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Minimal analytical model of neutrino distribution function in supernova

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The possibility of an analytical approximation of nonequilibrium neutrino radiation under core-collapse supernova conditions is considered. Analysis is based on results of a one-dimensional simulation of neutrino propagation, performed self-consistently with hydrodynamics in Prometheus-Vertex code. In minimal model, an analytical approximation depends on four parameters at each point of the supernova. As the analysis shown, in the outer part of the supernova the dependence of these parameters on the radial coordinate can be expressed through the radius of the protoneutron star, luminosity, spectrum width and the average energy of the neutrinos leaving the supernova. Note that the values of last two parameters are practically same in various simulations of the supernova explosion. Thus, in the outer part the neutrino radiation is determined only by two global parameters of the explosion: the protoneutron star radius and the neutrino luminosity.

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