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Are IceCube PeV neutrino events extraterrestrial or can be of atmospheric origin?

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Cascade showers with near PeV energies observed in the IceCube experiment in near horizontal direction gave a powerful pulse to discussions of their possible generation by extraterrestrial neutrinos. The reason is very simple. The expected neutrino flux of atmospheric origin is very small to produce such events. But if to take into account a possibility of production of a new state of matter in nucleus-nucleus interactions of cosmic rays with energy about 10^{16} eV and higher, the picture can be changed drastically. As calculations show, in this case muon and neutrino spectra will be much harder than usual atmospheric ones and can explain the appearance of such cascade showers. Muon energy spectrum measured in BUST and IceCube experiments at energies higher than 100 TeV showed the considerable excess of the measured number of muons in comparison with calculations based on a traditional approach. In this case, the observed IceCube events can be generated by neutrinos of atmospheric origin, and their detection evidences in favour of the production of the new state of matter at very high energies.

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