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Influence of magnetic field on beta-processes in neutrino-driven supernova explosion

In a neutrino-driven supernova explosion, beta-processes are responsible for the energy deposition to the stagnated shock wave. We investigate an influence of a magnetic field on beta-processes under conditions of a core-collapse supernova. For realistic magnetic fields reachable in astrophysical objects, we obtain simple analytical expressions for reaction rates of beta-processes as well as energy and momentum transferred from neutrino and antineutrinos to the matter. In numerical estimations, we use results of one-dimensional simulations of a supernova explosion. We found that, in the magnetic field with the strength $B \sim 10^{15}$ G, the quantities considered are modified by several percents only and, as a consequence, the magnetic-field effects can be safely ignored, considering neutrino interaction and propagation in a supernova matter. The work is supported by the Russian Science Foundation (Grant No. 18-72-10070).

Mini-abstract

The magnetic-field effects on beta-processes in supernova matter can reach several percent

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