

Imaging Observation for Cosmic MeV Gamma Background and Galactic Diffuse MeV Gamma by SMILE2+ balloon-bore experiment

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The evolution of Active Galactic Nuclei is one of most significant issues of Astrophysics, and both the spectrum and distribution of Cosmic MeV gamma Background (CMGB) are considered strongly to reflect the differences in theoretical models. However, until now only COMPTEL provided only the spectrum of CMGB measured from the wide sky area from 9years observation, although it included large statistical and systematic errors due to severe background radiation in space.

In 2018, we (SMILE-project in Cosmic-ray Group of Kyoto University) have observed MeV gamma rays for the southern hemisphere by Electron Tracking Compton Camera (ETCC) using JAXA one-day flight balloon at Australia (SMILE2+ Project). By measuring all parameters of Compton scattering in each gamma, ETCC has achieved to measure the complete direction of MeV gammas same as optical telescopes, and to distinguish signal gammas completely from huge background gammas. In this observation, ETCC observed MeV gammas in 0.2-5MeV from 3/5 of the southern hemisphere including galactic center and Crab, and we successfully obtained pure cosmic gammas by reducing background by near 3 orders, which is clearly certificated by an obvious enhancement in the light curve with $\sim 30\%$ during the galactic center passing through the FoV. This enhancement is consistent to the ratio of CBMG and Galactic Diffuse MeV gamma rays (GDMG), which ensures that $\sim 70\%$ of detected gammas are CBMG and only a few 10% are backgrounds. Thus, several of 10^4 gammas of CBMG are detected with quite low noise level, which is surely a first reliable data for discussing the above issue. Here we will present new Spectrum of CMGB and maybe its distribution. In addition, 511keV line gammas and GDMG are detected with ~ 5 and 11sigmas, respectively, which are surely very important for indirect search for light DMs and Cosmic-ray physics.

Author: TANIMORI, Toru (Kyoto University)

Presenter: TANIMORI, Toru (Kyoto University)

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