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Heliospheric boundary: Kinetic structure, cosmic ray property

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Heliosphere is a bubble occupied by the solar wind plasma and magnetic field in the local interstellar space. Matter and energy are actively transported and/or converted in the boundary region between the heliosphere and the local interstellar space. This region has been explored in-situ by Voyager spacecraft in this century[1-18]. Voyager spacecraft revealed a lot of features, some of which have been still unresolved, such as complex structures of two important discontinuities, unexpected properties of high energy particles, etc. In this study we first focus on the kinetic structures of the termination shock and the heliopause. Using particle-in-cell simulation, kinetic structure of the transition region of these discontinuities are investigated. In the termination shock the roles of pickup ions are examined carefully[19-22]. Kinetic structure of the heliopause influenced by the termination shock is also studied[3]. In the second part of this study the effect of global structure of the heliosphere in the cosmic ray invasion process is considered. It has been unknown how galactic cosmic rays enter and reach deep inside the heliosphere. To understand the cosmic ray invasion process in the level of particle trajectory, we perform a test particle simulation in the global electromagnetic structure of the heliosphere reproduced by using high resolution 3D MHD simulation. A number of characteristic trajectories of different energy cosmic ray particles are reported.

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