RevMexAA (Serie de Conferencias), **40**, 135–140 (2011)

THE LARGE APERTURE GAMMA RAY OBSERVATORY AS AN OBSERVATIONAL ALTERNATIVE AT HIGH ALTITUDE

M. Rosales[1] for the LAGO Collaboration

RESUMEN

A pesar de que las observaciones por satélite han permitido develar algunos misterios sobre el origen y localización de rayos cósmicos a bajas energías, hay preguntas aún no resueltas en los rangos más altos de energías (>1 GeV). El flujo de partículas a altas energías es muy bajo, necesitando de grandes áreas de medición, por lo que la detección de partículas secundarias en observatorios sobre la superficie terrestre representa una solución viable. Aunque el Observatorio Pierre Auger tiene esa capacidad, dados sus 16000 m^2 de detectores, su baja altura sobre el nivel del mar reduce en gran medida su capacidad de detección. El proyecto LAGO es una alternativa de observación aceptable, que intenta superar ésta limitación. Este proyecto, iniciado en el 2005, sitúa detectores Cherenkov de agua a gran altura. Los sitios de observación han sido seleccionados siguiendo algunos requisitos básicos, a saber: altitud, infraestructura académica y técnica, existencia de un grupo de investigación responsable del montaje y mantenimiento de los detectores así como de la visualización, análisis, divulgación y preservación de los datos. Este artículo presenta el estado general de los observatorios de Sierra Negra-México, Chacaltaya-Bolivia, Marcapomacocha-Perú, Mérida-Venezuela y Bucaramanga-Colombia.

ABSTRACT

Although satellite observations have revealed some mysteries about the origin and location of cosmic rays at low energies, questions remain to be resolved in higher energy ranges (>1 GeV). However, the flow of particles at high energies is very low, large sensitive areas are necessary, so that the detection of secondary particles from observatories on the surface of the earth is a technically viable solution. While the Pierre Auger Observatory has such capacity given its 16000 m^2 of detectors, low height above sea level greatly reduces its detection capability. The Large Aperture Gamma Ray Observatory (LAGO) is an observational alternative that attempts to overcome this limitation. This project was started in 2005, placing water Cherenkov Detectors at high altitude. Observation sites have been selected with some basic requirements: altitude, academic and technical infrastructure, existence of a research group responsible for assembly and maintenance of the detectors and the analysis, visualization, divulgation and data storage. This paper presents the general status of the observatories of Sierra Negra-México, Chacaltaya-Bolívia, Marcapomacocha-Perú, Mérida-Venezuela and Bucaramanga-Colombia.

Key Words: gamma rays: observations — instrumentation: detectors

1. INTRODUCTION: THE LAGO PROJECT

Since their discovery at the end of the 60's by the US military satellites VELA (Klebesabel et al. 1973), Gamma Ray Bursts (GRB) have been of high interest to astrophysicists. A GRB is characterized by a sudden emission of gamma rays during a very short period of time (between 0.1 and 100 seconds). The luminosity reached during this flare, assuming the emission is isotropic, is typically between 10^{51} and 10^{55} ergs. The astrophysical source of these bursts is still not totally clear but good candidates are coalescence of compact objects (neutron stars) for short bursts (less than 2 seconds), and supernovae produced by very massive stars (hypernovae) for the long bursts (more than 2 seconds). Mechanisms based on internal shocks of relativistic winds in beamed relativistic shocks give good agreement between theory and observations.

A first large data set of GRB was provided by the BATSE instrument on board the Compton Gamma Rays Observatory (1991–2000). From this data set the two types of GRB (short and long) were identified and the isotropy of GRB was verified. However, a deficit of faint GRB was observed pointing to a non uniformity of sources. Detection of GRB by BEPPO-SAX (1997–2002) allowed the determination of their distance by measuring their afterglow in optical wavelength. They were found to be of cosmological origins and their fluence was determined. Current measurements (mainly by SWIFT

[1]Dept. de Física, Fac. Ciencias, Univ. de Los Andes, Mérida, Venezuela.