Contribution ID: **14** Type: **not specified**

Complex NEVOD for multi-component investigations of cosmic rays in the record-wide energy range 10^10 −10^19 eV

The wide energy range covered by the complex NEVOD is determined by a unique combination of detectors and installations that have no analogues in the world. The energy region from few GeV to ˜ 100 GeV is covered by muon hodoscope URAGAN with an area of 46 m^2. The region from several tens of GeV to several tens of TeV is covered by the Cherenkov water calorimeter with a volume of 2000 m^3 with a dense lattice of quasi-spherical measuring modules. The region from ˜ 10^14 to 10^17 eV is covered by four installations for registration of various components of EAS. The scintillation calibration telescope system with an area of 80 m^2 is used for registration of the EAS in the threshold energy region (˜ 10^14 eV). The NEVOD-EAS installation allows investigation of the EAS in the energy region of 10^15 −10^17 eV. The prototype installation PRISMA-32 of 400 m^2 and the first phase of the URAN detector with area of 2000 m^2 are intended for registration of the neutron component over the entire area of EAS in the energy region of 10^15 −10^16 eV. The region of very- and ultra-high energies (10^15-10^19 eV) is covered by a coordinate-tracking detector DECOR with a total area of 70 m^2; it is designed for the registration of muon bundles generated in inclined EAS.

In recent years, two important results have been obtained at the complex NEVOD: a growing excess of muons with the rise of energy in the EAS, which is not explained by existing models (so-called “muon puzzle”) has been revealed, and a method of muonography of near-Earth space has been developed with the purpose of the early detection of potentially dangerous phenomena in the heliosphere, magnetosphere and the Earth’s atmosphere.

The upcoming task of the complex is solution of the “muon puzzle”by means of independent measurements of the number of muons in the bundles in the coordinate-tracking detector and their energy release in the Cherenkov water calorimeter. With the inclusion of new muon generation processes, the specific energy release (per muon) will start increasing.

The scheduled upgrade of the complex NEVOD, in particular, the creation of a new co-ordinate-tracking detector TREK with an area of 250 m^2 and the expansion of the detection system of the Cherenkov water detector to its full volume will significantly improve the conditions and will reduce the necessary duration of this experiment. In the field of muonography, it is planned to develop the muon hodoscope of the new generation to create a distributed network in Russia and Europe for the continuous monitoring of the space weather.

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Track Classification: Large experiments and projects