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A neutrino flux above 5 PeV and implications for ultrahigh-energy cosmic rays

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The detections of rare events above 5 PeV by two neutrino telescopes highlights the existence of a neutrino flux at these energies. In over a decade of data taken by the IceCube Neutrino Observatory, three events were detected and reconstructed to have energies above 5 PeV. More recently, the KM3NeT neutrino telescope announced their detection of a possible O(100 PeV) neutrino candidate. The connection between the highest-energy neutrinos and cosmic rays is well established. Here, for the first time, we simultaneously fit the neutrino data from IceCube and KM3NeT, as well as the ultrahigh-energy cosmic ray spectrum and composition data from the Pierre Auger Observatory (Auger), to test a common-origin hypothesis. We show that a phenomenological model is able to describe the combined data across these three observatories, and, depending on the true energy of the event detected by KM3NeT, suggests an additional cosmic ray source population not yet robustly detected by Auger. Next-generation observatories, such as IceCube-Gen2, will have the sensitivity to make a significant detection of this flux.

Collaboration(s)

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