AZIMUTHAL AND MERIDIONAL ASYMMETRIES OF THE SOLAR WIND AND QUASIPERIODIC VARIATIONS OF INTENSITY OF GALACTIC COSMIC RAYS (GCR)

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ABSTRACT

The results of analysis of 27-day, annual and quasi-two-year variation of GCR are presented. The dependence of the periods of 27-day GCR variation on the energy of ini - tial radiation is discovered, according to the data during I980 of the World network of station in sufficiently wide range of the observed threshold energy. The dependence of the annual variation of GCR is established, according to the data of the Huancayo station in conformity with the change of the polarity of the General Magnetic Field of the Sun (GMFS).

I. 27-day variation of GCR intensity

In paper /1/, the supposition, that the duration τ of 27-day oscillation of GCR ought not depend on the stage of development of the 11-year cycleness was expressed and in average τ =9÷I0 Sun's rotation time was addmited. However, observations on the wider intervals of time show that these confirmations are true not for all cycles of Solar activity, in particular, it appeared, that for the period of I962-I964 $\tau \approx 22$ Sun's rotation time. At present we have the data for 20-2I cycles of Solar activity, which show that τ is changing in a quite wide range of time.

We have made complex analysis of Solar activity data; gemagnetic activity(Solar Geophysical data) of neutron component of GCR Kiel(FRG), Tokyo(Japan), Sanae(antarctica) South Africa, the vertical direction of GCR rigid component of supertelescopes on ground station at Nagoya and the underground station at Sakashita (80 m.w.e. underground) Not so often we meet the case, when the duration of 27-day variations of GCR intensity is very long. Particular interest has been attached to the epoch I980 when τ was quite big and at the same time it was possible to correlate the GCR data with the change of Solar wind characteristics, made directly in cosmic space. The results of calculation by the method of superposition analysis for several stations of CR are presented in Fig.I. The stations are chosen so that the difference in the cut-off of initial radiation could be noticable. The attention must be paid to the extremly interesting observed phenomena- the dependence of the period of the reccurent change of GCR intensity on the cut-off energy. The period, determined in first rotations of the Sun according to the data with less cutoff of CR is essentialy longer than according to the data with the big cutoff. It is difficult to ascribe the above mentioned dependence to the not considered temperature effects in the rigid component data at Nagoya and Sakashita stations, as the analogic phenomenon is observed in the neutron data at Tokyo station, where the temperature effect is obsviously small, at the cutoff energy is essentialy more than at Kiel station.

In a number of papers the change of periods of 27-day GCR variation was investigated. In paper/4/ it is established that the average period of 27-day GCR variation depends on the polarity of GMFS. In the present paper the dependence of period of 27-day GCR variation on the cycle phase of Solar activity (SA) is investigated. The investigation was made by the method of Fourier transform /5/ using the Han windows, on the basis of hour data of neutron monitor at Kiel station.

The period of 27-day variation- T_{27} of GCR intensity is defined by 2-year data with the subsequent drifts of number of datum for a year. The value of the period T_{27} was determined by Fourier spectrum function $F(\tau)$ so that T_{27} -corresponded to the maximum of function $F(\tau)$ in the interval of period $\tau = 25 \div 32$ days.

In Fig. 2 the change of the period T_{27} in time is presented. It is possible, to notice that the period T_{27} 27-day GCR variation in the maximum epoch of SA reaches the synodic period of the Sun's rotation, but in minimum of SA T_{27} is maximum.

2. Annual variation

In paper /6/ the annual variation of GCR intensity was investigated, according to the data of CR neutron component in connection with the polarity of GMFS. We've made the analogical analysis, using the data of ionic chamber (IC) at stations, Iakytsk and Huancayo for the other epochs. The aVeraging of vectors of the annual variation was made in conformity with the direction of GMFS (I946-I955 and I960-I968). The results of harmonic analysis of the average monthly data of these stations, show that the IC data at Iakytsk contains the influence of the seasonal temperature change. It is due to expect that so far as the Huancayo station is equatorial, the seasonal change is not essential. Indeed the results of harmonic analysis according to the data of Huancayo station, show that supposed in /6/ the effect observed in the neutron component of high latitudinal station, connected with the change of GMFS polarity is as well clearly expressed in the data of IC equatorial station at Huancayo /Fig.3/.

3. GCR quasi-two-year variations

In paper /7/ it was noticed, that the observed quasi-two-year variations of neutron and μ -meson components of CR are caused not only by the cycle changes of parameters of solar modulation of CR, but at the expense of two-year variations of meteorological parameters of the Earth atmosphere.

For the present moment we've widened our analysis. For the more assurance we used the Forbush data too /2/.

Then we obtained that the quasi-two-year variations of intensity of rigid μ -meson component of CR, corrected on the temperature and barometric effects of IC-I(Iakytsk) for the period I954-I976 are synchronous with the quasi-two-year variations of SA. Quasi-two-year variations corrected on the meteorological effects, are apparently caused /7/ rather by the quasi-two-year variations of the meridional asymmetry of Solar wind velocity /8/.

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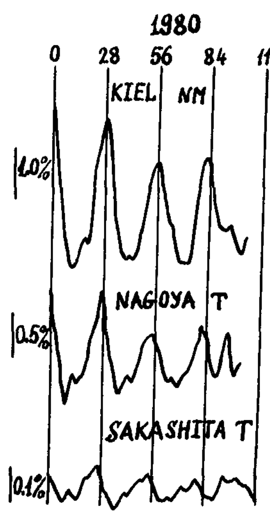

Fig. 1

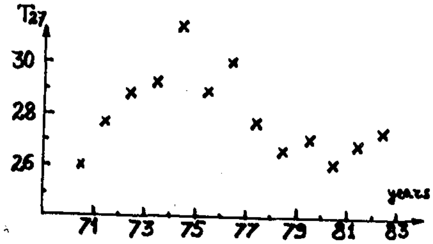

Fig. 2

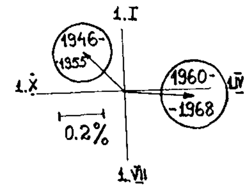

Fig.3