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EXTREMELY HIGH ENERGY (E > 10^{20} eV) COSMIC RAYS: OBSERVATIONS AND POTENTIAL SOURCES

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Determination of the nature and sources of ultrahigh energy cosmic rays (UHECR, E>10^{18} eV) is still unsolved problem in cosmic ray physics. The observed high degree of UHECR isotropy, caused mainly by the deviations of the UHECR trajectories in extragalactic and Galactic magnetic fields, together with a significant uncertainty in their chemical composition (atomic mass), don't allow observed events to be linked to their sources. It is possible to reduce the influence of magnetic deflection in two ways - by considering events with extremely high energy (EHECR, E> 10^{20} eV) and taking into account modern models of the Galactic magnetic field for correction of their trajectories. In our work, the observed by Auger and TA detectors EHECR arrival directions are corrected for the influence of Galactic and random extragalactic magnetic fields. New (corrected) EHECR arrival directions are compared to four samples of potential EHECR sources: 17 AGNs with powerful gamma-ray emission (from the 2FHL catalog), 23 radio-flux-selected star-burst galaxies, as well as 42 radio-galaxies from the parameterized catalog of radio-galaxies. Taking into account the energy loss lengths of the EHECR nuclear components (H, He, C, Si, Fe) in the extragalactic environment and the expected typical distances to potential sources (~100 Mpc for H and Si –Fe and ~50 Mpc for He, C), the astrophysical objects of the above samples that could be sources of relevant EHECR events are highlighted. The potential acceleration mechanisms in the selected objects are analyzed, and the contribution of possible Galactic sources (magnetar giant flares) to the observed EHECR events is evaluated.

Keywords

ultra high energy cosmic rays; active galaxy nuclei; radio-galaxies; magnetars

Collaboration

other Collaboration

Subcategory

Theoretical Results

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