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## Hadronic physics with the Pierre Auger Observatory

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Extensive air showers are the result of billions of particle reactions initiated by single cosmic rays at ultra-high energy. Their characteristics are sensitive both to the mass of the primary cosmic ray and to the details of hadronic interactions, including energies and kinematic regions beyond those tested by human-made accelerators.

We report on how the Pierre Auger Observatory is able to measure the proton-air cross section for particle production at a center-of-mass energy per nucleon of 39 TeV and 56 TeV and also to constrain the new LHC-tuned hadronic interaction models by measuring the muon content and muon production depth of air showers with a primary center-of-mass energy per nucleon around and above 140 TeV.

**Primary author:** CAZON, Lorenzo (LIP)

**Co-author:** PIERRE AUGER COLLABORATION, Pierre Auger Observatory (Malargue, Argentina)

**Presenter:** CAZON, Lorenzo (LIP)

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