Contribution ID: **1428** Type: **Talk**

Observation of the spectral turnover in the afterglow emission of GRB 221009A

Monday 21 July 2025 14:20 (15 minutes)

Long-duration gamma-ray bursts (GRBs) are produced with ultra-relativistic jets that emerge soon after the collapse of massive stars. The highly variable prompt-emission, lasting for a few minutes, originates from the internal dissipation within the jet. This is followed by afterglow emissions, which can persist for several days. The observed afterglow, from radio to TeV energies, is typically produced by the synchrotron and synchrotron self-Compton mechanisms. However, identification of the prompt/early TeV spectral component of GRBs has been difficult because of the limited MeV-GeV sensitivity. This talk will focus on the GeV-TeV spectral component of GRB 221009A, observed in the first 20 minutes. By modeling data from LAT at early times and AGILE at later times for the GeV range, along with TeV data from LHAASO, we establish constraints on the magnetic field and electron energies involved in the relativistic shock. Although prompt/early very-high-energy gamma-ray (VHE; E>100 GeV) emission is crucial, it is not well explored due to challenges such as the short duration of GRBs, delays between MeV instrument triggers and notifications received by the pointing VHE telescopes, and the slew-time of the telescopes. In this regard, a novel observational strategy proposed to capture the prompt/early VHE emission using pointing VHE facilities (MAGIC, CTAO/LST) will be discussed. An innovative approach has been proposed for the MAGIC telescopes: responding rapidly to Fermi/GBM triggers to scan the sky localization with short exposures of tens of seconds. We will discuss the efficiency of covering the number of GRBs per year using this strategy, which could potentially be adapted for the upcoming CTAO/LST.

Collaboration(s)

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Session Classification: GA

Track Classification: Gamma-Ray Astrophysics