

Ultra-High-Energy Cosmic Rays from a Population of Non-identical Sources

Astrophysical candidates for the sources of ultra-high-energy cosmic rays (UHECRs) exhibit a large diversity in terms of their properties relevant for the acceleration of charged particles, such as luminosity, Lorentz factor, size and magnetic field. Yet, fits of the observed UHECR spectrum and composition often assume identical sources.

Here we investigate a population of sources with a power-law distribution of maximum energies. We show that the allowed source-to-source variance of the maximum energy must be small to describe the UHECR data. Even in the most extreme scenario, with a very sharp cutoff of individual source spectra and negative redshift evolution of the accelerators, the maximum energies of 90% of sources must be identical within a factor of three – in contrast to the variance expected for astrophysical sources.

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