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**Séminaire
SPP**

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Highlights of the Pierre Auger Observatory, after 10 years of operation

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The Pierre Auger Observatory has been detecting ultra-high energy cosmic rays (UHECRs) for more than ten years. Comprising a 3000 km² surface detector (SD) of 1600 water Cherenkov stations spaced by 1500 m overlooked by four fluorescence detectors (FD), it now includes also a 23.5 km² denser SD (61 stations with 750 m spacing, 7 of them equipped with muon detectors) overlooked by three additional high-elevation FD and a 17 km² array of 153 radio antennas, all extending the energy range down to 10¹⁷ eV. The analyses of data has led to a multitude of results on UHECRs that we will highlight in this talk. The high-exposure (more than 50000 km² sr yr) and high-precision measurement of the energy spectrum over more than three decades in energy is a shining example of the power of combining different detectors. Also, the combination of the two sets of fluorescence detectors has allowed to measure the depth of the shower maximum down to 10¹⁷ eV, extending by one decade in energy the interpretation in terms of mass composition based on LHC-tuned shower models. The evolution of the flux and of the mass composition versus energy has stimulated us to a first attempt to confront our data with a simple astrophysical model. While the depth of shower maximum as observed by the FD is the premier observable to infer the nature of UHECRs, we have exploited observables with the SD too. On the one hand, this has allowed the search for UHE photons and neutrinos with unprecedented sensitivity, also due to the increased exposure. On the other hand, the study of SD mass-related observables, such as the number of muons, has revealed itself as a probe of shower models at center-of-mass energies as high as 140 TeV, thus providing insights into hadronic interactions at otherwise inaccessible energies. To complement the spectrum and mass measurements, we have studied the distribution of the UHECR arrival directions at different angular scales. At the highest energies, above 40 EeV, we have looked for small- to intermediate-scale anisotropies, both intrinsic ones and in correlation with potential astrophysical sources. We have also implemented different analyses to search for large-scale anisotropies over four orders of magnitude in energy, above about 10¹⁶ eV. The mostly unanticipated harvest of 10 years of operation has led the Collaboration to conceive a plan for an upgrade of the Observatory. The rationale behind it and its status will be shortly introduced.

Le café sera servi 10 minutes avant.

NB : La présentation d'une pièce d'identité est exigée à l'entrée du centre. Tous les auditeurs extérieurs sont priés de prévenir à l'avance Martine Oger, tél. 01 69 08 23 50, e-mail : martine.oger@cea.fr. (U.E. : délai de 24 h, hors U.E. : délai de 4 jours).