

Detection of sterile neutrinos in the Neutrino-4 experiment, comparison with the results of other experiments and the 3 + 1 neutrino model

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The results of measurements of the dependences of the flux of reactor antineutrinos and their spectrum on the distance to the center of the active zone of the SM-3 reactor (Dimitrovgrad, Russia) in the range of 6–12 meters are presented. We observe the effect of oscillations at a confidence level of 3σ in the vicinity of the parameter values $\Delta m_{14}^2 = (7.3 \pm 0.13_{st} \pm 1.16_{syst}) \text{ eV}^2$ and $\sin^2 2\theta = 0.36 \pm 0.12_{stat} (2.9\sigma)$. The paper presents a comparison of this result with the results of other experiments on the search for sterile neutrinos. Combining the results of the Neutrino-4 experiment with the results of gallium and reactor anomalies, we obtained the value $\sin^2 2\theta_{14} \approx 0.19 \pm 0.04 (4.6\sigma)$. The results of the Neutrino-4 experiment are compared with the results of other reactor experiments NEOS, DANSS, STEREO, PROSPECT and with the results of the accelerator experiments MiniBooNE, LSND and with the results of the IceCube experiment. An analysis of the results within the framework of the 3 + 1 neutrino model is presented. The mass of sterile neutrinos from the Neutrino-4 experiment (assuming that $m_4^2 \approx \Delta m_{14}^2$) is $m_4 = 2.68 \pm 0.13 \text{ eV}$. Using estimates of mixing angles from other experiments, the following masses for electron neutrinos, muon neutrinos, and tau neutrinos can be calculated: $m_\beta = (0.58 \pm 0.09) \text{ eV}$, $m_\mu = 0.42 \pm 0.24 \text{ eV}$, $m_\tau \leq 0.65 \text{ eV}$. The PMNS matrix for four states together with sterile neutrinos is presented, as well as a scheme for mixing neutrino flavors with sterile neutrinos for direct and inverse mass hierarchies.

References:

1. Serebrov A.P. et al. Experiment Neutrino-4 search for sterile neutrino and results of measurements Phys. Rev. D in press, arXiv:2005.05301
2. Serebrov A.P., Samoilov R.M. Analysis of the Results of the Neutrino-4 Experiment on the Search for the Sterile Neutrino and Comparison with Results of Other Experiments. JETP Lett. **112**, 199–212 (2020). arXiv:2003.03199 <https://doi.org/10.1134/S0021364020160122>.

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