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TEMPERATURE EFFECT OF THE NEUTRON COMPONENT OF COSMIC RAYS IN A PERIOD OF HIGH SOLAR ACTIVITY

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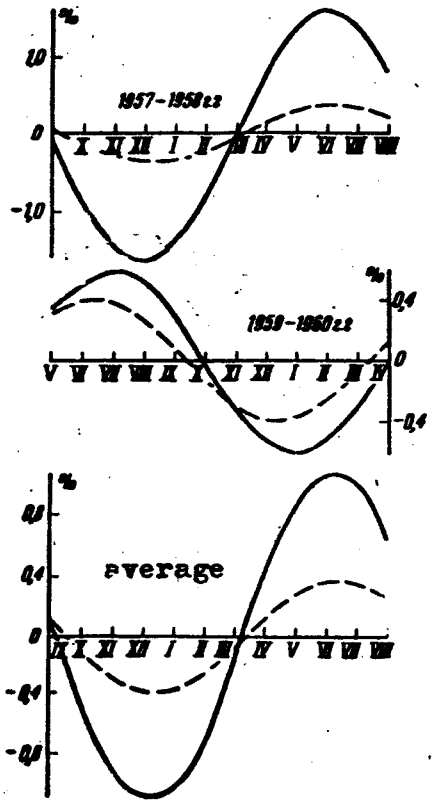
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The determination of the temperature effect of the neutron component of cosmic rays constitutes great interest in connection with the investigation of cascade processes, attending the passages of cosmic rays through the terrestrial atmosphere. No reliable estimation of the effect was made during a long period [1, 2] , since its value is significantly less than the variation of the neutron component, conditioned by the variations of primary radiation. Therefore, a method was proposed by us, which allows to investigate the variation of the neutron component, arising at variation of the atmosphere temperature [3] , reliably excluding the variations of primary components. Its essence consists in that we used the differences in intensities of two devices, corrected for the barometric effects and disposed at close geomagnetic latitudes (or having close values of hardness cut-off), but in opposite hemispheres of the Earth. As is evident, the variations of the primary component in this case are completely eliminated, and the variations of temperature

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origin are doubled.

This method was successfully applied for the determination of the temperature effect of the neutron component according to data of station Hobart (g =1.79 Bev) and Chicago (g= 1.91 Bev). The temperature effect, found by the average monthly value of the intensity (seasonal wave) for 1960 - 1962, represented a regular seasonal wave of average amplitude -0.6%, negatively correlating with the temperature variation of the atmosphere. The effect resulted approximately twice greater than the theoretical, computed with the aid of a density curve of the temperature coefficient [4].

Although the origin of the revealed seasonal wave in the intensity of the neutron component was linked by us with the seasonal variation of the atmosphere temperature, its origin can, in principle, be conditioned by other causes. In particular, a north-south asymmetry of primary radiation can arise in the presence of a density gradient of cosmic rays in the interplanetary medium connected with solar modulation, which will be manifest in the form of an annual intensity wave. Such asymmetry can be the consequence of the long-existing anisotropy of primary radiation, revealed for example in work [5].

Taking into account that the temperature effect, revealed by us, was obtained from data referring to a period of solar activity decrease,

it is of interest to repeat the investigation using the experimental material characteristic of a period of high solar activity. In this case, we can expect that if the effect has a meteorological origin, the results will be the same as in work [3]. If the effect is caused by anisotropy of primary radiation, then the character and the degree of anisotropy in the year of high solar activity will most probably be essentially different from that of 1960 - 1962.

With the help of the method used in work [3], the variations of the primary component from the data of the neutron monitor stations, Chicago and Hobart for the years 1957 - 1959, corresponding to the period of solar activity maximum, were eliminated. The preliminary comparisons of experimental data have shown that the apparatus at these stations worked reliably in the period from September 1957 to September 1958 and from May 1959 to May 1960. These two periods were precisely utilized for bringing forth the seasonal intensity wave of the neutron component.

On the graph, the first harmonics of the seasonal wave of the neutron component (solid lines) and the seasonal wave of the anticipated temperature effect [4] (dashes) are plotted for the years 1957 - 1958, 1959 - 1960, and the average for two years.

As in work [3], the phases of the experimental and calculated curves coincide well. However, the amplitudes of the effects resulted substantially different. In 1957 - 1958, the amplitude of the wave reached 1.6%; that is, it surpassed the theoretical, anticipated value by four times. In 1959 - 1960, the amplitudes of the experimental and theoretical curves are comparable in magnitude (ratio ~ 1.5). As an average for two years, the seasonal wave has the amplitude, surpassing the calculated

one by approximately 2.7 times. If we unite the data of the present work with those of work [3] , it appears that the five-year average of the amplitude of the seasonal wave in the neutron component exceeds by 2.1 times the theoretically, calculated value.

Therefore, it can be concluded that there exists a steady, seasonal wave, in the years of high as well as moderate solar activity in the neutron component. The fact that the seasonal wave has a meteorological origin is most probable; that is, it represents a variation conditioned by the seasonal temperature change in the atmosphere.

In conclusion, we express our gratitude to L. I. Dorman for his discussion of the question.

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*** THE END ***

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