Research Report
ICRR Inter-University Research Program 2019

Research Subject: Ultra-high-energy cosmic-ray origin studies with the Telescope Array and TAx4 surface detector

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Summary of Research Result :

The upper limits are set on the flux of photons from each particular direction in the sky within the Telescope Array field of view, according to the experiment's angular resolution for photons. Average 95% C.L. upper limits for the point-source flux of photons with energies greater than 10^{18}, $10^{18.5}$, 10^{19}, $10^{19.5}$ and 10^{20} eV are 0.094, 0.029, 0.010, 0.0073 and 0.0058 $km^{-2}yr^{-1}$ respectively. For the energies higher than $10^{18.5}$ eV, the photon point-source limits are set for the first time. Numerical results for each given direction in each energy range are obtained.

An upper limit on the flux of ultra-high-energy down-going neutrinos for $E>10^{18}$ eV is derived with the nine years of data collected by the Telescope Array surface detector (05-11-2008 -- 05-10-2017). The method of the analysis is based on the multivariate analysis technique, so-called Boosted Decision Trees (BDT). The proton-neutrino classifier is built upon 16 observables related to both the properties of the shower front and the lateral distribution function.

We begin the analysis of the Telescope Array Surface Detector sensitivity to the modification of the hadronic models. Namely, the modification of the CORSIKA QGSJET II-04 model is performed with the increase of the leading rho0 production rate.

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