Abstract Submitted
for the DPP06 Meeting of
The American Physical Society

Acceleration of High Energy Cosmic Rays in the Nonlinear Shock Precursor F. DERZHINSKY, P.H. DIAMOND, M.A. MALKOV, University of California, San Diego, CASS 0424, La Jolla, CA 92093-0424 USA — The problem of understanding acceleration of very energetic cosmic rays to energies above the 'knee' in the spectrum at 10^{15}-10^{16}eV remains one of the great challenges in modern physics. Recently, we have proposed a new approach to understanding high energy acceleration, based on exploiting scattering of cosmic rays by inhomogenities in the compressive nonlinear shock precursor, rather than by scattering across the main shock, as is conventionally assumed. We extend that theory by proposing a mechanism for the generation of mesoscale magnetic fields ($kr_g < 1$, where r_g is the cosmic ray gyroradius). The mechanism is the decay or modulational instability of resonantly generated Alfven waves scattering off ambient density perturbations in the precursors. Such perturbations can be produced by Drury instability. This mechanism leads to the generation of longer wavelength Alfven waves, thus enabling the confinement of higher energy particles. A simplified version of the theory, cast in the form of a Fokker-Planck equation for the Alfven population, will also be presented. This process also limits field generation on r_g scales.

Patrick Diamond
University of California, San Diego

Date submitted: 22 Jul 2006 Electronic form version 1.4