Revisiting of the non-linear amplification of a magnetic field driven by cosmic ray streaming

Mitsuo Oka[1]; Toshio Terasawa[2]

[1] Earth and Planetary Sci., Tokyo Univ; [2] Dept. Earth Planetary Sci., Univ. of Tokyo

http://stp-www.eps.s.u-tokyo.ac.jp/~oka/

In order to explain the energy spectrum of the galactic cosmic rays of up to 10^{15} eV, diffusive shock acceleration theory has been applied at SNR shocks for last several decades, but there still remains an order difference in the highest energy of the accelerated particles compared to the observation. Recently, Lucek and Bell,2000 presented an idea that account for the discrepancy. They argued that the magnetic field in the upstream of the shock can be amplified by the accelerated particles themselves, which in turn leads to the increase of the highest energy of particles. Their argument is based on the nonlinear development (dB/B0 gt 1) of the ion beam cyclotron instability induced by the shock accelerated cosmic ray protons. However, their model has assumptions and simplifications that cannot to be overlooked. In this presentation, we will inspect some of the problems and reconsider the physics of magnetic field amplification.

Although classified in astrophysics, we think the topic is worth being presented in this session because the wave excitation mechanism has been well tested in the shock acceleration site in the heliosphere, and the topic may be a good example of interdisciplinary study.