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On the role of slow mode shocks in the reconnection region for generating energetic electrons during solar flares

G. Mann, H. Aurass, H. \"Onel, and A. Warmuth

Leibniz-Institut für Astrophysik, Astrophysikalisches Institut Potsdam, Potsdam, Germany (gmann@aip.de, +49 331 7499 292)

A flare is defined as an sudden enhancement of the emission of electromagnetic radiation of the Sun covering a broad range of the spectrum from the radio up to the gamma-ray range. That indicates the generation of energetic electrons during flares, which are considered as the manifestation of magnetic reconnection. According to this model, the inflow region of the reconnection region is separated from the outflow one by pairs of slow mode shocks. At them, the magnetic field energy is efficiently annihilated and transfered into a strong heating of the outflow plasma leading to the generation of energetic electrons as needed for the hard X-ray radiation at large flares.

The slow mode shocks are studied in terms of the Rankine-Hugoniot relationships. Especially, the jump of the temperature and the magnetic field across the shock is evaluated to study the heating of the plasma in the outflow region. The resulting fluxes of energetic electrons in the outflow region are calculated in a fully relativistic manner. Due to the strong heating of the plasma at the slow mode shocks, electrons with energies > 40 keV are generated in the outflow region as needed for the hard X-ray radiation. The theoretically obtained fluxes of energetic electrons agree well with those as measured by RHESSI satellite during large flares.