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The evolution of the coronal loop structure due to the phase mixing of Alfvén waves

Coronal loops are known to host Alfvén waves propagating in the corona from the lower layers of the solar atmosphere and because of their internal structure, phase-mixing is likely to occur. The structure of the coronal loop could be significantly affected by the thermodynamic feedback of the heating generated by phase-mixing. However, this phenomenon can be sensitive to the period of the propagating Alfvén waves due to how short period waves can be easily dissipated and the way long period waves may accumulate considerable energy in resonating coronal loops. Using the Lare 2D code, a coronal loop model of a field-aligned thermodynamic equilibrium and a cross-field background heating profile is created, with an additional forcing term added to drive Alfvén waves with coronal amplitudes between 5-30km/s. We show that high frequency waves can generate heating corresponding to a 10% increase of the initial coronal shell temperature, chromospheric upflows of up to 0.6km/s and a coronal shell mass increase of 15%. These changes are sufficient to alter and maintain a new coronal loop density structure, broadening the region where efficient phase-mixing occurs. In contrast, low frequency waves are unable to be effectively dissipated, resulting in minimal changes to the loop structure. We see little evidence of wave energy accumulation in the corona and are unable to conclude that the dissipation of low frequency Alfvén waves can be an effective heating mechanism in coronal loops.

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