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MMS/FEEPS Observations of Electron Microinjections Due to Kelvin-Helmholtz Waves and Flux Transfer Events

Shiva Kavosi (1), Harlan Spence (1), Joseph Fennell (2), Drew Turner (2), and Joachim Raeder (1)

(1) University of New Hampshire, Space Science center, Durham, NH, USA; e-mail: Shiva.Kavosi@unh.edu; e-mail: Harlan.Spence@unh.edu; e-mail: j.Raeder@unh.edu , (2) The Aerospace Corporation, Los Angeles, CA, USA ;e-mail: joseph.f.fennell@aero.org ; e-mail: Drew.L.Turner@aero.org

Boundary motions driven by Kelvin Helmholtz instability and flux transfer event are both important phenomena at the earth magnetopause which frequently opens the gates to solar wind plasma and changes the dynamics of the magnetosphere. Although, these processes have been studied extensively for understanding plasma entry from the solar wind into the magnetosphere, it still unknown how they couple into inner magnetosphere where they can play an important role in particle transport and energization in the inner magnetosphere. Recent energetic electron observations 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 quasi-periodic (2-6 min), energy-dispersed bursts of energetic electrons (50–400 keV) termed "Microinjections" occurring in the dusk to pre-midnight sector of magnetosphere [Fennell et al., 2016]. These microinjections are clearly a new signature that remotely senses large-scale magnetospheric boundary dynamics. To investigate possible origins and source regions of the electron microinjections, we have combined MMS EPD/FEEPS observations with global MHD simulations driven by measured solar wind input and MHD-Particle-Tracer. Our simulation results suggest that the electron microinjections, observed in the dusk to pre-midnight sector, are associated with Kelvin-Helmholtz waves (KHWs) and flux transfer events (FTEs). Energetic electrons launched from a limited range of locations near the post-noon dusk magnetopause and at times when KHWs and FTEs pass by that region have drift paths that connect with MMS and thus create time-dependent microinjection electron signatures.