Magnetic-field influence on beta-processes in core-collapse supernova

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Neutrinos play a significant and sometimes even dominant role in all phases of the supernova explosion. The dominant neutrino processes in a core-collapse supernova are beta-processes, which are responsible for the energy exchange between neutrinos and the matter and change a chemical composition of a matter. We investigate an influence of a magnetic field on beta-processes under conditions of a supernova matter. 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 our analysis we use results of one-dimensional simulations of a supernova explosion performed with the PROMETHEUS-VERTEX code [1,2]. 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 [3]. This work is supported by the Russian Science Foundation (grant No. 18-72-10070).

[1] Hüdepohl L 2014 *Neutrinos from the Formation, Cooling, and Black Hole Collapse of Neutron Stars* Ph.D. thesis Technische Universität München

[2] URL `https://wwwmpa.mpa-garching.mpg.de/ccsnarchive/archive.html`

[3] Dobrynina A and Ognev I 2020 *Phys. Rev. D* **101** 083003 (arXiv:1912.12889)