Contribution ID: **241** Type: **Talk**

Collision dynamics in GRB internal shocks

Monday 27 August 2018 17:10 (15 minutes)

Due to the large amounts of energy they release, the luminous transients called Gamma-Ray Bursts (GRBs) are of great interest for high energy astroparticle physics. In the fireball internal shock scenario, the prompt high energy emission is generated in collisions between regions of the jet with different Lorentz factors. However, the classical internal shock model faces several difficulties like low overall energy dissipation efficiencies, which could be solved by imposing different assumptions on the collision process. The feasibility of such model modifications can be studied with hydrodynamic simulations. Focusing on the so-called ultraefficient shock scenario, we will discuss the results of these studies and their implications for GRB modeling. Implementing different collision models in multi-collision GRB simulations, we review their impact on the GRB evolution and on the production of multiple astrophysical messengers.

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Session Classification: Extragalactic Science

Track Classification: Extragalactic