Contribution ID: **75** Type: **not specified**

Full lepto-hadronic radiative treatment of GRBs in the internal shock scenario and application to Fermi-LAT detected events

Wednesday 12 January 2022 18:00 (15 minutes)

Gamma-Ray Bursts (GRBs) are long-standing cosmic-ray source candidates. It is however unclear how large the fraction of energy transferred to non-thermal protons (often dubbed baryonic loading) can be in order to be still compatible with observed photon spectra. Using the internal shock model for the dynamic evolution of the outflow, we perform self-consistent lepto-hadronic radiation models of the GRB prompt phase. Our description allows to calculate both time-dependent observables like the light curve as well as time-integrated photon and neutrino spectra. First turning to an educative example, we scrutinize the impact of modeling choices such as the mean Lorentz factor of the outflow, the fraction of energy transferred to the magnetic field and the baryonic loading. We find that for large baryonic loadings, secondary cascades largely impact the spectrum around the sub-MeV peak and may outshine the primary electron emission. From the simple, educative example we move to prototypes that reproduce the main observables (light curve structure, observed fluence and peak energy) of Fermi-LAT detected events and show that their simulated properties depend similarly on modeling choices.

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Session Classification: Particle acceleration II