Astrophysics > High Energy Astrophysical Phenomena

X-ray flare candidates in short gamma-ray bursts

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We present the first systematic study of X-ray flare candidates in short gamma-ray bursts (SGRBs) exploiting the large 6-year Swift database with the aim to constrain the physical nature of such fluctuations. We find that flare candidates appear in different types of SGRB host galaxy environments and show no clear correlation with the X-ray afterglow lifetime; flare candidates are detected both in SGRBs with a bright extended emission in the soft gamma-rays and in SGRBs which do not show such component. We furthermore show that SGRB X-ray flare candidates only partially share the set of observational properties of long GRB (LGRB) flares. In particular,the main parameter driving the duration evolution of X-ray variability episodes in both classes is found to be the elapsed time from the explosion, with very limited dependence on the different progenitors, environments, central engine life-times, prompt variability time-scales and energy budgets. On the contrary, SGRB flare candidates significantly differ from LGRB flares in terms of peak luminosity, isotropic energy, flare-to-prompt luminosity ratio and relative variability flux. However, these differences disappear when the central engine time-scales and energy budget are accounted for, suggesting that (i) flare candidates and prompt pulses in SGRBs likely have a common origin; (ii) similar dissipation and/or emission mechanisms are responsible for the prompt and flare emission in long and short GRBs, with SGRBs being less energetic albeit faster evolving versions of the long class. Finally, we show that in strict analogy to the SGRB prompt emission, flares candidates fall off the lag-luminosity relation defined by LGRBs, thus strengthening the SGRB flare-prompt pulse connection.

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