Abstract for an Invited Paper
for the APR06 Meeting of
The American Physical Society

The Importance of magnetic-field angle in diffusive shock acceleration of cosmic rays

JOE GIACALONE, University of Arizona

We discuss the physics of charged-particle acceleration by shock waves, focussing on the importance of the shock-normal angle. This has important applications for our understanding of supernovae shocks, the solar-wind termination shock, and propagating shocks near the Sun. For the case in which the shock normal is parallel to the incident field - a parallel shock - acceleration of particles to very high energies (e.g. the knee in the cosmic-ray spectrum, or >GeV energy solar cosmic rays) requires very special conditions to explain the observations. These include a strong increase in the magnetic field, perhaps due to excitation from the streaming cosmic rays. In this talk, we show that no such special circumstances are required when one considers acceleration at nearly perpendicular shocks. We suggest that the observations of high-energy charged particles can be accounted for using reasonable values for the diffusion coefficients and observed shock speeds. A critical issue in the theory of diffusive shock acceleration at nearly perpendicular shocks is the well-known injection problem. We suggest that, in actuality, there is no such injection problem and, in fact, the acceleration efficiency does not depend strongly on the shock-normal angle. This can be understood in terms of the increased cross-field transport arising from so-called field-line random walk due to the large-scale (ccompared to the particle gyroradii) turbulent magnetic field.