

Ultra-high energy cosmic ray propagation in a structured Universe

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The sky in ultra-high-energy cosmic ray (UHECRs) above a few EeV is surprisingly isotropic which complicates the identification of the sources. UHECR spectrum, composition and angular distributions are influenced by interactions with background photon fields and by the deflection in extragalactic and galactic magnetic fields (EGMF and GMF). Moreover, the spatial structure of the EGMF is not yet well understood. In this work we study the propagation of UHECRs with the Monte Carlo code CRPropa3 for a range of UHECR source and EGMF models. UHECR deflection in the GMF is taken into account by mapping arrival directions at the edge of the Milky Way to those at Earth. We predict the sky distributions of UHECRs at Earth for various combinations of source catalogues, injected energy and mass distributions, and EGMFs. We identify the impact of the different model ingredients on spectrum, composition and UHECR sky. Comparison with data can then constrain scenarios for the source and EGMF models.

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