Solar Energetic Electron Events

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Solar energetic electron events are the most common solar particle acceleration phenomenon detected in the interplanetary medium. This acceleration, however, has very peculiar characteristics: almost a one-to-one association with type III radio bursts, extreme enrichment of 3He and the presence of low-energy electrons down to <1 keV, plus a close association with coronal mass ejections. Recent studies on solar energetic electron events suggest the occurrence of two distinct electron injections at the Sun: the low-energy (~0.4 to 9 keV) electron injection starts ~9 min before the coronal release of type III radio bursts and lasts for hundreds of minutes, but the high-energy (~10 to 300 keV) electron injection starts ~8 min after the release of type III bursts and last for ~5-10 times shorter. The low-energy electron injection are the source of type III radio bursts and it may provide seed particles for the acceleration of high-energy electrons. During their propagation en route to 1 AU, low-energy electrons propagate essentially scatter-free, while high-energy electrons experience pitch-angle scattering with scattering strength increasing with energy (e.g., due to resonant interaction with solar wind turbulence at scale >~ ρTp). For solar energetic electron events detected in situ at energies from ~ 1 keV to 200-300 keV, the electron peak differential flux generally fit to a double-power-law function with a steepening above ~ 60 keV.