IRIS-Hinode Collaborative Observations of Oscillating Prominences and Discovery of Resonant Absorption

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Coronal heating and the acceleration of the solar wind are unsolved problems in solar physics. The propagation of Alfven waves along magnetic field lines is one of the candidate mechanisms for carrying energy to large distances from the surface and heat the coronal plasma. Although such waves are actually damped in short spatial and temporal scales in observations, it is still unclear whether any significant dissipation occurs, or whether most of the energy is merely converted from one wave mode to another.

Here we report prominence observations coordinated with IRIS, Hinode/SOT, and SDO/AIA to find evidence and clues of dissipation. In the high-spatial, temporal, and spectral observation, we found temperature increase in oscillating small-scale structures and a characteristic phase difference between the transverse motions of the threads and the line-of-sight velocities.

These observational features support a scenario in which resonant absorption takes place on the surface of oscillating prominence flux tubes in the corona. In this particular model, the transverse shear motions from the dipole flow are enhanced by the azimuthal flows in the resonant layer, a process that can lead to the Kelvin-Helmholtz instability. This mechanism deforms the tube's boundaries and generates thin current sheets and turbulence, leading to dissipation of the wave energy into heat. This observation identifies the locations and form of energy dissipation to propose the existence of numerous thin current sheets with enhanced turbulent regions on the oscillating threads.