

Unveiling the origin of steep decay in gamma-ray bursts

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γ -ray bursts (GRBs) are cataclysmic events, whose role became central in the new multi-messenger era. GRBs are thought to originate from internal dissipation of the energy carried by ultra-relativistic jets launched by the remnant of a massive star's death or a compact binary coalescence. In the present work I propose a novel investigation of the GRB emission mechanism, via time-resolved spectral analysis of the X-ray tails of bright GRB pulses, discovering a unique relation between the spectral index and the flux. The investigation of the spectral evolution is the ideal diagnostic to understand the connection between the emission processes and the outflow. I thoroughly discuss possible interpretations in relation to current available models and I show the incompatibility of our results with the high latitude emission of efficiently cooled particles. Our results for the first time show evidence of adiabatic cooling of the emitting particles, shedding light on fundamental physics of relativistic outflows in GRBs.

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