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Ultra-high energy cosmic rays with the Pierre Auger Observatory

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In the era of the multi-messenger astronomy, ultra-high energy cosmic rays offer the unique opportunity to investigate the nature of astrophysical sources and of particle interactions in an energy range far beyond that covered by current particle accelerators.

The Pierre Auger Observatory, the world's largest cosmic ray detector, combines in a hybrid design the information from fluorescence telescopes, observing the longitudinal profile of extensive air showers, with a surface array, measuring the lateral distributions of secondary particles at the ground.

A review of selected results will be presented, focusing on the energy spectrum, nuclear mass composition measurements and search for neutral particles.

The future prospects will also be discussed in light of the extensive upgrade program being now implemented to further improve the potential of the Observatory.

Summary

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