NEUTRINO EMISSION PROCESSES IN THE WEINBERG-SALAM THEORY

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The neutrino emission processes play essential roles in stellar evolution as expemplified by the observations of the neutrinos from SN 1987a by the KAMIOKANDE-II and IMB experiments. Recently a very extensive study of the various neutrino emission processes based on the Weinberg-Salam theory has been completed by the present author and his collaborators. The neutrino emission processes calculated by the author's group include pair, photo-, plasma, and bremsstrahlung neutrino processes. The neutrino energy loss rates due to pair, photo-, and plasma processes in the framework of the Weinberg-Salam theory are found to be substantially lower than the result obtained by Beaudet, Petrosian, and Salpeter. The reduction factor α is in the range $0.35 < \alpha < 0.88$ depending on the neutrino masses, density, and temperature. The ionic correlation effects play important roles in the bremsstrahlung neutrino process. The present author and his collaborators recently calculated the bremsstrahlung neutrino energy loss rate taking into account the ionic correlation effects in the crystalline lattice state as well as in the liquid metal state. They found that the ionic correlation effects suppress the bremsstrhlung neutrino energy loss typically by a factor 2-20. The present findings will bear great importance in neutrino astronomy.

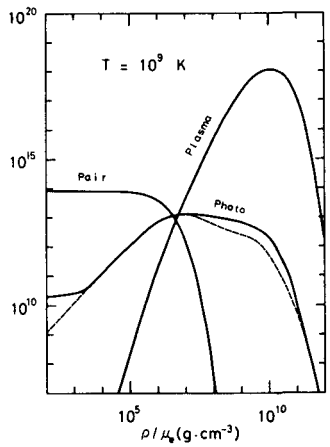

FIG. 1. - Pair, photo, and plasma neutrino energy loss rates. (ergs s^{-1} cm^{-3}) for $T=10^9$K.

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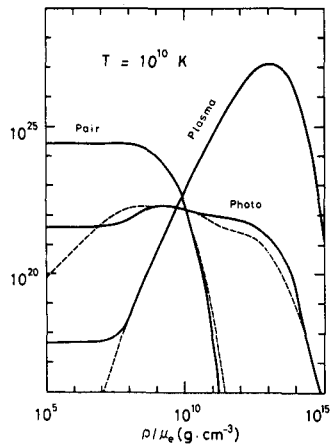

FIG. 2. - Pair, photo, and plasma neutrino energy loss rates. (ergs s^{-1} cm^{-3}) for $T=10^{10}K$.

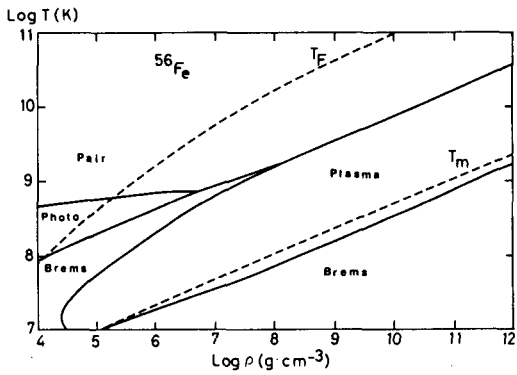

FIG. 3. - Most dominant neurtino process for a given density and temperature for the case of n=1 and ^{56}Fe matter.

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