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Origin of early emission of Gamma-Ray Bursts at GeV energies.

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Prompt emission of GRB is believed to be produced from electrons accelerated up to non thermal energies in the internal shocks. This emission peaks in the keV-MeV energy band, but a high energy (HE; 0.1-100 GeV) component is theoretically expected. While photons in the very high energy (VHE; E>20GeV) domain have been detected by Imaging Atmospheric Cherenkov Telescopes in recent years, prompt-related VHE photons have not been observed yet. Their detection would be crucial for the understanding of the physics related to the prompt emission.
In the last 15 years of LAT operation, many GRBs showed HE gamma-ray emission temporally coincident with prompt emission phase, but with different spectral properties.
This GeV emission has been interpreted by several authors as mostly dominated by the afterglow. I will present new results based on a systematic study of GRBs with an early GeV emission detected by Fermi/LAT. This study uses a physical model to explain the prompt emission. Temporal evolution of the GeV emission from the first seconds up to several hours identifies several GRBs with prompt emission. The systematic temporal and broad-band keV-GeV spectral analysis reveals that in many cases the GeV radiation is part of the main spectral component of the prompt emission. In contrast, in some other cases, these GeV photons are related to a second spectral component, which might peak at VHE gamma rays. I will discuss the physical origin of this component and its implications in light of the new results from this study and prospects for upcoming CTA.

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