Contribution ID: **216** Type: **Talk**

A composition-informed search for large-scale anisotropy with the Pierre Auger Observatory

Tuesday 15 July 2025 13:20 (15 minutes)

The large-scale dipole structure in the arrival directions of ultra-high-energy cosmic rays above 8 EeV observed by the Pierre Auger Collaboration is a well-established anisotropy measurement. This anisotropy is understood to be of extragalactic origin, as the maximum of the dipolar component is located $\sim 115^\circ$ away from the Galactic Center. Cosmic rays interact with background radiation and magnetized regions along their path from their sources to Earth. These interactions, which depend on the cosmic-ray energy, charge and mass composition, give rise to different propagation horizons and deflections that are expected to lead to different anisotropies in the arrival directions of cosmic rays at Earth.

In this contribution, we investigate for the first time the composition signature on the large-scale anisotropy taking advantage of composition estimators obtained for the data gathered with the surface detector. A way of probing for composition signatures in anisotropy patterns is to divide the data into composition-distinct subsets. In a simulation library, we evaluated the possibility of measuring a separation in total dipole amplitude between two such populations of the measured dataset under a source-agnostic model. Following a positive prospect, the Auger Phase 1 data set was separated into “light” and “heavy” subsets. We present the 3D dipole for each population, highlighting a separation in both amplitude and direction. The observed dipole amplitude for the light population is larger than that of the overall data, supporting the hypothesis of a composition signature on large-scale anisotropies.

Collaboration(s)

Pierre Auger Collaboration

Author: GOLUP, Geraldina

Presenter: GOLUP, Geraldina

Session Classification: CRI

Track Classification: Cosmic-Ray Indirect