On the coronal energy release in the same order of magnitude as the nanoflare based on the multi-wavelength observations

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The dissipations of Alfvén wave and the small-scale magnetic reconnections may play a key role in heating the solar corona. However, it is controversy whether the release of magnetic energy is sufficient to heat the coronal and what result in the Alfvén wave and magnetic reconnection. Using high-resolution observations and the neural network for single image super-resolution, we will talk about two kinds of energy release that are approximately of the same order of magnitude as the nanoflare.

Firstly, we show the evolutions of the separated strands within the apparent single coronal loops observed in Atmospheric Imaging Assembly (AIA) images[4] The loop strands are detected on two kinds of upsampled AIA 193 Å images, which are obtained by upscaling the Point Spread Function matched AIA images via Bicubic interpolation and are generated using a super-resolution convolutional neural network, respectively. The architecture of the network is designed to map the AIA images to unprecedentedly high spatial resolution coronal images taken by High-resolution Coronal Imager (Hi-C) during its brief flight[1]. At some times, pairs of individual strands appeared to braid with each other and subsequently evolved to become pairs of almost parallel ones with their segments having exchanged totally. These evolutions provide morphological evidence supporting occurrences of magnetic reconnections between the braiding strands, which are further confirmed by the occurrences of the transient hot emissions (>5 MK) located at the footpoints of the braiding structures.

The results we present reveal the feasibility of reconnection-type heating within warm coronal loops.

Secondly, we presented a prominence observed by New Vacuum Solar Telescope (NVST) in H_α wavelength[3]. Assuming that the descending knots were capable of exciting Alfvén waves[2] that could then dissipate within the local corona, the gravitational potential energy of the knots may have been converted into thermal energy. Assuming a perfectly elastic system, we therefore estimate that the gravitational potential energy of each knot may have been converted into thermal energy, the amount of which is corresponding to that of a nanoflare.

References

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