

## A marginally fast-cooling proton-synchrotron model for prompt GRBs

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A small fraction of GRBs with available data down to soft X-rays ( $\sim 0.5$  keV) have been shown to feature a spectral break in the low energy part of their prompt emission spectrum. The overall spectral shape is consistent with optically thin synchrotron emission from a population of marginally fast cooling particles. In this work we firstly consider that the radiating particles are hadrons and investigate the idea that the prompt emission originates from relativistic protons that radiate synchrotron in the marginally fast cooling regime. We compute the source parameters required for such a scenario to work and investigate analytically and numerically how additional processes, namely photohadronic interactions and gamma-gamma pair production, contribute to the overall spectrum. We show that this idea is physically disfavored and readdress the one zone electro synchrotron scenario, which has been already been studied in previous works. We seek the initial source parameters that could explain the production of the GRB spectra taken from the sample presented by Oganessian et al 2019.

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