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Simulations of Diffusive Shock Acceleration with AMR Scheme and SDE Method

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It is believed that coronal mass ejection driven shock waves can produce energetic particles by diffusive shock acceleration. We model this mechanism by the following 2 steps: a study of the shock propagation and a study of acceleration at the shock. The shock wave is realized by a hydrodynamic simulation with an Adaptive Mesh Refinement(AMR) scheme. The acceleration of particles is simulated by Stochastic Differential Equation (SDE) method. We showed, in COSPAR-2008, that the treatment was technically established. However, the region used in the hydrodynamic simulation was only upto the Earth orbit. Therefore, the component of energetic particles reflected at the shock propagating out of the Earth orbit was not taken into account and the flux of energetic particles was less than expected.

In this report, we show the spectra of particles obtained by using the results for the simulation in which the simulation box covers the orbit of 2.3AU and discuss contribution of the shock wave which has passed.

Keywords: shock acceleration, high energy particle, Adapted Mesh Refinement, Stochastic Differential Equation