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# Hinode Spectroscopic Observation of Magnetic Reconnection in a Solar Flare

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Magnetic reconnection is a key process both in solar flares and substorms in the solar system, so it is important to reveal the fundamental mechanism of onset and energy release via magnetic reconnection in cooperation with solar and space observations. In the Hinode (Solar-B) era, it has become possible to directly measure the plasma flow velocity and electron temperature using the EUV Imaging Spectrometer (EIS). Recently solar activity has increased, and we have succeeded in obtaining spectroscopic observations of a few cusp-shaped flares. The cusp-shape is thought to be the reconnection X-point structure, but whether it is related to slow-shocks or not is still under discussion.

Here we show one of the first spectroscopic observations of a cusp-shaped flare on 2011 February 14. It was simultaneously observed with Hinode, SDO and RHESSI. All these observations enable detailed investigation of the temporal evolution and spatial distribution of the temperature. We found that, first, an emerging magnetic loop triggers magnetic reconnection. This is followed by a hard X-ray burst and a plasmoid ejection. The ejection triggers another neighboring magnetic reconnection, which was observed as a second hard X-ray burst and a cusp-shaped structure. Observed nonthermal electrons are in the energy range of 15-25 keV, and thermal electrons in the cusp-shape are heated up to 10ˆ7 K. This thermal temperature and its distribution were measured by EIS and X-ray telescope (XRT) independently, and their results are almost consistent. During the impulsive phase, we also found bi-directional upward and downward fast flows at the loop-top, i.e. reconnection jet (˜100 km/s), and an fast evaporation flow at the footpoint of the loops (˜400 km/s) after some time delay. In this observation, reconnection inflow was too weak to measure compared with the background flows, and the ion temperature was also not successfully measured. These observations would be interesting for future work exploring the details of the slow-shocks attached to the X-point.

Keywords: Magnetic Reconnection, Solar Flare, Hinode (Solar-B)