

Modulation and acceleration of cosmic rays in the inner heliosheath

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Recent Voyager 1 observations at the termination shock crossing show that both that the fluxes of both galactic and anomalous cosmic rays are below their levels in mid 2002 when the spacecraft was still in the upstream region. This indicates that cosmic rays at the termination shock are still modulated by the solar wind. As Voyager 1 penetrates deep into the heliosheath due to the inward motion of the termination shock, both the galactic and anomalous cosmic rays increase but their spectra still show sign of modulation. This indicates that the sources of the both species are probably located outside of the spacecraft. The increase may be the result of the disappearance of GMIR or highly tilted heliospheric current sheet of the previous solar maximum, but it can also come from the spatial distribution of the cosmic ray flux. While the modulation of galactic cosmic rays in the heliosheath is expected, the behavior of anomalous cosmic rays is totally a surprise. In this paper, we provide a calculation of cosmic rays in a model with a propagating GMIRs and a possible strong second-order Fermi acceleration in the heliosheath. Signatures of these effects will be compared with Voyager 1 and 2 observations.