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Dynamics of suprathermal electron and proton fluxes during magnetotail dipolarization associated with magnetic flux pile up in the near-Earth plasma sheet

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We used multipoint observations by Cluster and THEMIS P3 probe in the near-Earth plasma sheet (at X $\sim$ -7 - -9 RE) to study properties and spectra of electron and proton injections during substorm-related dipolarization. The dipolarization was associated with braking and azimuthal diversion of multiple bursty bulk flows and dipolarization fronts (DFs). Multipoint observations revealed that the beginning of increase in suprathermal (> 50 keV) electron flux, i.e. the "injection boundary", was observed simultaneously with dipolarization onset and propagated dawnward along with the onset-related DF. The subsequent dynamics of electron flux was also similar to the dynamics of magnetic dipolarization, i.e. a gradual growth of electron flux occurred at the same time scale as the dipolarization growth and it also comprised multiple short ($\sim$ few minutes) electron injections associated with the BZ pulses. This behavior is due to the combined action of local betatron acceleration at the BZ pulses and subsequent gradient drifts of electrons in the flux pile up region through the essentially not uniform magnetic field. On the contrary, proton injections were observed only in the vicinity of strongest BZ pulses. The energy spectra of these injections demonstrate the operation of nonadiabatic resonant acceleration of protons up to $\sim$70 – 90 keV by bursts of the dawn-dusk electric field associated with the BZ pulses.

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