STUDYING THE CLUSTER STRUCTURE OF ^{9}Be EXCITED STATES IN $^9\mathbf{Be}(d, d'n)X$ AND $^9\mathbf{Be}(\alpha, \alpha'n)X$ REACTIONS

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Abstract. Studying the structure of light nuclei is of fundamental importance in nuclear physics. Among all light nuclei, those of beryllium are of particular interest due to their clearly pronounced cluster structure. ^{9}Be is known to be a Borromean nucleus formed by three clusters ($\alpha + \alpha + n$) that completely breaks up as soon as one cluster is removed. Besides of the three-cluster ($\alpha + \alpha + n$) configuration, ^{9}Be also may have two-cluster ^{8}Be + n and α + ^{5}He configurations. Both of them are formed by a stable particle (n, α) and an unstable nucleus (^{8}Be, ^{5}He) and may play an important role for the excited states of ^{9}Be. Removing one of the elements of such a two-cluster configuration leads to a breakup of the unstable nucleus $^8\text{Be} \to \alpha + \alpha$ or $^5\text{He} \to \alpha + n$. We propose to determine the cluster structure of ^{9}Be excited states by studying the inelastic scattering of deuterons or alpha particles from ^{9}Be nucleus with registration both a scattered particle (deuteron or alpha particle) and a decay particle emitted during the breakup of these states (neutron or alpha particle).

A kinematic simulation of the $^9\text{Be}(\alpha, \alpha'n)X$ and $^9\text{Be}(d, d'n)X$ reactions for various excited levels of ^{9}Be and different breakup channels was carried out. The results of the simulation show that recording a scattered particle (deuteron or alpha particle) with excitation of a specific excited ^{9}Be state in coincidence with a particle from the decay of this state (neutron or alpha particle) will make it possible to determine the contributions of various cluster configurations to the structure of these excited states.

A study of the ^{9}Be cluster structure in the coincident experiment was started on the α-beam at the Skobeltsyn Institute of Nuclear Physics. Scattered deuterons are detected by a telescope of silicon detectors in one arm of the setup, while neutrons are detected in the second arm of the setup. As a neutron detector liquid hydrogen-containing scintillator EJ301 with ability of neutron-gamma separation was used. Neutron energy was determined by time-of-flight technique using a fast output of the E-detector as a start and that of the n-detector as a stop signal. The calibration of the spectrometer was obtained measuring timing spectrum of $\alpha - n$ coincidence in two-body d + ^{2}H $\to$ ^{3}He + n reaction. Preliminary data are obtained for coincident spectra of α-particles and neutrons from the breakup of various excited levels of ^{9}Be.

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