wave dynamics in resistive single-fluid magnetohydrodynamics shows the presence of cut-off wavenumber i.e. Alfvén (fast) waves with wavenumbers higher than the cut-off value are evanescent. The cut-off wavenumber appears in both, fully and partially ionized plasmas. To point out the reason for the appearance of a cut-off wavenumber, we start with three-fluid equations (with electrons, protons and neutral hydrogen atoms) and make consecutive approximations until the usual single-fluid description is obtained. We solve the dispersion relation of linear Alfvén waves at each step and seek for the approximation responsible of the cut-off wavenumber appearance. The cut-off wavenumber in single-fluid MHD is the result of neglecting the inertial and Hall terms.

Keywords: MHD waves, Partially ionized plasma

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