HEATING EFFECTS FROM DRIVEN KINK AND ALFVEN WAVES IN CORONAL LOOPS

Mingzhe Guo\textsuperscript{1,2}, Tom Van Doorsselaere\textsuperscript{1}, Kostas Karampelas\textsuperscript{1}, Bo Li\textsuperscript{2}, Patrick Antolin\textsuperscript{3}, Ineke De Moortel\textsuperscript{3}

\textsuperscript{1}Centre for mathematical Plasma Astrophysics, Department of Mathematics, KU Leuven, Belgium
\textsuperscript{2}Institute of Space Sciences, Shandong University, Weihai, China
\textsuperscript{3}School of Mathematics and Statistics, University of St Andrews, St Andrews, UK

Recent numerical studies revealed that transverse motions of coronal loops can induce the Kelvin-Helmholtz Instability (KHI). This process could be important in coronal heating because it leads to dissipation of energy at small spatial-scale plasma interactions. Meanwhile, small amplitude decayless oscillations in coronal loops have been discovered recently in observations of SDO/AIA. We model such oscillations in coronal loops and study wave heating effects, considering a kink and Alfvén driver separately and a mixed driver at the bottom of flux tubes. Both the transverse and Alfvén oscillations can lead to the KHI. Meanwhile, the Alfvén oscillations established in loops will experience phase mixing. Both processes will generate small spatial-scale structures, which can help the dissipation of wave energy. Indeed, we observe the increase of internal energy and temperature in loop regions. The heating is more pronounced for the simulation containing the mixed kink and Alfvén driver. This means that the mixed wave modes can lead to a more efficient energy dissipation in the turbulent state of the plasma and that the KHI eddies act as an agent to dissipate energy in other wave modes. Furthermore, we also obtained forward modelling results using the FoMo code. We obtained forward models which are very similar to the observations of decayless oscillations. Due to the limited resolution of instruments, neither Alfvén modes nor the fine structures are observable. Therefore, this numerical study shows that Alfvén modes probably can co-exist with kink modes, leading to enhanced heating.