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Hybrid Simulations of the Termination Shock: Ion Velocity Distributions in the Heliosheath S. PETER GARY, KAIJUN LIU, DAN WINSKE, HERBERT O. FUNSTEN, Los Alamos National Laboratory, PIN WU, University of Delaware, NATHAN A. SCHWADRON, Boston University — TheLos Alamos hybrid simulation code has been used to examine kinetic properties of pickup ions at the heliospheric termination shock and in the downstream heliosheath. The simulations represent the electrons as a zero-mass fluid, and address only perpendicular shocks. Three topics are studied. First, one-dimensional shock simulations show that, contrary to a widely held opinion, specular reflection does not play a role in the energy gain of pickup ions at the termination shock. Rather, pickup ions which gain the most energy at the shock are those with gyrophase which enables them to return upstream and interact with the motional electric field. Second, simulations are carried out for three different upstream Mach numbers; the results show that faster solar wind flows lead to an increased flux of ions in the tails of the suprathermal component, consistent with energetic neutral atom observations by the IBEX spacecraft. Third, two-dimensional simulations of the shock show that anisotropies in the proton velocity distribution caused by the termination shock give rise to both Alfvén-cyclotron and proton mirror instabilities in the heliosheath. In these simulations, the cyclotron instability dominates and, via pitch-angle scattering, reduces the proton anisotropies in the heliosheath.

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