【Science and Engineering（Mathematical and physical science）】

Polarization Measurement aboard the Satellite and Solution of the Emission Mechanism of the Gamma-Ray Bursts

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【Outline of survey】

Gamma-Ray Bursts (GRBs) are well known as the biggest explosions in the universe which release a huge amount of energy, 10^{52} ergs, as the gamma-ray emission during the short time interval of several 10 seconds. GRBs are very bright, so we can use them to explore the early universe. However we have little knowledge about the emission mechanism of GRBs, and it is an important open question. Theoretically, it is thought to be a synchrotron radiation. If so, the radiations have strong polarization degree, and their detection is a key to solve the mechanism.

In this program, we develop a polarization detector and install it in the small solar-powered-sail satellite scheduled to launch in May, 2010. We realize the GRB polarization measurement for the first time. Our detector has a capability to measure the angular distribution of scattered gamma-ray photons via Compton effect.

During this program, we cover the detector development, the satellite launch, observations and publications of results. The gamma-ray polarization measurement is now noticed as the future observation technique, so we hope to establish the base of the gamma-ray polarization astronomy.

【Expected results】

The detector is small about 3 kg in weight, but we can realize the GRB polarization measurement overwhelmingly in short term schedule. We expect to detect the polarization signals from 2-4 GRBs and the Crab nebula during 1 year observations. Both GRB phenomena and the observation technique of the gamma-ray polarization are noticed in the astrophysical communities. Therefore we expect to obtain the observation results with the strong impact.

【References by the principal researcher】

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- Possible observational evidence for the θ^{-2} angular distribution of the opening half-angle of GRB jet: Yonetoku et al., Monthly Notices of the Royal Astronomical Society, Vol.362, Issue.3, pp.1114 (2005)
- Spectral evolution of GRB 060904A observed with Swift and Suzaku: Yonetoku et al., Publications of the Astronomical Society of Japan, Vol.60, No.SP1, pp.S352 (2008)

【Term of project】 FY2008－2012	【Budget allocation】 49,900,000 yen (direct cost)

【Homepage address】 http://astro.s.kanazawa-u.ac.jp/~yonetoku/