Contribution ID: **69** Type: **Talk**

Measurement of All-Particle Energy Spectrum and Mean Logarithmic Mass of Cosmic Rays until hundreds of PeV

Wednesday 23 July 2025 16:04 (15 minutes)

The Large High Altitude Air Shower Observatory (LHAASO) provides unprecedented capabilities for measuring cosmic-ray (CR) properties in the high energy regime. The LHAASO experiment has achieved unprecedented precision in measuring the cosmic ray all-particle energy spectrum and its mean logarithmic mass in the "knee" region. As statistics accumulate, it becomes feasible to accurately assess the cosmic ray all-particle energy spectrum and mean logarithmic mass at energies reaching hundreds of PeV. It is the transition region between the Galactic and extragalactic cosmic rays as proposed by most theoretical models. This study focuses on the cosmic ray all-particle energy spectrum up to hundreds of PeV, utilizing inclined incidence cases to measure cosmic ray energies at the maximum of atmospheric showers, ensuring high energy reconstruction precision. By optimizing the shower core position and zenith angle range, we enhance the cosmic ray observation aperture and improve the statistical yield. Combining information from the electromagnetic particle detectors and muon detectors of the LHAASO experiment, we develop an energy reconstruction method that is independent of the cosmic ray composition, thus eliminating the composition dependence on the energy spectrum and achieving high-precision cosmic ray energy spectrum measurements. Moreover, we accurately measure the mean logarithmic mass distribution of cosmic rays using the muon contents from air showers. Preliminary findings indicate "second knee"in the energy spectrum at around 100 PeV, and the mean logarithmic mass exhibits a gradual increase with energy, suggesting a transition toward heavier nuclear dominance across hundreds of PeV.

Collaboration(s)

LHAASO

Author: ZHANG, Hengying (Yunnan University)

Co-authors: HE, Huihai (IHEP); FENG, Cunfeng (Shandong Universtiy); MA, Lingling (IHEP)

Presenter: ZHANG, Hengying (Yunnan University)

Session Classification: CRI

Track Classification: Cosmic-Ray Indirect