Contribution ID: **263** Type: **Oral Presentation**

Electron Tracking Compton Camera with Balloon Borne Experiment for Celestial and Terrestrial MeV gamma-ray Observations in the North Pole

Thursday 9 June 2011 16:20 (20 minutes)

High energy gamma-ray astronomy has become a very promising field. On the other hand, in MeV region, there still remain many unobserved interesting celestial objects such as black holes and Gamma-ray Bursts. To explore this energy range, we have developed Electron Tracking Compton Camera (ETCC) consisting of a gaseous Time projection Chamber (TPC) based on the micro pixel gas counter (X-PIC) and fine Scintillator pixel array. By measuring the 3D-track of a recoil electron in TPC, ETCC can measure the direction of incident gamma-rays photon by photon with a 3str wide field of view, and provides both a good background rejection and an angular resolution of ˜1degree at 1MeV (FWHM). ETCC with a 1x1x0.5m size will be a good candidate for wide band measurement on 0.1-100MeV gamma rays by single detector. Our final goal is the all-sly survey with several ten times better sensitivities of COMPTEL between 100keV to 100MeV using above large ETCC in space. We already carried out the observation of celestial sub-MeV gamma rays using with a small ETCC with a balloon (Sub-MeV gamma ray Imaging Loaded-on-balloon Experiment: SMILE-I) in 2006, and successfully obtained diffuse cosmic and atmosphere gamma rays. Now we are constructing a medium ETCC with a 30 cm cubic for the next balloon experiment to catch gamma-rays from the Crab, GRB and terrestrial gamma-ray burst occurred in the North Pole (SMILE-II). Terrestrial gamma-ray bursts are generated by relativistic electron precipitation accelerated along the terrestrial magnetic field. Long duration flight (2weeks) around the North Pole is planned in 2013 using this SMILE-II.
Here I will mention about the design concept and performance of the ETCC using SMILE-II. Also results on the measurement of the angular resolution for the pair creation mode in 10-20MeV region using the ETCC is presented

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Session Classification: Astrophysics and Space Instr.

Track Classification: Astrophysics and Space Instrumentation