Heating by transverse waves in 3D simulations of turbulent coronal loops (Invited talk)

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Abstract

In the recent years, a number of numerical studies has been focusing on the significance of Kelvin-Helmholtz instability in the dynamics of oscillating coronal loops. This process, which enhances the transfer of energy into smaller scales, has also been connected with heating of coronal loops, by introducing dissipation mechanisms, like resistivity. The effects of wave heating appear at the turbulent layer, which is expected to be found near the outer regions of loops, leaving their denser inner parts without a sufficient heating mechanism. In the current work we study the effects of wave heating from transverse waves in a coronal loop. Using the MPI-AMRVAC code, we perform ideal, three dimensional magnetohydrodynamic (MHD) simulations of both (a) footpoint driven and (b) impulsively excited standing kink waves in a straight density enhanced coronal flux tube. Models of both spatially uniform and spatially changing initial temperature profiles are considered. The temporal and spatial evolution of our systems are studied, in the presence of numerical resistivity. We identify

Ohmic heating as the reason for the observed temperature increase, as indicated by the higher values of current densities and average temperatures near the footpoints for the cases of uniform initial temperature. Transverse Wave Induced Kelvin-Helmholtz (TWIKH) rolls are generated near the velocity antinodes of our models, leading to an expanded turbulent layer. At later simulation times, the initial density profile at the apex is completely deformed, leading to a lack of clear distinction between the various parts of the loop. Thus the loop becomes fully turbulent, spreading the effects of wave heating throughout the loop cross section.