Ultra-High Energy Proton-Proton Collision in the Laboratory System as the Source of Proton, Neutrino and Gamma Spectra in Space

Abstract.

My research shows that production, collisions, and decays of matter in space result in the forming of HE particle spectra, which are measured in cosmic ray physics and astrophysics. If we understand how a HE proton produces protons in the collision with another proton (or antiproton), it becomes possible to predict the form of the various particle spectra in astrophysics. LHC experiments can provide us with the proton spectra at the very high energy (VHE) of collision. A phenomenological study of previous years gave us the Quark-Gluon String Model for the modeling of baryon and meson production spectra in full kinematical range from centrally produced hadrons up to very forward ones. The method is only to convert the primary proton spectrum into the laboratory system and to compare it with the spectra of various CR particles. I have shown that spectra of neutrino and cosmic protons reproduce the form of proton production spectrum at the single collision of the initial proton of ultra-high energy (UHE). The gamma spectrum from Cygnus-X3 has not such specifics because it is influenced by the spectrum of low energy $\pi 0$ mesons. Nevertheless, the bump in the gamma spectrum exists in the measurements for PeV energies. In such a way, enhancement in the flows of gamma, neutrino, and cosmic ray protons at the end of spectra is the signature of UHE proton-proton collision.