Development of small-size filter photometers aboard the TARANIS microsatellite for the observation of TLEs and TGFs

Mitsuteru Sato[1]; Yukihiro Takahashi[2]; Makoto Suzuki[3]; Tomoo Ushio[4]; Toru Adachi[5]; Elisabeth Blanc[6]; Thomas Farges[6]

[1] RIKEN; [2] Dept. of Geophysics, Tohoku Univ.; [3] ISAS/JAXA; [4] Osaka Univ.; [5] RISH, Kyoto Univ.; [6] CEA

In the past 20 years, various new phenomena associated with lightning discharges were discovered. One of these phenomena is transient luminous events (TLEs), such as sprites, elves and blue jets. These transient optical flashes are generate by the strong cloud-to-ground discharges whose charge moment or peak current is extremely large. The other is terrestrial gamma-ray flashes (TLFs), which are first discovered by BATSE aboard the CGRO satellite in 1994 The most likely models for the generation of TGFs involve the production of runaway electron beams accelerated in an avalanche process by thundercloud associated with strong electric fields. However, fundamental issues regarding the association of TLEs or lightning with TGFs and the nature of the source of penetrating radiation itself remain a mystery. In order to study the generation region and mechanism of TGFs and to identify the relationship between TLEs and TGFs, simultaneous space measurements of lightning, TLEs and TGFs are essential. For these purposes a micro satellite mission named TARANIS (Tool for the Analysis of RAdiations from lightNIngs and Sprites) is under way. The scientific payload consists of two cameras, three photometers, one hard X-ray/gamma-ray detector, one energetic electron detector, and electric/magnetic field sensors. The orbit of the satellite will be polar sun-synchronous with an altitude of 650 km, and the local time of ascending node is required to be 22 LT with a slow drift of the order of 2 LT/year. We, Japanese group, have joined the TARANIS mission as co-investigators and develop the photometers. The photometers consist of three channels: two wide-FOV (57^o) with narrowband filter (337+/-5 nm, 762.5+/-5 nm), and one wide-FOV (95^o) with wideband filter (280-420 nm). As the optical detector of these photometers, metal-package photomultiplier tubes (PMTs) will be used. As the optics of the photometers, telecentric dioptrics system is adopted. The dimension and mass of the photometers is 3x10x10 cm and 700 g, respectively. We started to design the photometers and produce prototype model. At the presentation, we will discuss the optical and electrical performances of the prototype model of the photometers more in detail.