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# Microinjections and Drift Shell "Shredding"

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Recent energetic electron observations [1] using the Fly's Eye Energetic Particle Spectrometer (FEEPS) of the Energetic Particle Detector (EPD) instrument suite on NASA's Magnetosphere Multiscale mission (MMS), identified a robust feature in the data they termed "microinjections". Microinjections appear as short-lived, quasi-periodic, energy-dispersed bursts of electrons with energies between many 10's to many 100's of keV, occurring in the pre-midnight sector of the inner magnetotail. Fennell et al. [1] analyzed the microinjection spatial distribution of occurrence and their energy spectral characteristics, concluding that they are consistent with electrons originating from some earlier local time, that have gradient and curvature drifted to the location of MMS, modulated in intensity by some process either at the source, along their drift trajectory, or more local to the observation.

In this paper, we combine FEEPS observations of microinjections along with global MHD simulations to explore possible associations between microinjections and magnetopause dynamics. In particular, we use simulation results for several specific periods during which FEEPS observed microinjections. We complement FEEPS measurements taken in the magnetotail with observations from other active missions, including those from the Van Allen Probes mission. In particular, we use energetic electron measurements from the Radiation Belt Storm Probes - Energetic Particle, Composition, and Thermal plasma (RBSP-ECT) instrument suite [2].

Strong, quasi-periodic dynamical features in the MHD simulation's magnetopause characterize these intervals, consistent with the presence of both flux transfer events (FTEs) and Kelvin-Helmholtz (KH) wave processes. In this talk, we explore the role that such dynamical magnetopause processes may play in the production of microinjections, and by implication, how energetic electrons microinjections observed in the magnetotail may be used ultimately to remotely sense mesoscale magnetopause physics and dynamics. Through comparison of phase space densities and particle tracing, we associate outer zone electrons near the trapping boundary with microinjection electrons. We propose a drift shell "shredding" process by which large-scale wave processes (FTEs and KH waves) at the duskside magnetopause periodically "shred" the drift paths of outer zone electrons, breaking their third adiabatic invariant and detrapping them. When that process occurs in the post-noon sector along the magnetopause, then those liberated energetic electrons will gradient-curvature drift into the magnetotail, where they appear as microinjections.

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