

Celebrating 20 years of Swift Discoveries



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Distribution of the number of pulses within a long gamma-ray burst

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Time profiles of GRB prompt emission are still far from being understood, despite intensive efforts to characterise them in terms of duration, hardness ratio, minimum variability timescale, averaged and individual power density spectra. Surprisingly, the number of peaks that one could observe in a GRB light curve has mostly been overlooked.

For the first time, we studied and modelled the distribution of the number of peaks within each GRB across five major GRB catalogues, namely CGRO/BATSE, BeppoSAX/GRBM, Swift/BAT, Insight-HXMT, and Fermi/GBM, encompassing over 6000 GRBs and 20,000 peaks. We found that this distribution can be consistently modelled with a mixture of two exponentials, dividing GRBs in two classes, so-called “peak-rich” (20%) and “peak-poor” (80%) GRBs. Peak-rich GRBs exhibit sub-second variability on top of a slowly varying component, while peak-poor GRBs show only the latter.

We discuss the implications on the theoretical models that have been proposed to explain the variety and properties of GRB time profiles.

Authors: GUIDORZI, Cristiano (University of Ferrara); MACCARY, Romain Loic (Istituto Nazionale di Astrofisica (INAF))

Co-authors: Ms TSVETKOVA, Anastasia (Istituto Nazionale di Astrofisica (INAF)); Ms ANNA ELISA, Camisasca (Astronomical Observatory of the Autonomous Region of the Aosta Valley (OAVdA), Loc. Lignan 39, I-11020, Nus (Aosta Valley), Italy); Prof. LI, Chengkui (Institute of High Energy Physics); FRONTERA, Filippo; FERRO, Lisa (Istituto Nazionale di Astrofisica (INAF)); AMATI, Lorenzo (INAF - IASF Bologna); BAZZANINI, Lorenzo (University of Ferrara); MAISTRELLO, Manuele (University of Ferrara); Ms SARTORI, Martina (University of Ferrara); BULLA, Mattia; ZHANG, Shuang-Nan (Institute of High Energy Physics); Prof. SHAO-LIN, Xiong (Institute of High Energy Physics)

Presenter: MACCARY, Romain Loic (Istituto Nazionale di Astrofisica (INAF))

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