

# Three varying radiation belts in the Earth's magnetosphere detected by **STEP-F** and **SphinX** measurements as a sensitive marker of the geomagnetic irregularities

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We analyzed data from STEP-F particle detector and from solar soft X-ray spectrophotometer SphinX recorded in May 2009 onboard the LEO CORONAS-Photon satellite. While SphinX primarily observed the X-ray emission from the solar corona, nevertheless in its upper spectral energy channels recorded also bremsstrahlung emission arising from the interaction of magnetospheric electrons with satellite's housings and neighbor instruments.

**1. The third permanent layer was discovered by STEP-F particle telescope. This third belt is observed around the drift shell with an average McIlwaine parameter  $L$  of  $\approx 1.65$ . (Fig.1)**

**2. The SphinX reveal in many cases the three-belt structure seen by STEP-F although the fine details are different. (Fig.2)**

**3. The pattern of relations between the two sets of count rates derived from two independent sensors of SphinX with different sensitivities to particles shows distinct branches recorded when crossing different radiation zones of Earth's magnetosphere. (Fig.3).**

**4. Outer radiation belt particle fluxes recorded by both X-ray sensors of the SphinX in May 2009 are very sensitive to weak geomagnetic sub-storm (Fig.4).**

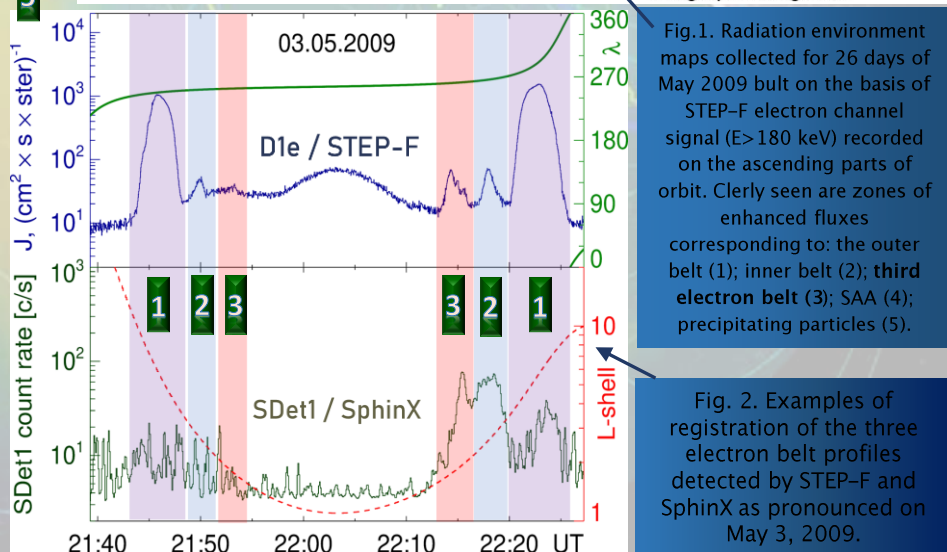
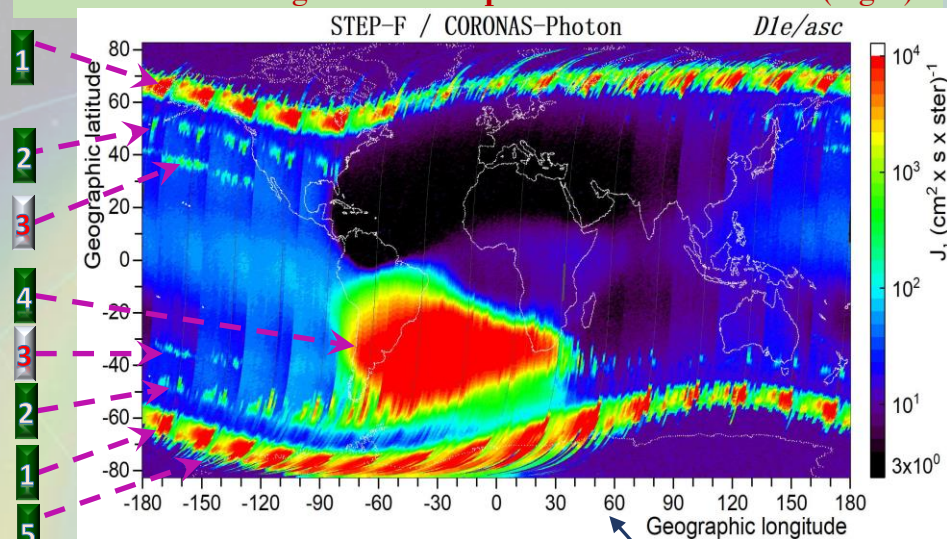


Fig.1. Radiation environment maps collected for 26 days of May 2009 built on the basis of STEP-F electron channel signal ( $E > 180$  keV) recorded on the ascending parts of orbit. Clearly seen are zones of enhanced fluxes corresponding to: the outer belt (1); inner belt (2); third electron belt (3); SAA (4); precipitating particles (5).

Fig. 2. Examples of registration of the three electron belt profiles detected by STEP-F and SphinX as pronounced on May 3, 2009.

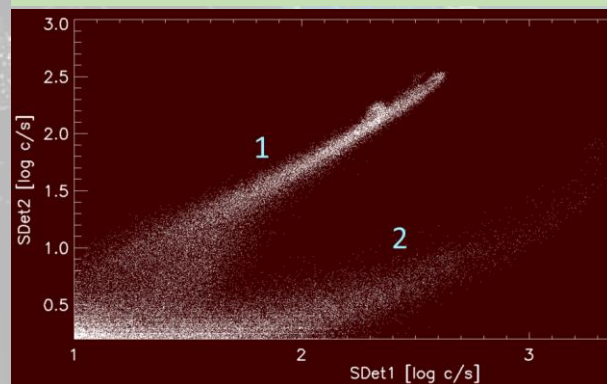


Fig. 3. Dependence of SphinX SDet2 to SDet1 signal ratio for the entire period from May 1 to May 31, 2009. The group of points (branch 1) corresponds to the satellite passage through the South Atlantic Anomaly, while (branch 2) corresponds to Van Allen outer radiation belt crossings.

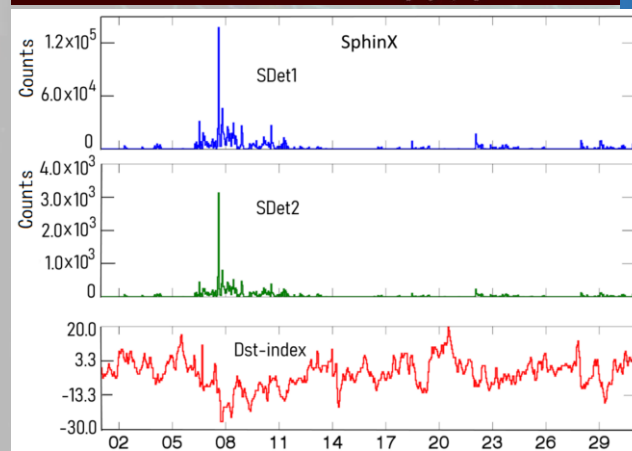


Fig. 4. Time unfolding of particle maximum counts recorded during the outer radiation belt passage in the highest ADC channels of both SphinX sensors compared with Dst-index runs during the entire May of 2009