Contribution ID: **21** Type: **Poster**

Pitch-angle distributions of accelerated particles in 3D current sheets with magnetic islands

Wednesday, May 26, 2021 1:00 PM (40 minutes)

Ambient particles passing through reconnecting current sheets gain substantial energy and pitch angle distributions imposed by magnetic field topology. By applying particle-in-cell (PIC) approach in 3D current sheets with single and multiple X and O-nullpoints, or magnetic islands, we explore energy and pitch angle distributions (PADs) of accelerated particles. We show that particles of opposite charges are separated at ejection from the current sheet into opposite semiplanes from the current sheet midplane. Particles of the same charge are also divided onto transit and bounced particles which are shown to gain different energy and pitch angle distributions. We present a few examples of virtual satellite crossings of the X and O-nullpoints and compare their PADs with available observations of electron PADS from WIND, STEREO and Parker Probe payload.

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Session Classification: Poster session: SQ3 and SQ6

Track Classification: Electron Energization