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A Temporal-spectral study of short gamma-ray transients: Identifying distinct signatures of gamma-ray bursts and magnetar giant flares

Short gamma-ray bursts (SGRBs) and magnetar giant flares (MGFs) are short gamma-ray transients (SGRTs) with similar temporal profiles but distinct progenitors—SGRBs arise from compact binary mergers, while MGFs originate from magnetars in nearby galaxies. When MGFs are observed at large distances, their characteristic fading pulses may be undetectable, making them difficult to distinguish from single-pulsed SGRBs, particularly in the absence of redshift information. This study analyses the temporal and spectral properties of redshift-known SGRBs detected by Fermi-GBM and two Fermi-detected MGFs, GRB200415A and GRB231115A. Pulse rise times, obtained via Norris function fits, reveal that MGFs exhibit significantly faster rise times than SGRBs. Spectral analysis over the 10 keV–40 MeV range using Comptonized and Band models shows that MGFs have much harder low-energy spectral indices. These differences support the interpretation that MGFs result from rapid energy release near a magnetar's surface, while SGRB emissions are likely driven by internal shocks at larger radii from the central engine.

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Primary author: MAHESO, Dimakatso

Co-author: RAZZAQUE, Soebur (University of Johannesburg)

Presenter: MAHESO, Dimakatso

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