

Spin asymmetries arising in neutrino-lepton processes in a magnetic field and their macroscopic appearance

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The cross sections of the neutrino-lepton processes $\nu_l e^- \rightarrow \nu_l e^-$, $\bar{\nu}_l e^- \rightarrow \bar{\nu}_l e^-$, $\nu_l \bar{\nu}_l \rightarrow e^- e^+$, $\nu_l \bar{\nu}_e \rightarrow l^- e^+$, $\nu_l e^- \rightarrow \nu_e l^-$ in a magnetic field and the results on the spin asymmetries arising in these processes are presented. The cross sections of the considered processes are calculated with allowance for the longitudinal and transverse polarizations of the charged leptons. The dependences of the cross sections on the spin variable of the charged leptons and on the polar and azimuthal angles of the neutrinos are analyzed. It is shown that the cross sections of considered processes are sensitive to the spin variable of the charged leptons and to the direction of neutrino momentum. The spin asymmetries arising in the considered neutrino-lepton processes lead to on the one hand asymmetric emission of the final leptons on the other hand anisotropies and asymmetries arising in the heating of the stellar matter and in the explosion of the outer layers of the collapsing stellar core. The obtained results can be used in neutrino experiments, in detection of neutrinos and they can also be applied in the study of a possible mechanism for gamma ray bursts and other astrophysical phenomena.