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The Pierre Auger Observatory: results on the highest energy particles

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The Pierre Auger Observatory has been designed to investigate the most energetic particles known, the ultra high energy cosmic rays.

The observatory, covering an area of 3000 km^2 , combines two different detection techniques to study the huge particle showers created by the interaction of the primary cosmic ray with the atmosphere.

The analysis of the showers allows to extract information on the nature of the primary cosmic rays as well as their origin. Moreover, the study of the interaction of these particles with the atmosphere offers an unique window to study particle physics at an energy more than one order of magnitude above the current highest energy man-made accelerator.

In this contribution, selected results are presented with focus on the primary mass composition, on the determination of the number of muons, which is very sensitive to the shower hadronic interactions, and on the measurement of the proton-air cross-section at $\sqrt{s} = 57 \text{ TeV}$. For the last topic, a link with the proton-proton cross-section measurements, done at accelerators, will be shown.

Results on the cosmic ray energy spectrum and on the searches for ultra high energy photons and neutrinos, will also be addressed.

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