INVESTIGATION OF α-CLUSTER STRUCTURE BY THE STRIPPING REACTION

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The (^{6}Li,d) reaction has been used by Kurchatov Institute- I.N.P group to study the properties of highly excited states of light nuclei: ^{16}O, ^{17}O, ^{20}Ne, ^{28}Si.[1-3] Lithium beam with energy from 24.5 to 60 MeV was provided by Cyclotron of Kurchatov Atomic Energy Institute.

The deutrons were recorded at the angles (8°-10°), close to the direction of the primary beam. Target + α particle systems were formed with excitation energies well above thresholds for particle emission. Investigated systems relax their excitation energies & transfered angular momenta predominantly by α particle decays leading to ground and low lying excited levels of target nuclei. Coincidence (d,α) spectra were obtained, and angular correlations of the decays corresponding to target ground states transitions were measured. The data enable to determine spins, parities, partial widths, reduced widths of several states or groups of states.

The α-cluster structure of nuclei at high excitation energy is demonstrated by existence of set of states which are selectivly populated in direct α transfer reaction, reduced α particle widths of these states are close to Wigner limit, they can be selected into quasirotational systematics, At higher excitation energy and /or heavier target (^{24}Mg) reduced widths are distributed among few close lying states which have the same characteristic. In case of ^{13}C(^{6}Li,d) ^{17}O reaction a weak coupling of single particle α cluster levels to ^{13}C core was observed[3].

Stripping of weakly bound particle followed by reemission of the transfered particle can be treated as the off-energy shell particle scattering. In terms of model out-

lined in ref.[4], in plane - wave approximation, cross-section for stripping reaction is essentialy described by product of intercluster momentum distribution and corresponding cross-section for interaction of transfered particle with target nucleus. In case of (^{6}Li,d) reaction coincidence energy spectrum and excitation function of diferential cross-section for elastic scattering are to be compare. Fig 1 presents: averaged over 500keV Mg(α,α) excitation curve at Θ_α=179°[5] weighted on deutron momentum distribution within ^{6}Li nucleus - P(q), and shape of α-particle coincidence spectrum from Mg(^{6}Li,d)Si(α)Mg reaction obtained at 24.5MeV beam energy and backward angle of α particle detection.[3] P(q), (where $q=(1/3)k_i - k_f$; k_i and k_f are initial and final momenta respectively for Mg(^{6}Li,d)Si reaction at E_{Lab}(^{6}Li) = 24.5 MeV) was taken from ref.[6] with characteristic momentum parameter q_o = 45 MeV/c.

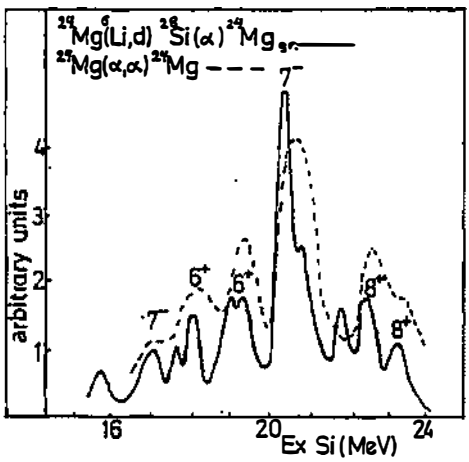

Fig.1 Shape of particle coincidence energy spectrum from ^{24}Mg(^{6}Li,d)^{28}Si(α)^{24}Mg reaction (solid line) and averaged elastic ^{24}Mg(α,α) cross-section times the intercluster momentum distribution within ^{6}Li nucleus-P(q) (dashed line).

Stripping of α particle into unbound region seems to offer an additional method to probe the α particle intermediate structure.

References

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