Contribution ID: **318** Type: **Poster report**

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

Wednesday, 14 October 2020 18:50 (20 minutes)

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}Ce $-^{144}$ Pr nuclei were measured with aim to determine the spectrum of electron antineutrinos. The artificial source of antineutrinos ^{144}Ce $-^{144}$ 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}Ce $-^{144}$ Pr nuclei into excited levels of daughter nuclei. As a result, the beta spectra of ^{144}Ce $-^{144}$ 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).

[1] A.V. Derbin, I.S. Drachnev, I.S. Lomskaya, V.N. Muratova, N.V. Pilipenko, D.A. Semenov, E.V. Unzhakov, Monte-Carlo sensitivity study for sterile neutrino search with ^{144}Ce $-^{144}$ Pr source and liquid scintillation detectors of various geometries, arXiv:1905.06670 (2019 r.)
[2] I.E. Alexeev, S.V. Bakhlanov, N.V. Bazlov, E.A. Chmel, A.V. Derbin, I.S. Drachnev, I.M. Kotina, V.N. Muratova, N.V. Pilipenko, D.A. Semenov, E.V. Unzhakov, V.K. Yeremin, Beta-spectrometer with Si-detectors for the study of ^{144}Ce $-^{144}$ Pr decays, Nuclear Inst. and Methods in Physics Research, A 890 (2018) 64–67
[3] N.V. Bazlov, S.V. Bakhlanov, A.V. Derbin, I.S. Drachnev, V.K. Eremin, I. M. Kotina, V.N. Muratova, N.V. Pilipenko, D.A. Semenov, E.V. Unzhakov, E.A. Chmel, A Beta Spectrometer Based on Silicon Detectors, Instruments and Experimental Techniques, 2018, Vol. 61, No. 3, pp. 323–327
[4] S. Bakhlanov, A. Derbin, I. Drachnev, I. Kotina, I. Lomskaya, V. Muratova, N. Niyazova, D. Semenov, E. Unzhakov, 4π semiconductor beta-spectrometer for measurement of 144Ce { 144Pr spectra, Journal of Physics: Conference Series 1390 (2019) 012117

Primary authors: Dr MURATOVA, Valentina (Petersburg Nuclear Physics Institute NRC KI); ALEKSEEV, Igor (V.G. Khlopin Radium Institute); BAKHLANOV, Sergey (Petersburg Nuclear Physics Institute NRC KI); DERBIN, Alexander (Petersburg Nuclear Physics Institute NRC KI); DRACHNEV, ilia (Petersburg Nuclear Physics Institute NRC KI); KOTINA, Irina (Petersburg Nuclear Physics Institute NRC KI); Mrs LOMSKAYA, Irina (Petersburg Nuclear Physics Institute NRC KI); NIYAZOVA, Nelly (Petersburg Nuclear Physics Institute NRC KI); SEMENOV, Dmitrii (Petersburg Nuclear Physics Institute NRC KI); UNZHAKOV, Evgeniy (Petersburg Nuclear Physics Institute NRC KI)

Presenter: Dr MURATOVA, Valentina (Petersburg Nuclear Physics Institute NRC KI)

Session Classification: Poster session 5

Track Classification: Section 5. Neutrino physics and astrophysics.