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Elastic and inelastic scattering of 14.1 MeV neutrons on ^{12}C

Content

As part of the TANGRA project [1], we had measured angular distribution of γ-quanta, arising from the reaction of inelastic scattering of 14.1 MeV neutrons on the ^{12}C nucleus [2]. Due to the properties of ^{12}C, the information on its nuclear level structure that can be obtained by the registering γ-rays from the ^{12}C(n,n'γ) reaction is very limited. It was decided to register the probe particles, neutrons, instead of γ-quanta in the hope of additionally studying the second (0_2^+, 7.65 MeV) and third (3_1^-, 9.64 MeV) excited states of ^{12}C. The Hoyle state at 7.65 MeV is of particular interest in this respect because of its importance for the description of nucleosynthesis [3].

The angular distributions of neutrons scattered on carbon nuclei were measured with the TANGRA facility using tagged neutrons and time-of-flight methods. The data obtained were compared with results from previous experiments on the scattering of 114 MeV neutrons by ^{12}C. Optical model
calculations (with coupled-channels approach), carried out using TALYS 1.9 nuclear reaction code [4], were used to describe the experimental data.

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