

PEM028-05

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Cosmic-ray acceleration and magnetic field amplification at supernova shocks

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Supernova explosions drive collisionless shocks in the interstellar (or circumstellar) medium. Such shocks are mediated by plasma waves, resulting in the shock transition on a scale much smaller than the collisional mean free path. Galactic cosmic rays are widely considered to be accelerated at collisionless shocks in supernova remnants via diffusive shock acceleration (DSA), which is also known as first-order Fermi acceleration. Although the basic concept of DSA is well established, the full problem is extremely complex, including the problem of nonlinear interactions between energetic particles and magnetohydrodynamic waves, which hampers further understanding of shock acceleration on theoretical grounds. On the other hand, recent development in X-ray and gamma-ray instruments have brought new insight into the physics of particle acceleration at supernova shocks. I will review recent observational results on particle acceleration in supernova remnants. Particular emphasis will be placed on (1) evidence of magnetic field amplification at shocks, and (2) evidence for the hadronic origin of gamma rays. Also, I will discuss the origin of Galactic cosmic rays in light of recent observational results in the X-ray and gamma-ray bands.

Keywords: cosmic rays, supernova remnants, shock waves, gamma rays, X-rays