The HAWC experiment and its sensitivity to gamma-ray bursts

Dmitry Zaborov 1 for the HAWC collaboration
1 Pennsylvania State University, University Park, PA, USA

Introduction

Recent observations by Fermi LAT [1,2] suggest that the high-energy emission of some GRBs extend at least to 30 GeV (90 GeV when corrected for redshift). However, at energies above 10 GeV, the data are very sparse due to limited effective area of Fermi LAT (0.8 m²) and the decrease of the gamma-ray flux with energy. The extension of these observations to higher energies requires a detector with much larger effective area.

The HAWC observatory

The High Altitude Water Cherenkov Observatory (HAWC) is an air shower array currently under construction in Mexico at an altitude of 4100 m. HAWC will consist of 300 large water tanks covering an area of about 22000 square meters and instrumented with 4 photomultipliers each.

New observations at the highest energies will shed new light on the physics mechanisms responsible for GRBs and properties of the extragalactic background light (EBL).

Sensitivity to GRBs

Brightest GRBs detected by Fermi should be observable with HAWC if the cutoff is above ~100 GeV. A trigger threshold of 70 PMT hits is assumed. Showers reconstructed with > 0.8° error are excluded. No gamma-hadron separation cut is applied. Angular resolution of 0.1° can be achieved at E > 5 TeV. Rejection of hadronic showers relies on the shower lateral size and high amplitude pulses produced by muons. Scalers will measure PMT counting rates. A sudden increase in counting rates may reveal a GRB. This method provides an energy threshold of a few GeV.

First science with VAMOS

The VAMOS test array collected ~3 months of raw data (live time) starting October 2011. The data can be used to search for high energy emission from GRBs, although with a ≈20-fold reduced sensitivity compared to the full HAWC array. Such an analysis has been exercised for a long-duration, intense GRB 111016B, detected by the IPN network, including Konus-Wind.

Summary

HAWC is a new generation wide field of view gamma-ray telescope currently under construction in Mexico. The high altitude, high duty cycle and large field of view make HAWC a suitable detector of gamma-ray bursts. HAWC will provide a realistic opportunity to observe the high-energy power law components of GRBs that extend at least up to 30 GeV. HAWC measurements will provide valuable information on the high-energy cutoff in the intrinsic GRB spectra and/or EBL absorption cutoff.

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References