

Cosmic-ray Escape from Supernova Remnants in the Circumstellar Medium

Cosmic rays (CRs) below 3 PeV are believed to be accelerated by the diffusive shock acceleration (DSA) in supernova remnants (SNRs). The DSA in the perpendicular shock of SNRs has been expected to accelerate CRs up to PeV without an upstream magnetic field amplification. Our recent work investigated the escape process from the perpendicular shock region of type Ia SNRs in the interstellar medium and showed that typical type Ia SNRs accelerate CRs to about 10 TeV without an upstream magnetic field amplification. In this study, we perform test particle simulations to investigate the escape process from core-collapse SNRs in the circumstellar medium and the escape-limited maximum energy. We showed that CRs are accelerated by the perpendicular shock region of core-collapse SNRs up to about 10-100 TeV without an upstream magnetic field amplification. In this talk, we will report the escape process from SNRs in the circumstellar medium and the escape-limited maximum energy.

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