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Investigation of Multi-Messenger Properties of FR0 Radio Galaxy Emitted Ultra-High Energy Cosmic Rays

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The low luminosity Fanaroff-Riley type 0 (FR0) radio galaxies are amongst potential contributors to the observed flux of ultra-high energy cosmic rays (UHECRs). Due to their much higher abundance in the local universe with respect to more powerful radio galaxies (e.g., FR0s are about five times more ubiquitous at redshifts $z \leq 0.05$ than FR1s), FR0s could provide a substantial fraction of the total UHECR energy density.

In the presented work we determine the mass composition and the energy spectrum of UHECRs emitted by FR0 sources by fitting simulation results from CRPropa3 framework to the recently published Pierre Auger Observatory data. The resulting emission spectral characteristics (spectral indices, rigidity cutoffs) and elemental group fractions are compared to the Auger results. The FR0 simulations include the approximately isotropic distribution of FR0s extrapolated from the measured FR0 galaxy properties, and various extragalactic magnetic field configurations including random and large-scale structured fields. We predict the fluxes of secondary photons and neutrinos produced during UHECR propagation through cosmic photon backgrounds. The presented results allow for probing the properties of the FR0 radio galaxies as cosmic-ray sources using observational high-energy multi-messenger data.

Submitted on behalf of a Collaboration?

No

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