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Reconnection and Energetic Particles at the Edge of the Exterior Cusp

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In this paper we use the Cluster-II/RAPID instruments to study bursts of energetic particles in the post-noon edge of the exterior cusp region, as well as their relation to the flux transfer events (FTE). On February 2, 2003, the Cluster satellites traversed across the exterior cusp on an outbound pass. The satellite configuration was such that C1, C2 and C4 were leading and quite close together, while C3 followed the others with a lag of about 30 min. The leading satellites observed the exterior cusp from 21:40 UT to 23:05 UT. Soon after leaving the cusp, the leading satellites observed numerous FTE-type signatures in the magnetic field, coinciding with significant bursts of energetic particles. The particle pitch-angle distribution shows that the energetic particles were released from the neighboring closed field lines of the high-latitude dayside magnetosphere in a reconnection process. At the same time C3 was still in the exterior cusp and also measured similar increases of energetic particle fluxes with and average delay of about 1 min compared to the leading satellites, suggesting that some of these particles could find their access to the exterior cusp. Calculations show that maximum energy gain per particle that can be attained by reconnection remains below 1 keV, thus far below the energy range of the RAPID instrument. Instead, the present findings support our earlier statistical results of the magnetospheric origin of energetic particles in the exterior cusp. Energetic particles can reach the cusp from the neighboring closed field lines either by direct diffusion or via the control of the dayside reconnection process. Thus, ultimately, the dominant source of energetic particles in the exterior cusp is the inner magnetosphere and the acceleration of these energetic particles mainly occurs in the near-Earth tail.