M06a Two-Step Acceleration of Electrons and Ions in Solar Flares

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Observations with the HXT and SXT on board *Yohkoh* clearly show that the reconnection process is common to many flares. We apply the reconnection theory to the coronal conditions derived from the *Yohkoh* data on the site and mechanism of magnetic energy transformation into kinetic and thermal energies of 'super-hot' plasma and accelerated particles. We consider the reconnecting current sheet as the source of flare energy and the first step mechanism in two-step acceleration of electrons and ions to high energies.

According to our model, reconnected field lines fastly move out of the high-temperature turbulent current sheet, being well frozen into 'super-hot' collisionless plasma, and form magnetic loops on the upstream side of the fast oblique collisionless shock (FOCS) placed above the soft X-ray emitting loops. The electrons and ions energized and pre-accelerated by the current sheet are trapped in magnetic loops. The top of each loop moves with a high speed towards the FOCS, while its both feet penetrate through the shock front. For these reasons, two mechanisms – the adiabatic heating inside the collapsing trap and acceleration by the shock front at two feet of the trap – efficiently increase energy of particles.

The life-time of an individual collapsing trap can be identified with the observed a-few-second delay in higher-energy hard X-rays and gamma-rays with respect to lower-energy hard X-rays. This trap of accelerated electrons can be seen as the coronal hard X-ray "above-the-loop-top source"; precipitation of accelerated electrons from the trap through the FOCS into the chromosphere is responsible for the hard X-ray "footpoint sources".