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Electron acceleration at slow-mode shocks in the magnetic reconnection region in solar flares

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A solar flare appears 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 in the solar corona. Spacecraft observations in the Earth's magnetosphere, as for instance by NASA's MMS mission, have shown that electrons can efficiently accelerated at the slow-mode shocks occuring in the magnetic reconnection region.

This mechanism is applied to solar flares. The electrons are accelerated by the cross-shock potential at slow-mode shocks resulting in magnetic field aligned beams of energetic electrons in the downstream region. The interaction of this electron beam with the plasma leads to the excitation of whistler waves and, subsequently, to a strong heating of the electrons in the downstream region.

Considering this process under coronal circumstances, enough electrons with energies >30keV are generated in the magnetic reconnection region as required for the hard X-ray radiation during solar flares as observed by NASA's RHESSI mission.