CROSS HELICITY OF SELF-GENERATED ALFVÉN WAVES DOWNSTREAM A PARALLEL SHOCK

R. Vainio
Space Research Laboratory, Department of Physics, University of Turku, Finland.
ravainio@utu.fi

Energetic proton acceleration and transport through self-generated Alfvén waves in vicinity of a parallel shock wave is considered, employing numerical Monte Carlo simulations. It is shown that the large scattering-center compression ratio predicted by the Alfvén-wave transmission through such a shock leads to a strong increase of the particle pressure, and to unphysically large values of the wave pressure downstream. If the wave energy density is constrained to reasonable values (by some unspecified damping mechanism) the energetic particles modify the cross helicity of the downstream waves to turn away from the shock at certain distance downstream the shock front. This leads to a finite size of the scattering region with large compression ratio, and to a cut off in the hard energetic proton spectrum. The simulations are shown to be a useful tool in understanding the physical mechanisms of avoiding singularities predicted by test-particle calculations.