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Muon puzzle in cosmic rays according to NEVOD-DECOR experiment data

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In a number of experiments on the study of ultrahigh-energy cosmic rays, an excess of muons in extensive air showers in comparison with calculations performed within modern (post-LHC) models of hadronic interactions is observed. An analysis of the NEVOD-DECOR data over a long period of time indicates an increase in the excess of muon bundles with increasing energy of primary cosmic ray particles, so that at $\sim 10^{18}$ eV the intensity is consistent with the expected one only under the assumption of an extremely heavy mass composition. The key to explaining the excess of muons may be the study of the energy characteristics of muon bundles, that are conducted in the NEVOD-DECOR experiment. Recently, estimates of the average muon energy in the bundles were obtained and its increase compared to the results of calculations at energies above 10^{17} eV was found. Thus, the solution of the muon puzzle may require major changes to the existing models of hadron interactions.

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