# Broadband electrons during storm-time substorm: Simultaneous FAST and Double Star-TC1 observations

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Broadband electrons (BBEs) represent remarkable flux enhancements of precipitating electrons over a broad energy range of 0.05-30 keV near the equatorward edge of the aurora oval during storm-time substorms. The FAST satellite observed BBEs at 1355-1359 UT, ˜61-66$^o$ ILATs, ˜6 MLT, and an altitude of ˜4000 km during the geomagnetic storm of 25 July 2004. At this time, the Double Star TC1 satellite was located near the magnetic equator at L= 5.7 (65$^o$ ILAT) in nearly the same local time as that of FAST. A storm-time substorm started at ˜13:51 UT.

TC1 observed a local depolarization, field-aligned upward electrons and downward ions, and intense low frequency (below ˜100 Hz) waves at 13:51 UT, 4 min before the BBE observation by FAST, when positive H-bay at low latitude geomagnetic stations started. From 13:52 UT, TC1 observed drastic enhancements of electron and ion fluxes at ˜0.5-30 keV. From magnetic field intensity obtained by FAST and TC1, field-aligned electrons within pitch angles of ˜10$^o$ at a TC1 altitude have pitch angle spread of 90$^o$ at the FAST altitude. Flux intensity of the field-aligned components in the enhanced electrons observed by TC1 is comparable to those observed by FAST. On the other hand, at lower energy range below ˜0.5 keV, FAST observed more intense fluxes than those at TC1 altitude. The pitch angle distribution of BBEs at FAST altitude had isotropic features at a higher energy range (˜0.5 keV-30 keV), while below ˜0.5 keV field-aligned electron fluxes tend to be larger than the perpendicular fluxes. We suggest that the field-aligned components of enhanced higher-energy electrons at the TC1 altitude became isotropic as they approach to the FAST altitudes by mirror force, so that they were observed by FAST as the isotropic higher energy components of the BBEs. The field-aligned lower energy components below ˜0.5 keV of BBEs could be accelerated in field-aligned directions between the FAST and TC1 altitudes. The enhanced particle fluxes at ˜0.5-30 keV observed by TC1 may be accelerated or heated in association with the substorm onset. The high energy particle data of TC1 indicate dispersionless injection of this particle energization. Earthward ion flow was not clearly identified. These facts suggest that particle acceleration or heating was occurring in the inner magnetosphere at L= 5.7 associated with the substorm.