The role of adiabatic focusing in coronal shock acceleration

Abstract

Solar energetic particles (SEPs) are considered a serious radiation threat to space technologies and humans in orbit. The sources of SEPS are solar eruptions, i.e., solar flares and coronal mass ejections (CMEs). We have used Monte Carlo simulations to study solar particle acceleration in coronal shocks. In particular, we have studied the effect of magnetic focusing, caused by the inhomogeneity of the magnetic field, on the efficiency of coronal shock waves as particle accelerators. We employ a simple model of the coronal magnetic field and a model of the foreshock turbulence that is motivated by the assumption that instabilities driven by the accelerated particles themselves are the cause of the upstream waves that scatter the particles and enable their rapid acceleration to high energies. Magnetic focusing due to magnetic field gradient is an important physical process in the transport of SEPs, but the theoretical framework of diffusive shock acceleration (DSA) in one dimension has been developed without including focusing. We present our study of the effects of focusing in one-dimensional particle transport.

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