

# Generation of MHD waves driven by high energy cosmic rays in the vicinity of shock waves

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The diffusive shock acceleration (DSA) is known as an acceleration mechanism of high energy cosmic rays produced, for instance, at supernova shocks. In the DSA model, charged particles are repeatedly scattered by upstream and downstream MHD waves. This process leads to a statistical acceleration of particles and is widely accepted as a model which can explain the power law spectrum of cosmic ray energy.

In the past, particle energy spectra were discussed via a quasi-linear theory by assuming that background MHD waves are unchanged (Blandford and Ostriker, 1978). However, when energy of accelerated particles becomes large enough, the MHD waves could be amplified by those high energy particles. In this study, an interaction between cosmic rays and MHD waves upstream of a shock is investigated by means of a one dimensional full particle simulation code.