Pitch-angle distribution of accelerated electrons in 3D current sheets with magnetic islands

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We will explore variations of electron pitch-angle distributions (PADs) during spacecraft crossing of reconnecting current sheets (RCSs) with magnetic islands. Our results can benchmark the sampled characteristic features with realistic piych-angle distributions (PADs) derived from in situ observations. Particle motion is simulated in 2.5D Harris-type RCSs using the particle-in-cell method and considering the plasma feed- back to electromagnetic fields induced by accelerated particles. We evaluate particle energy gains and PADs in different locations with virtual spacecraft passing the current sheet while moving in the different directions. The RCS parameters are comparable to heliosphere and solar wind conditions. We will report the simulated energy gains and PADs of particles depending on the specific topology of the magnetic fields. In addition, we demonstrate that the observed PADs depend on the crossing paths of the spacecraft. It was found that when the guiding field is weak, there are the bi-directional electron beams (strahls) are located just above or below the X-nullpoints in the inflow regions. The magnetic field relaxation near the X-nullpoint alters the PADs towards 90◦. As the guiding field becomes larger, the regions with bi-directional strahls are compressed towards small areas in the exhausts of RCSs. Mono-directional strahls are quasi-parallel to the magnetic field lines near the X-nullpoint due to the dominant Fermi-type magnetic curvature-drift acceleration. Meanwhile, the high-energy electrons confined inside magnetic islands create PADs of around 90 degrees.The simulated PADs can help to explain a variety of the electron features reported in recent observations in the solar wind and the Earth's magnetosphere.