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Extrapolating FR-0 radio galaxy source properties from the propagation of multi-messenger ultra-high-energy cosmic rays

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Recently, it has been shown that relatively low luminosity Fanaroff-Riley type 0 (FR-0) radio galaxies are a good candidate source class for a predominant fraction of cosmic rays (CR) accelerated to ultra-high energies (UHE, E>10^18 eV). FR-0s can potentially provide a significant fraction of the UHECR energy density as they are much more numerous in the local universe (up to a factor of ~5 with z<= 0.05) than more energetic radio galaxies such as FR-1s or FR-2s.

In the present work, UHECR mass composition and energy spectra at the FR-0 sources are estimated by fitting simulation results to the published Pierre Auger Observatory and Telescope Array data. This fitting is done using a simulated isotropic sky distribution extrapolated from the measured FR-0 galaxy properties and propagating CRs in plausible extragalactic magnetic field configurations using the CRPropa3 framework. In addition, we present estimates of the fluxes of secondary photons and neutrinos created in UHECR interactions with cosmic photon backgrounds during CR propagation. With this approach, we aim to investigate the properties of the sources with the help of observational multi-messenger data.

Keywords

UHECR, cosmic rays, active galaxies, radio galaxies, FR-0, multi-messenger, energy spectrum, composition

Collaboration

other Collaboration

Subcategory

Theoretical Results

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