The disappearance of cosmic ray anisotropy and quiet solar wind

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***Abstract*. Conditions for the disappearance of cosmic ray anisotropy have been studied. It is shown that it occurs at low solar activity and is associated with a decrease of influence of the "gofer" in the interplanetary magnetic field. The basis for this theory is an idea of electric potential.**

***Keywords*: anisotropy, solar wind**

Galactic cosmic rays undergo the modulation caused by influence of interplanetary magnetic field contained in the solar wind. As a result of this fact there are cosmic ray variations particularly their anisotropy. Usually the anisotropy presence is associated with cosmic ray anisotropy diffusion and with its convection together with the wind. At the same time the anisotropy can occur during the absence of particle dispersion as well as in absence of the diffusion. Such conditions are created at a low level of solar activity. In [1] it is shown that the magnetic drift of particles leads to a single relation of their energy with electric potential in the heliosphere. In the case of potential electric field all particle trajectories which lead them to the space given point are equitable and from [2] it follows that the anisotropy must be absent. And in regular fields the potentiality near the neutral surface of interplanetary magnetic field is disturbed if it is deformed, i.e. "gofer" is available. The particle drift along this space occurs without systematic change of their energy and hence the single relation of the particle energy with electric potential is violated. One can speak about the potential acceleration within gofer and about the cosmic ray anisotropy, respectively.

Thus, one can except the anisotropy disappearances first, while the magnetic turbulence being absent and particles come from the outer heliosphere boundary to the Earth. Secondly, the Earth heliolatitude must be such as to exclude its hit into the goffer zone. If to take into account that the presence of systematic drift of the neutral surface to the south [1,3], the anisotropy disappearance preferably must occur when the Earth is in the heliosphere northern part. Minimum turbulence is expected during a positive polarity of the Sun's common magnetic field when the particles drift from high latitudes to the equator plane.

In in Fig. 1 the cosmic ray anisotropy vectors on data of the ground and underground muon measurements in Yakutsk are presented. Arrows show a magnitude and a direction of cosmic ray current when the Earth is towards the north from solar equator (thin arrows)and to the south from it (thick). Three periods corresponding to solar activity minima during a positive (1975-1977, 1995-1997) and negative polarity (1985-1987) are chosen. It is shown that the anisotropy minimum magnitude is observed at the positive epoch and when the Earth is located northerly of the helioequator. One needs to pay special attention to the long anisotropy absence in 1954 (Fig.2 in [2]). This fact testifies on solar activity exclusively deep minimum at that time.

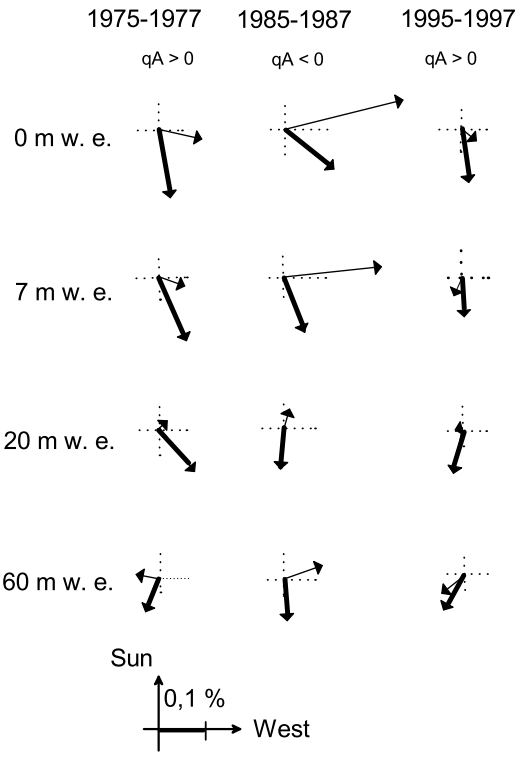

Fig. 1. Cosmic ray currents on data of telescopes on Earth surface (0 m w.e) and on depths 7, 20, 60 m w.e. during solar activity minimum. Thick arrows correspond to the moment when the Earth's heliolatitude is -7.2^0, thin arrows, when the Earth's heliolatitude is +7.2^0. 0.1% equals to the current value 75 km/sec.

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