

The effect of magnetic field on cosmic ray modified shocks

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Galactic cosmic rays are believed to be accelerated by the supernova remnant shocks. When the acceleration process enters the nonlinear regime, the cosmic rays exert back reactions to the shocks (Drury & Falle 1981). Recent some observations of supernova remnants imply this back reactions actually occur (Helder et al. 2009; Hughes et al. 2000; Vink et al. 2006). These shocks whose structures change because of the existence of cosmic rays are called cosmic ray modified shocks.

On the other hand, there is the maximum energy problem as one of important subject in acceleration mechanism of galactic cosmic rays. To this issue, the solutions by magnetic amplification is proposed by many researches. Among them, Malkov & Diamond (2010) suggest that the instability due to back reactions of cosmic rays, particularly a gradient of cosmic ray pressure (Drury & Falle 1986), plays a dominant role in this matter.

In our research, we investigate the amplification effect of this instability and interaction of it with shocks. Drury & Downes (2012) conducted MHD simulation and showed magnetic amplification. But they treated only with the precursor region which is located in front of shocks without shocks. In our research, we conduct simulations including shocks in self-consistent form. We can discuss the whole system of back reactions of cosmic rays, shock structures and the structure of magnetic field. We also evaluate the relations between magnetic amplification and parameters of shocks.

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