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Measurement and Interpretation of UHECR Mass Composition at the Pierre Auger Observatory

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The Pierre Auger Observatory has driven the field of ultra-high-energy cosmic ray (UHECR) physics, producing several groundbreaking observations over the last 20 years. One of the most striking findings has been the complex evolution of UHECR mass composition, as revealed by detailed analyses of observables such as the depth of shower maximum (X_{\max}) and the muon content of showers. As more data are collected and sophisticated analyses are undertaken, not only are new fine details emerging, but the general picture of UHECR mass composition is becoming increasingly robust. This contribution will present recent results on UHECR mass composition derived from surface, fluorescence, and radio detectors. Together with other key findings from the Observatory, these results converge to present a coherent picture of UHECR mass composition- effectively ruling out proton dominance and challenging the interpretation of the observed flux suppression near 46 EeV as a purely proton-induced GZK effect. To finish the contribution, we discuss how the upgraded detectors in the Observatory's second phase of data-taking will further refine our understanding of UHECR mass composition.

Collaboration(s)

Pierre Auger Collaboration

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