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Measurement of angular distributions of neutrons and gamma quanta from the interaction between 14.1 MeV neutrons and carbon nuclei.

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The study of neutron-induced nuclear reactions on carbon is of interest both from the point of view of improving data on the properties of carbon excitation levels and for refining model parameters for describing the neutron interaction mechanism with carbon nuclei. Carbon plays an important role in the process of nucleosynthesis, in particular, according to F. Hoyle, the existence of life on Earth is due to the level of carbon with an energy of 7.65 MeV.
In the framework of the TANGRA project, angular distributions of scattering neutrons on carbon were measured using the tagged neutron method. As the source of neutrons, the ING-27 generator with a built-in 256-pixel alpha-particle detector was used. A graphite plate with dimensions 44x44x2 cm3 was used as a target and was located at a distance of 31.4 cm from the neutron source. Scattered neutrons were measured using 20 plastic detectors located around the target at a distance of ~2 m. The energy of scattered neutrons was determined by the time of flight. Angular distributions for elastic and inelastic scattering for 4.44 MeV, 7.65 MeV and 9.64 MeV states were obtained. Also, the angular distribution of gamma-ray emission were measured. The results were compared with the available experimental data, as well as with theoretical optical model calculations performed with TALYS 1.9 code. A new set of optical parameters was found.

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