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Synchrotron footprints in GRB prompt emission spectra

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At last, after more than 40 years from their discovery, the long-lasting tension between predictions and observations of GRBs spectra could be solved. We realized that the observed spectra can be produced by the synchrotron process from a distribution of electrons truncated at low energies. This low energy cut-off demands that electrons do not completely cool. Evidence for incomplete cooling was recently found in Swift GRBs with prompt observations down to 0.5 keV (Oganesyan et al. 2017, 2018). In this talk, I will review the most recent results drawn from the spectral analysis of the brightest short and long GRBs detected by the Fermi satellite (Ravasio et al. 2018, 2019). We found that in 8/10 long GRBs there is compelling evidence of a low energy break (below the peak energy) and a good agreement with the photon indices (below and above that break) predicted by the synchrotron spectrum (-2/3 and -3/2, respectively). Interestingly, none of the ten short GRBs analysed shows a break, but the low energy spectral slope is consistent with -2/3. In a standard scenario, these results imply a very low magnetic field in the emitting region, at odds with expectations.

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