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Coronal waves: Propagation and dissipation in the multi-fluid description

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Recent UV, EUV and X-Ray observations recorded by different instruments on board of SOHO and TRACE revealed evidence for MHD waves propagating in the solar corona. MHD oscillations in closed magnetic structures decay rapidly in time which indicates a strong damping[1]. Progress in terms of MHD modeling has been made in studies of wave propagation and dissipation in the magnetically structured and gravitationally stratified corona; these models are relevant to the interpretation of the recent observations. MHD linear perturbation theory, or full nonlinear simulation, cannot address the microphysics of the dissipation that occurs at small scales, since MHD is mainly a large-scale theory. This difficulty is very often avoided by enhancing the transport coefficient by several orders of magnitude over their classical values. Consequently, in order to take into account the natural scales of the coronal plasma ranging from high-frequency short-scale kinetic dynamics up to low-frequency large-scale fluid dynamics, we use, in the present study, a multi-fluid plasma model in order to address wave propagation and dissipation in the gravitationally stratified corona. We apply a local perturbation analysis using the WKB theory assuming that the wavelengths are much smaller than the inhomogeneity length scales.

References:

[1] Nakariakov, V. M., Ofman, L., DeLuca, E., et al. 1999, Science 285, 862.