

SPATIAL DAMPING OF LINEAR NON-ADIABATIC MAGNETOACOUSTIC WAVES IN A PROMINENCE MEDIUM

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We study the spatial damping of linear non-adiabatic magnetoacoustic waves in a homogeneous, isothermal and unbounded medium permeated by a uniform magnetic field, with physical properties akin to those of solar prominences. We consider an energy equation with optically thin radiative losses, thermal conduction and heating, and linearize the MHD equations to obtain a sixth order polynomial in the wavenumber k which represents the dispersion relation for slow, fast and thermal MHD waves. Since we are interested in the spatial damping, we have taken ω as real and have solved numerically the dispersion relation to obtain complex solutions for the wavenumber k corresponding to fast, slow and thermal waves. The thermal wave shows the strongest spatial damping while the fast wave shows the weakest spatial damping. At periods greater than 1 s the spatial damping of magnetoacoustic waves is dominated by radiation, while at shorter periods the spatial damping is dominated by thermal conduction. For very short periods the isothermal regime is attained and the damping length becomes almost constant. Radiative effects on linear magnetoacoustic slow waves can be a viable mechanism for the spatial damping of short period prominence oscillations while thermal conduction does not play any role. In particular, short-period oscillations (5–15 min) observed in quiescent limb prominences, which seem to be due to internal fundamental slow modes, have damping lengths in the range $10^4 - 5 \times 10^4$ km, in good agreement with our results.