

## Heating of the low-beta chromosphere by fast magnetic shock wave

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The energy balance in the chromosphere is dominated by mechanical heating and radiative loss. Shock wave is one of the candidates for chromospheric heating. Previous researches provide different wave heating scenarios and comparison among them is necessary. However, it is difficult as the previous theoretical works usually use the artificial model that can include only one or a few mechanisms. On the other hand, previous studies using realistic simulations usually focus on synthesized observation without investigating the detailed physics about the heating mechanisms or the propagation of waves.

This study aims to investigate the propagation of MHD waves in realistic simulations and quantitatively determine the role of different wave modes in chromospheric heating. We perform two-dimensional MHD simulations from the convection zone to the corona with local thermodynamic equilibrium radiative transfer in the photosphere and approximated chromospheric and coronal radiative loss. From the simulation results, we identify the shocks by filtering the regions with large negative divergence of velocity. After identification of shocks, we separate fast and slow MHD waves by identifying the relation between magnetic pressure and gas pressure in the upstream and the downstream regions. We further calculate the contribution to chromospheric heating through the measurement of entropy jump. The results show that fast magnetic waves play a significant role in heating the low-beta chromosphere. The low-beta fast magnetic waves are generated by mode conversion from fast acoustic waves in the high-beta region.

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