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Anisotropies in the arrival directions of ultra-high-energy cosmic rays measured at the Pierre Auger Observatory

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The search for anisotropies in the arrival directions of cosmic rays of the highest energies is essential in the on-going effort to identify their sources. After more than 15 years of operation, the exposure of the Pierre Auger Observatory exceeds 100,000 km^2 sr yr and several important scientific findings regarding anisotropy studies on various angular scales have been reported.
In the large-scale regime, a dipolar modulation above an energy threshold of 8 EeV was discovered with a significance exceeding the 5\sigma confidence level. The dipole exhibits an amplitude of 6.6^{+1.2}_{-0.8}\% and its maximum points ~125^\circ away from the Galactic center, thus providing observational evidence for an extragalactic origin of the highest-energy cosmic rays. The analysis of the equatorial component was extended to lower energies of ~0.03 EeV where the dipole phase changes towards the Galactic center. However, none of the lower-energy amplitudes is yet significant.
At the highest energies, searches for small- and intermediate-scale anisotropies were performed. A model-independent search for overdensities as well as a correlation study with the direction of the nearby radio galaxy Cen A was conducted. The latter analysis yields a one-sided post-trial significance of 3.9 \sigma for energies above 37 EeV on an angular scale of 28^\circ. Additionally, comparisons to four catalogs of candidate sources were performed using a maximum likelihood analysis. The comparison of the cosmic-ray arrival directions to a sample of starburst galaxies results in the highest post-trial significance, which lately surpassed the 4.5 \sigma confidence level above 38 EeV.

Internet talk

Is this abstract from experiment?

Yes

Name of experiment and experimental site

The Pierre Auger Collaboration

Is the speaker for that presentation defined?

Yes

Details

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