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AugerPrime, the Upgrade of the Pierre Auger Observatory

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The data collected with the Pierre Auger Observatory have led to a number of unexpected discoveries. While a strong suppression of the particle flux at the highest energies has been established unambiguously, the dominant physics processes related to this suppression cannot yet be identified. Within the energy range covered by fluorescence detector observations with sufficient statistics, an unexpected energy evolution of the distribution of depth of shower maximum is found. Using LHC tuned interaction models these observations can be understood as a correlated change of the fluxes of different mass groups. On the other hand, they could also indicate a change in hadronic interactions above the energy of the ankle. Complementing the water-Cherenkov detectors of the surface array with scintillator detectors will, mainly through the determination of the muonic shower component, extend the composition sensitivity of the Auger Observatory into the flux suppression region. The upgrade of the Auger Observatory, called AugerPrime, will allow us to estimate the primary mass of the highest energy cosmic rays on a shower-by-shower basis. In addition to measuring the mass composition, AugerPrime will open the possibility to search for light primaries at the highest energies, to perform composition-selected anisotropy studies, and to search for new phenomena including unexpected changes in hadronic interactions. After introducing the physics motivation for upgrading the Auger Observatory, the planned detector upgrade and the deployed engineering array are presented. In the second part of the contribution, the expected performance and improved physics sensitivity of the upgraded Auger Observatory are discussed.

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