Relationship between the inner heliosheath thickness and the pickup ion density

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The interaction of the supersonic solar wind with the interstellar medium results in the formation of the shock wave (termination shock; TS) inside the heliosphere, as well as the discontinuous interface between them (heliopause; HP). The location of the TS and HP characterizes the size and shape of the heliosphere, which suggests a feature of the pressure equilibrium with interstellar space. Therefore, it is important to quantitatively associate the thickness of the inner heliosheath (IHS), the region between the TS and HP, with the energy composition there. Recently, both Voyager 1 and 2 (V1, V2) crossed the TS at the heliocentric radial distance of 94 (V1) and 84 (V2) au, and the HP at 122 (V1) and 119 (V2) au, estimating the IHS thickness along the V1 and V2 trajectories 28 (V1) and 35 (V2) au, respectively. This difference is mainly caused by that of solar wind conditions, because each crossing was in a different phase of the solar activity. However, it is insufficient to evaluate the pressure in the IHS by solar wind parameters only. The striking feature of the IHS plasmas is the dominant contribution of pickup ions (PUIs) to the energy density. It is well known that the presence of PUIs greatly modifies the TS property and the consequent energy composition in the downstream. In this talk, we aim to study the dependence of the PUI density on the size of the IHS by simultaneously generating the TS and HP via large-scale hybrid simulations. A simple analytical assessment is also presented. We expect that the results will be useful to deduce the PUI density itself from the observed IHS thickness.

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