THE COSMIC RAY RADIAL AND LATITUDINAL GRADIENTS IN THE HELIOSPHERE NEAR SOLAR MINIMA

Ming Zhang (1) and F. B. McDonald (2)
(1) Enrico Fermi Institute, University of Chicago, Chicago, IL, USA, (2) Institute for Physical Science and Technology, University of Maryland, College Park, MD, USA.

Based on existing measurements of galactic and anomalous cosmic ray gradients obtained by the heliopsheric network spacecraft (Pioneer 10/11, Voyager 1/2, Ulysses and IMP-8) in the last three solar minima, we found that there is a roughly linear relationship between the magnitude of the radial gradient and the magnitude of the latitudinal gradient. Cosmic rays of a particular species/energy that exhibit a large latitudinal gradient tend to have a large radial gradient too and vice versus. This linear relationship is not affected by the sign of solar magnetic polarity. A similar linear relationship between the amplitude of 27-day recurrent variations and the magnitude of the latitudinal gradient was discovered earlier. These relationships mean that the distributions of cosmic rays in the heliosphere (up to 70 AU) have a scaling similarity among different species/energies. These observations suggest that there is common, dominant mechanism controlling cosmic ray distribution independent of the flow pattern of cosmic rays in the 3-dimensional heliosphere.