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Results of the Neutrino-4 experiment, sterile neutrinos, dark matter and the Standard Model

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Joint analysis of the results of the Neutrino-4 experiment and the data of the GALLEX, SAGE and BEST experiments confirms the parameters of neutrino oscillations declared by the Neutrino-4 experiment (Δm_14^2= 7.3 eV^2 and sin^2⁡2θ_14 ≈0.36) and increases the confidence level to 5.8σ. Such a sterile neutrino thermalizes in cosmic plasma, contributes 5% to the energy density of the Universe, and can explain 15-20% of dark matter. It is discussed that the extension of the neutrino model by introducing two more heavy sterile neutrinos in accordance with the number of types of active neutrinos but with very small mixing angles to avoid thermalization will make it possible to explain the large-scale structure of the Universe and bring the contribution of sterile neutrinos to the dark matter of the Universe to the level of 27%. This approach to the problem of dark matter means that dark matter can be explained in terms of an extended Standard Model with right-handed neutrinos. An analysis of astrophysical data shows that right-handed neutrinos with a mass less than 7 keV have not yet been disfavored by direct experiments. The dynamic process of the origin of dark matter, consisting of three right-handed neutrinos, is presented. It is shown that, based on modern astrophysical data, it is impossible to draw a definite conclusion in favor of the model of three or four thermalized neutrinos. The influence of lepton asymmetry on the comparison of models of three or four neutrinos is considered. An estimate was made for the upper limit of the lepton asymmetry, in particular for N_ν=3 -0.04<ξ_e<0.04, and for N_ν=4 0.02<ξ_e<0.10. The possibility of the appearance of lepton asymmetry due to CP violation during oscillations into sterile neutrinos is discussed

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