

Acceleration of Cosmic Rays

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The Fermi processes is tightly linked with the magnetic transport processes and their efficiency directly depends on the efficiency of particle momentum scattering. The characteristic acceleration times are of the form $\tau_{\text{acc}} \sim \tau_s / \beta_c^2$, where τ_s is the characteristic time of particle momentum scattering by magnetic field irregularities and β_c is the velocity of an accelerating front.

1 Fermi Acceleration of Cosmic Rays

1.1 The Basic Fermi Process

1.1.1 Nonrelativistic Regime: First and Second Order Processes

1.1.2 A Simple Model of Second Order Fermi Acceleration

1.1.3 Fermi Process in Alfvén Turbulence

1.1.4 Fermi Process at a Shear Layer

1.1.5 First Order Fermi Process at a Nonrelativistic Shock

1.2 Fermi Process at a Nonrelativistic Shock

1.2.1 Spectrum

1.3 Astrophysical Application: Cosmic Rays and Supernovae

1.4 Astrophysical Application: Synchrotron Sources

1.5 Generation of Magnetic Turbulence

1.6 Why Are Fermi Processes Favored at Shocks?

1.7 What about the Relativistic Regime of Fermi Acceleration?