Cosmic ray modulation in an asymmetrical heliosphere

U. W. Langner (1,2), T. Borrmann (1), H. Fichtner (1) and M. S. Potgieter (2)

(1) Institut für Theoretische Physik IV, Ruhr-Universität Bochum, 44780 Bochum, Germany,
(2) Unit for Space Physics, School of Physics, Potchefstroom University for CHE, 2520
Potchefstroom, South Africa

(ul@tp4.rub.de / Fax: +49 (0) 234 32 14177 / Phone: +49 (0) 234 32 23779)

The development of realistic and self-consistent global models for the modulation of
cosmic rays in the heliosphere has been stimulated the past few years by excellent
observations, in particular with the approach of the solar wind termination shock by
the *Voyager 1* spacecraft. In this light our previous two-dimensional solar wind termi-
nation shock model which was used to simultaneously demonstrate the heliospheric
modulation for various galactic and anomalous species was extended to include an
arbitrarily shaped heliospheric outer modulation boundary. In this work the model is
used with an asymmetrically bounded heliosphere. Energetic particles are described
kinetically using the Parker transport equation. The model includes the solar wind
termination shock, drifts, adiabatic energy changes, diffusion, convection, and a he-
liosheath. This model was used to describe differences between the modulation so-
lutions of a symmetrical and an asymmetrical heliosphere. The solutions are shown
for solar minimum and moderate maximum conditions for both heliospheric magnetic
field polarity cycles. These simulations can be of use for future missions to the outer
heliosphere and beyond.