

Escape-limited maximum energy at perpendicular shocks in the interstellar magnetic field

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The origin of cosmic rays is still a long-standing problem in astrophysics. Supernova remnants are plausible candidates of cosmic rays up to $10^{15.5}$ eV. For cosmic ray nuclei, the maximum energy is limited by the escape from accelerators. In previous studies about the cosmic-ray escape, the diffusion approximation is assumed. However, the diffusion approximation cannot apply to investigate the escape process from a perpendicular shock region because the gyration can be important for a perpendicular shock acceleration. It is suggested that the diffusive shock acceleration at a perpendicular shock is a potential acceleration mechanism to accelerate particles up to PeV scale without the magnetic field amplification in the upstream region. However, the escape process and the escape-limited maximum energy at perpendicular shocks are still unknown. In this study, we investigate the escape process from a perpendicular shock region of supernova remnants in the interstellar magnetic field by using a test particle simulation. In this talk, we will report results about the escape process and the escape-limited maximum energy at a perpendicular shock region of supernova remnants in the interstellar magnetic field.

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