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Kinetic radial structure of heliospheric boundary

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The kinetic structure of the heliospheric boundary region is investigated using one-dimensional full PIC (Particle-In-Cell) simulations. A shock tube problem is numerically solved under the condition that a relatively tenuous and weakly magnetized plasma, mimicking the solar wind (SW) plasma, is continuously pushed by a relatively dense and strongly magnetized plasma, mimicking the interstellar (IS) plasma, having supersonic relative velocity. A forward and a reverse shock, corresponding to the SW termination shock and the IS bow shock, and a contact discontinuity, to the heliopause, are self-consistently reproduced. The spatial width of the heliopause increases as the angle between the discontinuity normal and ambient magnetic field decreases. The inner structure of the heliopause shows different profiles between magnetic field and plasma density, or pressure, which is caused by a non-MHD effect of the local plasma. The region between the two shocks is turbulent. The turbulence in the relatively dense plasma, corresponding to the outer heliosheath, is compressible and propagating away from the heliopause, although the turbulence in the relatively tenuous plasma, corresponding to the inner heliosheath, contains both compressible and incompressible fluctuations. The source of the compressible turbulence in the outer heliosheath is in the inner heliosheath. Only compressible fast mode fluctuations generated in the inner heliosheath are transmitted through the heliopause and propagate in the outer heliosheath. The results are discussed in the context of recent observations by Voyager spacecraft.

Note: Abstract should be in 1 page.