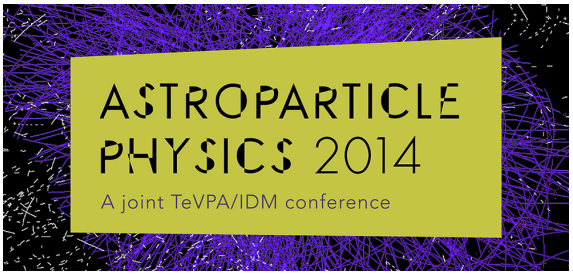

Contribution ID: **209** Type: **not specified**

Cosmic-ray spectral anomaly at GeV-TeV energies

Monday, June 23, 2014 4:48 PM (18 minutes)

Recent measurement of cosmic rays by the ATIC, CREAM and PAMELA experiments have found that the energy spectrum in the TeV region is harder than at GeV energies. The origin of the hardening is not clearly understood. Suggested explanations include hardening in the cosmic-ray source spectrum, changes in the cosmic-ray propagation properties in the Galaxy and the effect of the nearby sources. In this contribution, I will discuss the possibility that the spectral anomaly might be an effect of re-acceleration of cosmic rays by weak shocks in the Galaxy. After acceleration by strong supernova remnant shock waves, cosmic rays undergo diffusive propagation in the Galaxy. During the propagation, cosmic rays may again encounter expanding supernova remnant shock waves, and get re-accelerated. As the probability of encountering old supernova remnants is expected to be larger than the young ones due to their bigger size, the re-acceleration is expected to be produced mainly by weaker shocks. Since weaker shocks generate a softer particle spectrum, the resulting re-accelerated component will have a spectrum steeper than the initial cosmic-ray source spectrum produced by strong shocks. For a reasonable set of model parameters, I will show that such re-accelerated component can dominate the GeV energy region while the non-reaccelerated component dominates at higher energies, thereby explaining the observed GeV-TeV spectral anomaly.

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Session Classification: Cosmic Rays

Track Classification: Cosmic Rays