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Magnetic turbulence in the shock precursor and CR acceleration

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We overview recent progress on small-scale dynamo and apply the results to the problem of nonlinear shock acceleration in which particle mean free paths in front of the shock are greatly reduced due to magnetic fields in the shock precursor which are generated through small-scale dynamo in the density gradient's-induced turbulence. Previous DSA models considered magnetic fields amplified through cosmic ray streaming instabilities either by way of individual particles scattering in the magnetic fields, or by macroscopic electric currents associated with large-scale cosmic ray streaming. The small-scale dynamo mechanism provides fast growth and is very generic. For supernovae shocks this mechanism is estimated to generate upstream magnetic fields that are sufficient for accelerating cosmic rays up to around 10^{16} eV.

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