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Collisionless transport equations in the solar wind with Kappa distribution

E. Slominska (1), G. Voitcu (2), M. Echim (2,3), H. Lamy (3), V. Pierrard (3) and J. Lemaire (3)

(1) Space Research Centre Polish Academy of Sciences, Warsaw, Poland, (2) Institute for Space Sciences, Magurele, Romania, (3) Belgian Institute for Space Aeronomy, Bruxelles, Belgium (ewa@cbk.waw.pl)

A study of collisionless transport equations in the solar wind is presented. The results included in this paper are obtained with the exospheric model of the solar wind developed by Lamy et al. (2003). The model considers a nonmonotonic total potential energy for the protons. The velocity distribution function (VDF) of electrons at the exobase is given by a Kappa distribution and the velocity distribution function of protons is given by a Maxwellian distribution. The analysis was carried out for an exobase position located at 1.5 solar radii and for several values of the kappa index. The moments of the VDF for both protons and electrons are introduced into the mass continuity, momentum and energy conservation equations. It is shown that the moments derived for a Kappa VDF fulfill the transport equations and give an accurate macroscopic description of plasma. We also compute the radial distance where the outward electric force becomes larger than the inward gravitational force. Close to the acceleration region the pressure gradient is equal to the polarization electric field. Additionally, we show that faster solar wind is produced when the value of kappa index for electrons decrease and the relative importance of various terms of the transport equations for each species.