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Exploring GRB Afterglows in the TeV Era: New Diagnostics of Particle Acceleration

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The TeV gamma-ray band is essential for probing the most extreme particle acceleration processes in the Universe. The recent detections of gamma-ray bursts (GRBs) at these energies offer an incredible opportunity to investigate the origins of such transient events in an unprecedented way. In this presentation, we analyze the afterglows of these GRBs by modeling their synchrotron and inverse Compton emission within an optimized relativistic fireball framework. By comparing observational data with theoretical predictions, we constrain key model parameters and track their temporal evolution. The comparison of different TeV-detected GRBs reveals an intriguing variety among them, potentially reflecting differences in the particle acceleration processes that have to be very fast and able to accelerate to large energies. We discuss how late-time afterglow observations of X-ray and GeV-TeV emissions are crucial for providing diagnostics into the physics of GRBs. At this scope, we also present the most updated results of the AGILE telescope, which support our interpretation. Finally, we highlight theoretical predictions for future TeV observations and their implications for understanding these extreme cosmic explosions.

Collaboration(s)

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