PARTICLE ACCELERATION AT PERPENDICULAR SHOCKS: THE ROLE OF FIELD LINE TOPOLOGY

JÓZSEF KÓTA

The University of Arizona, LPL, Tucson, Arizona 85721-0092, USA,
Email: kota@lpl.arizona.edu

Much of our perception and expectation for shock acceleration is based on 1-dimensional shocks. In a real case, however, there can be significant variations along the shock face, both on large and small scales. For instance, magnetic field lines can and frequently do intersect the shock more than once. This is a feature that cannot be described in 1-D, and leads to quite significant effects in 2-D or 3-D. Voyager observation provided a clear large-scale example demonstrating the need for 2-D modeling. Similar 2-D effects may be quite important on other, smaller scales, too.
We present analytical approximations and numerical simulations to demonstrate that the efficiency of acceleration may change quite dramatically along the shock. Cold regions are expected at places where the field lines cross into the downstream region but soon re-cross the shock back to the upstream region. The opposite configuration, on the other hand, leads to rapid and effective acceleration producing hot spots along the shock. We discuss, in some detail, what happens on smaller scale when a shock hits a curved field line. We show that rapid acceleration is possible through multiple mirroring at the stronger downstream field.

Energetic particles, shock, acceleration

Jozsef Kota, University of Arizona, LPL, Tucson AZ 85721-0092, USA
Phone: 1-520 621 4396, fax: 1-520-626 0850, e-mail: kota@lpl.arizona.edu