Electron Acceleration in the Heliosphere

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Electrons are accelerated to very high, non-thermal energies during explosive energy-release phenomena such as solar flares and terrestrial substorms. While it has been established that magnetic reconnection plays a key role in these phenomena, the precise mechanism of electron acceleration via reconnection remains unclear. Here we show, based on a compilation of recent observations, that the power-law index d is often ~4 or larger in solar hard X-ray coronal sources and in the plasma sheet of Earth's magnetotail, where d is defined in the flux density (differential flux) distribution. This is in stark contrast to the case of electron acceleration at shocks (such as interplanetary shocks and the terrestrial bow shock) whose power-law index d is often smaller than ~4. We suggest that reconnection-related phenomena (in solar corona and in Earth's magentotail) may not be as efficient as shocks in terms of accelerating electrons at least in the heliospheric, non-relativistic environment of plasmas.

Keywords: electron acceleration, shock, magnetic reconnection

