

Precision measurement of β -spectra of $^{144}\text{Ce} - ^{144}\text{Pr}$ nuclei.

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Precision measurements of β -spectra have always been and are still playing an important role in several fundamental physical problems, predominantly in neutrino physics. In Petersburg Nuclear Physics Inst. NRC KI, the β -spectra of $^{144}\text{Ce} - ^{144}\text{Pr}$ nuclei were measured with aim to determine the spectrum of electron antineutrinos. The artificial source of antineutrinos $^{144}\text{Ce} - ^{144}\text{Pr}$ is one of the most promising for the experiments on the search for neutrino oscillations to the sterile state [1]. Several β -spectrometers based on silicon detectors have been developed. The first β -spectrometer, based on full absorption Si(Li) detector and thin transmission detector, allows to perform efficient separation β -radiation and accompanying X-rays and γ -radiation [2,3].

A new β -spectrometer was created from two Si(Li) detectors with a sensitive region thickness of more than 8 mm [4]. The response function of such a spectrometer for electrons with an energy of less than 3 MeV is almost Gaussian. The setup includes a $3''$ BGO detector for detecting gamma rays in order to select the decays of $^{144}\text{Ce} - ^{144}\text{Pr}$ nuclei into excited levels of daughter nuclei. As a result, the beta spectra of $^{144}\text{Ce} - ^{144}\text{Pr}$ nuclei were measured and the spectra of electron antineutrinos corresponding to β -transitions to the main and excited states. The measured form of the allowed β -transition is completely consistent with theoretical calculations. The created spectrometer with a response function close to Gaussian practically solves the problem of determining the spectrum of electronic antineutrino arising in the β -decay of ^{144}Pr nuclei. The spectrometer can also be used in precision measurements of the spectrum shape of various radioactive nuclei. This work was supported by the Russian Science Foundation (project nos. 17-12-01009) and by the Russian Foundation for Basic Research (project nos. 16-29-13014, 19-02-00097 and 20-02-00571).

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