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Energetic Electron Microinjections Observed by MMS in the Dusk Plasma Sheet and Drift Resonance Interpretation drift resonance interpretation

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Microinjection phenomena, characterized by dispersive oscillations of electron fluxes at the Pc5 period and bi-directional pitch angle anisotropy, are frequently observed by MMS in the dusk to midnight plasma sheet. In our work, two such events are analyzed and the features of toroidal mode drift resonance measured meanwhile are shown in detail. The prominent observation is that the fluctuations of the electron flux and the electric field have either -90˚ or +90˚ phase difference at the resonant energy, and the phase difference rises as the energy increases (Figure 1). We extend the present theory [1] for drift resonance of toroidal mode wave with only the equatorial moving electrons in a dipole field to include bouncing electrons. The predicted phase differences based on the new theory are consistent well with the observations in the microinjection events. It is thus suggested that drift resonance may act as the forming mechanism for the observed microinjections.

References

[1] Li, L et al. (2021). JGR: Space Physics, 126, e2020JA028842.

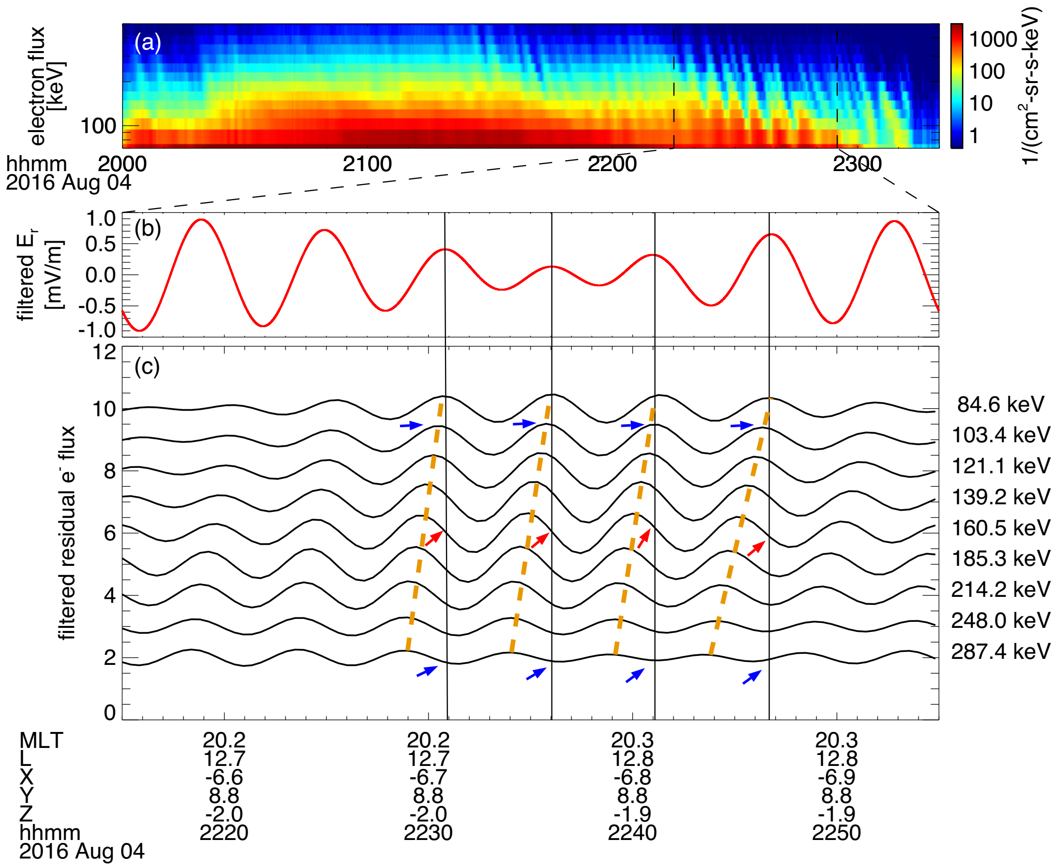

Figure 1. The phase relationship between the filtered E_r and residual electron flux in the microinjection event on August 4th, 2016. (a) Energy spectrogram of energetic electron flux between 20:00 and 23:20. (b) Band-pass filtered E_r between 22:15 and 22:55 with the strongest frequency (2.92 mHz) reserved. (c) Band-pass filtered residual electron flux, which is defined as $J/(J-J_0)$, where J is the observed omnidirectional electron flux and J_0 is the 15-minute averaged background of J. The phase differences between electron differential fluxes and E_r increase from lower to higher energy channels, and they are equal to ~0˚, ~90˚, and ~180˚ at 103.4keV, 160.5keV, and 287.4keV, respectively, indicating that the drift resonance occurred at ~160.5keV.