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The precision measurements of all-particle energy spectrum and mean logarithmic mass of cosmic rays using LHAASO-KM2A

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Understanding the origin of the knee in terms of the energy spectrum is often considered fundamental for determining the origin of cosmic rays. The kilometer-square array (KM2A) of the Large High Altitude Air Shower Observatory (LHAASO) simultaneously measures air shower sizes of both electromagnetic particles and muons with high precision at 4410 m a.s.l. where cosmic ray air showers with primary energies in the knee region reach approximately maximum resulting in the least fluctuations. This enables the primary energy being measured in a calorimetric way from a new variable $N_{e\mu}$ by combining the number of muons and electromagnetic particles, which shows very weak dependency on primary compositions. We present the measurement of all-particle cosmic ray energy spectrum with unprecedented accuracy in 0.3-30 PeV with KM2A data collected from September 2021 to December 2022, while the mean logarithmic mass in the same energy range is measured.

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