

The origin of UHECR: the distance to the nearest source and the dipole

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The origin of UHECR remains one of the most intriguing open question in astroparticle physics. In this work, we delve into this matter by seeking to build a solid understanding of the role of local sources of UHECR, with a few tens of Mpc, in both the energy spectrum and the angular distribution of arrival directions. We present semi-analytical approaches for the propagation of UHECR in turbulent extra-galactic magnetic fields and for calculating the angular arrival distribution. With that, we are able to study both the spectrum and dipole evolution with energy. For the energy spectrum, we estimate the relative contribution of sources at different distance shells, showing the onset of a propagation horizon at the highest energies and a magnetic horizon at lower energies. Constrains on the distance to the nearest source are imposed, showing the need for local sources with few tens of Mpc. For the arrival directions, on the other hand, we show the arising of the dipolar behavior of the distribution, as well as how it evolves with energy and depends on the astrophysical hypotheses. We also argue for the need for an angular power spectrum analysis of the data.

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