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THE EXPERIMENTAL ARRANGEMENT AND PRELIMINARY RESULTS OF SEARCH FOR LIGHT NEUTRON CLUSTERS IN 235U NUCLEI DECAY

Dudkin G.N., Chumakov D.K., Varlachev V.A.
National Research Tomsk Polytechnic University, Tomsk, Russia;
E-mail: dkc1@tpu.ru

The problem of light clusters of neutrons existence, such as dineutron, tetraneutron, hexaneutron, octaneutron is under study for at least 60 years, but it is still of interest both for theoretical and experimental research. The most recent reviews [1,2] published this year prove this.
In our experiment the method of search for neutron clusters, proposed in [3] is used. Light neutron clusters are registered after their escape from heavy nuclei (232Th, 235U, 238U). These clusters may split into k free neutrons which are detected more efficiently than the spontaneous fission neutrons (average number of fission neutrons Nn = 2) of these nuclei.
The experimental arrangement used to search for neutron clusters is shown in Fig. 1. A neutron emitter sample (E) containing heavy decaying nuclei is placed between two neutron counters (ND). The possible contribution of background events caused mainly by cosmic muons is suppressed using anti-coincidence system with the scintillation detectors (1-12) surrounding the neutron counters. The output signal from detectors is registered by two digital oscilloscopes, and then the information about registered events (neutrons multiplicity, time of neutron and background events registration) is processed online. The long-time measurements are being performed at this moment with thin UO3 film weighing 2.2 g (90% 235U, 10% 238U), which is used as emitter. The preliminary results will be reported.

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Figure 1: The experimental arrangement for light neutron cluster investigation: dotted –Plexiglas sheet, unfilled (1-12) –scintillation detectors, line-filled (ND) –neutron detectors, cross-filled (E) –neutron emitter sample

References:

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3. V.M. Bystritsky et al. Nucl. Instrum. Methods Phys. Res. A **834**, 164–168 (2016)

Authors: Mr DUDKIN, Gennadiy N. (National Research Tomsk Polytechnic University); CHUMAKOV, Daniil K. (National Research Tomsk Polytechnic University); Mr VARLACHEV, Valeriy A. (National Research Tomsk Polytechnic University)

Presenter: CHUMAKOV, Daniil K. (National Research Tomsk Polytechnic University)

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