

UHECRs in harmonic space

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I shall review our recent proposal of the use of the harmonic-space cross-correlation power spectrum between the arrival directions of ultra-high energy cosmic rays (UHECRs) and the distributions of galaxies in the Universe, as observed by cosmological surveys of the large-scale structure (LSS). We expect the two observables to correlate, due to both galaxies and UHECR sources being hosted within dark matter haloes, which constitute the very LSS. This cross-correlation has not yet been considered in the literature. We formalise analytically such a cross-correlation and show how, if the distribution of UHECR sources trace indeed the LSS, that the combination of auto- and cross-correlation greatly helps to detect UHECR anisotropies with current data, even with current data. We show that the cross-correlation is more sensitive to UHECR anisotropies on smaller angular scales, more robust to systematic uncertainties, and it could be used to determine the redshift distribution of UHECR source.

Keywords

multi-messenger astronomy; cosmology; cross-correlations; large-scale cosmic structure.

Collaboration

other (fill field below)

other Collaboration

Euclid Consortium; SKA Observatory.

Subcategory

Theoretical Methods

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