Contribution ID: **740** Type: **Parallel**

The science of ultra-high energy cosmic rays after 20 years of operation of the Pierre Auger Observatory

The Pierre Auger Observatory has been on the astroparticle scene for over twenty years now. It's a mature player in this field, yet it retains all its vitality to provide data whose richness sheds light not only on the origin of ultra-high-energy cosmic rays (UHECRs), but also on high-energy hadronic interactions, multi-messenger astrophysics, beyond Standard Model (BSM) physics and atmospheric electricity phenomena. An essential feature of the Observatory is its hybrid design: UHECRs are detected through the observation of the associated extensive air showers with different and complementary techniques. The analyses of the multi-detector data have enabled high-statistics and high-precision studies above ~100 PeV. The energy spectrum is falling down at UHE through a two-step change of spectral index. Mass-composition data are consistent with group elements getting heavier beyond the ankle energy and taking over one after the other so that the all-particle flux gets dominated by one specific group elements as the energy increases. While no discrete source of UHECRs has been identified so far, the extragalactic origin of the particles has been confirmed from the arrival directions above 8 EeV, and the net is closing around nearby astrophysical sites at higher energies. Also, the established upper limits on fluxes of UHE neutrinos and photons have implications not only on multi-messenger studies, but also on various phenomena of BSM physics that could occur at a high scale. The resulting constraints are summarized in this contribution

Secondary track

Author: DELIGNY, Olivier

Session Classification: T01

Track Classification: T01 - Astroparticles, Gravitation and Cosmology