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Magnetic Field Amplification in Nonlinear Diffusive Shock Acceleration - a Monte Carlo Model[1] ANDREY E. VLADIMIROV, DONALD C. ELLISON, North Carolina State University, ANDREI M. BYKOV, Ioffe Physical-Technical Institute, St. Petersburg, Russia — Recent observations indicating very high values of magnetic fields in collisionless shocks of supernova remnants have triggered extensive research in magnetic field amplification (MFA) by diffusive shock acceleration (DSA). The problem is essentially nonlinear – that is, magnetic turbulence and accelerated particles produced in the process of DSA carry enough energy to feed back on the structure of the collisionless shock that determines the regime of DSA. Although many aspects of MFA and of dynamics of charged particles in the amplified fields are unknown, the structure of shocks can be studied from the standpoint of fundamental conservation laws. We present the outline and some results of a Monte Carlo model of nonlinearly modified shocks with efficient acceleration of particles and generation of strong stochastic magnetic fields. The model provides insight on the complex connections between components of strong collisionless shocks and makes predictions applicable in various astrophysical problems ranging from structure formation in the Universe to supernova remnant evolution and the origin of cosmic rays.

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