Electron acceleration by cascading reconnection in the solar corona

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Abstract

We investigate electron acceleration by electric field induced by cascading reconnections in current sheets trailing coronal mass ejections via a test particle approach in the framework of the guiding center approximation. Although the resistive electric field is much weaker than the inductive electric field, the electron acceleration is still dominated by the former. Anomalous resistivity ŋ is switched on only in regions where the current-carrier's drift velocity is large enough. As a consequence, electron acceleration is very sensitive to the spatial distribution of the resistive electric fields and electrons accelerated in different segments of the current sheet have different characteristics. Due to the geometry of the 2.5D electromagnetic fields and strong resistive electric field accelerations, accelerated high energy electrons can be trapped in the corona, precipitating into the chromosphere or escaping into the interplanetary space. The trapped and precipitating electrons can reach a few MeV within one second and have a very hard energy distribution. Spatial structure of the acceleration sites may also introduce breaks in the electron energy distribution. Most of the interplanetary electrons reach hundreds of keV with a softer distribution. To compare with observations of solar flares and electrons in solar energetic particle events, we derive hard X-ray spectra produced by the trapped and precipitating electrons, fluxes of the precipitating and interplanetary electrons as well as spatial distributions of all energetic electrons.