Two-Dimensional Modeling of Galactic Cosmic Rays Propagation in the Heliosphere

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Abstract

Two dimensional transport equation with drift in the stationary case has been numerically solved for the Parker's (Parker,1965), Jokipii and Kota's (Jokipii and Kota,1989) and Fisk's (Fisk,1996) types of the interplanetary magnetic field models. The ratio of the perpendicular $K_\perp$ and the parallel $K_{||}$ with respect to the interplanetary magnetic field lines diffusion coefficients for 10 GeV energy galactic cosmic ray particles is taken equal to $K_\perp/K_|$ = 0.1 at the Earth's orbit. The solar wind velocity is equal to $4x10^7$ cm/s at the helioequatorial regions and increases versus the heliolatitudes according to the measurements on the Ulysses board (Wenzel,1995). There is considered the minimum epoch of solar activity and therefore the plane neutral current sheet is assumed. The differences in the behaviors of the radial and the heliolatitudinal gradients obtained based on the solutions of the transport equation have been found for the different interplanetary magnetic field models. Namely, there is the distinction between the expected radial and heliolatitudinal gradients of galactic cosmic for the Parker's and Fisk's types of the interplanetary magnetic field models in the inner heliosphere, while in the outer heliospere there are differences between the expected radial and heliolatitudinal gradients of galactic cosmic rays for the Parker's and Jokipii and Kota's magnetic field models. The expected spatial distributions of the density, radial and heliolatitudinal gradients of galactic cosmic rays have been found and the comparison with the experimental data has been done.

References

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