Study of the cosmic rays transport problems using second order partial differential equation.

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Abstract

It is exactly 100 years since V.F. Hess's historical discovery: an extra-terrestrial origin of cosmic rays (Hess, 1912). Galactic cosmic rays (GCR), being charged particles, penetrate the heliosphere and are modulated by the solar magnetic field. The propagation of cosmic rays is described by Parker's transport equation (Parker, 1965), which is a second order parabolic type partial differential equation. It is time dependent 4- variables (with ρ, θ, φ, R, meaning: distance from the Sun, heliolatitudes, heliolongitudes and particles' rigidity, respectively) equation which is a well known tool for studying problems connected with solar modulation of cosmic rays. Transport equation contains all fundamental processes taking place in the heliosphere: convection, diffusion, energy changes of the GCR particles owing to the interaction with solar wind's inhomogeneities, drift due to the gradient and curvature of the regular interplanetary magnetic field and on the heliospheric current sheet.
In our paper we investigate a topic of the 27-day variation of the galactic cosmic rays intensity, which is connected with solar rotation. We numerically solve the Parker's transport equation involving in situ measurements of solar wind and magnetic field.

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