Gamma-Ray Constraints on Maximum Cosmogenic Neutrino Fluxes and UHECR Source Evolution Models

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The dip model assumes that the ultra-high energy cosmic rays (UHECRs) above 10^{18} eV consist exclusively of protons and is consistent with the spectrum and composition measure by HiRes. Here we present the range of cosmogenic neutrino fluxes in the dip-model which are compatible with a recent determination of the extragalactic very high energy (VHE) gamma-ray diffuse background derived from 2.5 years of Fermi/LAT data. We show that the largest fluxes predicted in the dip model would be detectable by IceCube in about 10 years of observation and are within the reach of a few years of observation with the ARA project. In the incomplete UHECR model in which protons are assumed to dominate only above 10^{19} eV, the cosmogenic neutrino fluxes could be a factor of 2 or 3 larger. Any fraction of heavier nuclei in the UHECR at these energies would reduce the maximum cosmogenic neutrino fluxes. We also consider here special evolution models in which the UHECR sources are assumed to have the same evolution of either the star formation rate (SFR), or the gamma-ray burst (GRB) rate, or the active galactic nuclei (AGN) rate in the Universe and found that the last two are disfavored (and in the dip model rejected) by the new VHE gamma-ray background.

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