



MODELING OF THE 11-YEAR VARIATIONS OF THE GALACTIC COSMIC RAY INTENSITY BASED ON THE TEMPORAL CHANGES OF THE RIGIDITY SPECTRUM

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Extended Abstract: We propose a new approach to the modeling of the long period (11-year) variations of the Galactic Cosmic Ray (GCR) intensity based on the transport equation. We include in the transport equation the changes of the rigidity spectrum exponent γ ($\delta D(R)/D(R) \propto R^{-\gamma}$) of the GCR isotropic intensity variations as a time dependent parameter. Also, in the transport equation are included all very known universal processes- convection, diffusion, drifts due to the gradient and curvature of the regular Interplanetary Magnetic Field and on heliospheric neutral sheet, and changes of the GCR particles' energy in the diverged solar wind. We assume that the change of the character of diffusion (diffusion coefficient) of the GCR particles versus solar activity remains as one of the essential reasons of the 11-year variation of the GCR intensity and determines a shape of the temporal changes of the rigidity spectrum of the GCR isotropic intensity variations. This assumption is related with the dependence of the diffusion coefficient on the GCR particle's rigidity, being a significant among equally important dependencies of the diffusion coefficient on the other parameters of the solar activity and solar wind. We use the Parker's transport equation for the non-stationary case

$$\nabla_i (K_{ij} \nabla_j N) - \nabla_i (U_i N) + \frac{1}{3} \frac{\partial}{\partial R} (N R) \nabla_i U_i = \frac{\partial N}{\partial t}$$

where, N and R are a density and rigidity of GCR particles, respectively. The solar wind velocity is constant $U = 400 \text{ km/s}$. The components of the generalized anisotropic diffusion tensor K_{ij} of GCR for the three dimensional IMF in the spherical coordinate system (ρ, θ, φ) . The parallel diffusion coefficient is determined as follows, $K_{\parallel} = K_0 \cdot K(r) \cdot K(R) \cdot K(\gamma)$, where, $K_0 = 2 \cdot 10^{22} \text{ cm}^2 \text{ s}^{-1}$ for the energy of 10 GeV; $K(r) = 1 + 50 \cdot r$; r is dimensionless distance from the Sun $K(R) = \left(\frac{R}{1 \text{ GV}} \right)^\alpha$ the parameter α ($0 \leq \alpha \leq 2$) shows a dependence on the GCR particle's rigidity R $K(\gamma) = \text{Exp}(-\beta\gamma(t))$ -determines a time dependent character of the rigidity spectrum exponent γ . The coefficient β plays a role of normalization. The solution of the equation shows that ~75-80% of the amplitudes of the 11-year variations is stipulated by the changes of the structure of the IMF turbulence versus solar activity, which leads the soft rigidity spectrum of the GCR intensity variations in the maxima epoch, and the hard spectrum in the minima epoch of solar activity..