Contribution ID : **1177** Type : **Oral**

PoGOLite: a balloon-borne soft gamma-ray polarimeter.

Friday, 6 July 2007 12:05 (0:12)

Abstract content

Polarized gamma-rays are expected from a wide variety of sources including rotation-powered pulsars, accreting black holes and neutron stars, and jet- dominated active galaxies. Polarization measurements provide a powerful probe of the gamma-ray emission mechanism and the distribution of magnetic and radiation fields around the source. No measurements have been performed in the soft gamma-ray band where non-thermal processes are expected to produce high degrees of polarization. The PoGOLite experiment applies well- type phoswich detector technology to polarization measurements in the 25 - 100 keV energy range. The instrument uses Compton scattering and photoabsorption in an array of 217 phoswich detector cells made of plastic and BGO scintillators, and surrounded by active BGO shields. A prototype of the flight instrument has been tested with polarized gamma-rays and background generated with radioactive sources. The test results and computer simulations confirm that the instrument can detect 10% polarization of a 100 mCrab source in one 6 hour balloon observation. In flight, targets are constrained to within better than 5% of the field-of-view (˜5 degrees squared) in order to maximize the effective detection area during observations. The pointing direction on the sky is determined by an attitude control system comprising star trackers, differential GPS receiver system, gyroscopes, accelerometers and magnetometers which provide correction signals to a reaction wheel and torque motor system. Additionally, the entire polarimeter assembly rotates around its viewing axis to minimize systematic bias during observations. Flights are foreseen to start in 2009 and will target northern sky sources including the Crab pulsar/nebula, Cygnus X-1, and Hercules X-1. These observations will provide valuable information about the pulsar emission mechanism, the geometry around the black hole, and photon transportation in the strongly magnetized neutron star surface, respectively. Future goals include a long duration balloon flight from the Esrange facility in the North of Sweden to Canada.

If this papers is presented for a collaboration, please specify the collaboration

PoGOLite Collaboration

Summary

Reference

Proceedings of the 30th International Cosmic Ray Conference; Rogelio Caballero, Juan Carlos D'Olivo, Gustavo Medina-Tanco, Lukas Nellen, Federico A. Sánchez, José F. Valdés-Galicia (eds.); Universidad Nacional Autónoma de México, Mexico City, Mexico, 2008; Vol. 2 (OG part 1), pages 479-482

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Session Classification : OG 1.5

Track Classification : OG.1.5