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Multi-Wavelength Study of GRB Afterglows: Exploring Double-Peaked Spectral Distributions and Anomalies.

The detection of a double-peaked broadband spectral energy distribution in the long GRB 190114C highlights the need for a systematic study of Gamma-Ray Burst (GRB) temporal and spectral evolution. This study will examine multi-wavelength observations of GRB afterglows, analysing their spectral evolution across seven orders of magnitude in energy, ranging from 0.3 keV to 107 keV. The sample includes 12 GRBs detected by the Fermi Large Area Telescope (30 MeV - 300 GeV) between 2008 and 2018 with test statistics (TS) greater than 20, which also have simultaneous observations from the X-ray Telescope (0.3 - 10 keV) onboard the Neil Gehrels Swift Observatory. Our analysis reveals that 5 GRB afterglows including anomalies such as flares and plateaus, exhibit double-peaked spectral energy distributions, while 7 are consistent with the single synchrotron radiation model. These findings support previous research and highlight the significance of very high-energy (VHE) observation in better understanding the acceleration processes in relativistic shocks. GRB physics. The talk will present the multi-wavelength spectral properties of standard afterglow and anomalies such as flares and plateaus and their theoretical implications.

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