Contribution ID: **88** Type: **Parallel Flash talk**

A marginally fast-cooling proton-synchrotron model for prompt GRB emission

Monday, 22 February 2021 11:40 (5 minutes)

A small fraction of GRBs with available data down to soft X-rays (~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. If the radiating particles are electrons, this interpretation implies relatively weak magnetic fields and large emitting regions to limit, respectively, synchrotron and inverse Compton cooling. Both requirements are, however, in tension with the idea of a compact region producing the variable GRB prompt emission. In this work we consider the hadronic scenario 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 how additional processes, namely photohadronic interactions and gamma-gamma pair production, contribute to the overall spectrum. We numerically compute the observed photon spectra and calculate the expected high-energy neutrino emission following the assumptions of this work.

Collaboration name

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Session Classification: Astrophysical Models