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Experimental study of the processes of elastic and inelastic scattering of protons on the 45Sc nucleus at an energy of 22 MeV

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The processes of scattering of light charged particles (p, d, t, ^{3}He, ^{4}He) on nuclei at low and medium energies are the main source of information on the properties of the internuclear interaction potential, which is one of the fundamentally important problems of nuclear physics. The totality of data of the last decades on the structure of nuclei and the mechanism of reactions in the energy range $\geq$ 10 MeV/nucleon indicate the dominant role in the formation of their cross sections of more complex processes that differ in their nature from classical ones and their relationship with the structure of interacting systems. The specificity of studying the mechanisms of nuclear reactions at the present stage is associated with the need to measure the energy spectra of reaction products in the fullest possible range of particle energies: from the Coulomb barrier energy up to energies corresponding to the formation of the final nucleus in the ground state. The objective of this study is an experimental and theoretical study of the clustering phenomenon using the ^{45}Sc nucleus as an example.
The elastic and inelastic scattering cross sections of 22 MeV protons on a 2 μm
thick Sc target were measured at the U-150M cyclotron of the Institute of Nuclear Physics (Almaty, Kazakhstan). A 60 cm diameter scattering chamber was used for the experiment. The reaction products were recorded using semiconductor telescopes consisting of two detectors: ΔE (100 μm) and E (3200 μm), designed to measure specific losses and residual energy E_r. This telescope configuration made it possible to identify the reaction products by charge Z and mass A, and to measure their total kinetic energy by summing up the calibrated values of specific losses. The experimental results obtained and their comparison with the theoretical analysis will be presented.

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