Contribution ID: **29** Type: **Talk**

Acceleration of ultrahigh-energy cosmic rays in the early afterglows of gamma-ray bursts: concurrence of jet's dynamics and wave-particle interactions

Tuesday 20 July 2021 18:36 (12 minutes)

The origin of ultrahigh-energy cosmic rays (UHECRs) still remains mystery. It has been suggested that UHECRs can be produced by the stochastic acceleration in relativistic jets of gamma-ray bursts (GRBs) at the early afterglow phase. Here, we propose a time-dependent model for proton energization by cascading compressible waves in GRB jets with concurrence of the jet's dynamics and the mutual interactions between turbulent waves and particles. With the assumption of an initial turbulent injection spectrum W(k) ∝ k^(−3/2) and interstellar medium (ISM) for circumburst environment, our numerical results suggest that protons can be accelerated up to 10^19 eV at the early afterglow. An estimation shows UHE nuclei can easily survive photodisintegration in the external shocks in most cases, thus allowing the acceleration of 10^20 eV cosmic rays in the proposed frame. The spectral slope can be as hard as dN/dE ∝ E^0, which is consistent with the requirement for the interpretation of intermediate-mass composition of UHECR as measured by the Pierre Auger Observatory.

Keywords

particle acceleration, ultrahigh-energy cosmic rays, gamma-ray bursts, turbulence

Collaboration

other (fill field below)

other Collaboration

Nanjing University

Subcategory

Theoretical Methods

Primary authors: Dr ZE-LIN, Zhang (Nanjing University); Dr RUO-YU, Liu (Nanjing University); Prof. XIANG-YU, Wang (Nanjing University)

Presenter: Dr ZE-LIN, Zhang (Nanjing University)

Session Classification: Discussion

Track Classification: Scientific Field: CRI | Cosmic Ray Indirect