Contribution ID : **812** Type : **Poster**

Forbush decreases and lunar cycles in the thermal neutron counting rate for the period from May 2015 to February 2019 by using the experimental data of ”Neutron” setup

Monday, 5 October 2020 19:45 (15)

In this work, the experimental data on thermal neutron flux registered by the “Neutron” setup on the Earth’s surface for the period from May 2015 to February 2019 were analyzed. The Forbush decreases (FD), arising from the influence of solar activity on the flux of cosmic rays, as well as the lunar cycles associated with an increase of the release of radioactive radon due to the occurrence of a lunar tidal wave, were studied.

The “Neutron” setup, which is a part of the Experimental Complex NEVOD (MEPhI, Moscow), is designed to register the thermal neutrons flux on the Earth’s surface. It is in operation in a continuous mode since 2010. The setup includes four identical neutron detectors based on the inorganic scintillator 6LiF+ZnS (Ag). Due to the different location of the detectors (from − 3 m to 10.5 m relative the ground surface) and their high sensitivity to thermal neutrons, it was possible to study various phenomena that affect the background neutron flux near the surface. The counting rate of each detector was corrected for the barometric pressure effect.

As a result of the analysis of the setup data during the specified period, 20 FD were found, for each of them the FD amplitude and recovery time were estimated. The comparison with the results of FD studies in data of two other setups: the Moscow neutron monitor (MNM) and the muon hodoscope URAGAN (MEPhI, Moscow) was made. Comparison showed that the FD amplitudes of “Neutron” are comparable with those of MNM (on average, less by about 30%), and about 1.5 times more than for URAGAN. The counting rate recovery of “Neutron” detectors is much faster than for MNM and URAGAN.

Also, the epoch superposition method was used to study lunar waves: semidiurnal tidal wave (M2) with a period of 24 hours 50 minutes, and synodic month wave with a period of ˜ 29.53 days. For the synodic month wave there is a clear increase in the counting rate during the full moon for the first detector located in the building basement. For the other three detectors, the effect is less.

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Session Classification : Poster session

Track Classification : Astroparticle physics