

Hybrid Simulations of Interstellar Pick-Up Ion Acceleration at the Solar Wind Termination Shock*

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Anomalous cosmic rays may result from the acceleration of pick-up ions at the solar wind termination shock. Here we present results of one-dimensional hybrid simulations of pick-up ion acceleration at the solar wind termination shock, where both solar wind and pick-up ions are treated self-consistently. In these simulations of oblique shocks, reflected pick-up ions excite large amplitude upstream magnetosonic waves [1]. The spectrum of excited waves is narrow at early times, but broadens as the pick-up ions are scattered by the waves. We find that the termination shock efficiently accelerates the interstellar pick-up hydrogen. A study of accelerated pick-up ion orbits shows that the energy gain comes predominantly from shock drift acceleration in the shock front, with the waves aiding the acceleration by allowing multiple encounters with the shock. The **observed energetic particle fluxes are in qualitative agreement with the prediction of diffusive shock acceleration theory.** The computations are performed on the Intel Delta Touchstone parallel supercomputer.

¹P. C. Liewer, B. E. Goldstein, and N. Omid, "Hybrid simulations of the effects of pick-up ions on the solar wind termination shock," JGR 98, 15,211 (1993)

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