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SMILE project: all-sky MeV gamma-ray observation and dark matter survey

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In the MeV gamma-ray band, the observed Galactic diffuse gamma-rays has the excessive component cannot be explained by the current standard model of the Galaxy. This excess might be gamma-rays due to annihilation of MeV scale WIMP dark matter or evaporations of primordial black holes. The MeV band has the advantage over the GeV band because there is less diffuse gamma-ray background due to no π^0 bump.

In 2018 April 7, we carried out the campaign, sub-MeV and MeV gamma-ray imaging loaded-on balloon experiment 2+ (SMILE-2+), in order to demonstrate the imaging performance of the gaseous electron tracking Compton camera (ETCC). Unlike conventional Compton cameras such as COMPTEL, ETCC uniquely reconstructs the directions of gamma-rays and realizes the noiseless gamma-ray observation even in the space environment by the particle identification and Compton kinematical test. This detector has the energy range from 200 keV to 5 MeV and the wide field of view (3str). We observed the Galactic center for 8 hours and detect it with the significances of 5σ (511 keV) and 10σ (continuum). The sensitivity of the satellite with ETCC will reach 1 mCrab (10^6 sec, 3σ) and the HPR of its PSF will be 5 degree.

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