analytically within the three-body problem in approach of two-particle $V_{\alpha\alpha}$- and $V_{\alpha N}$-interaction

In treated case integration procedure <A|A-x, x> over the internal coordinates of separated clusters is resulted in their relative motion wave function consisting of S- and D-components, each presented as an expansion in constituents of initial ^{9}Be wave function and those of corresponding to free clusters.

Let us note, that in the present scheme one may vary the parameters characterising the mean square sizes of the clusters what obviously reflects on their separation distances, but following the orthogonality conditions on the discrete and continuous spectra such an arbitrariness will be restricted.

The obtained results have been rewritten in impulse representation. The last one shows that symmetric S-component and deformed D-component are quite comparable by absolute values at some q, so one may expect their specific manifestation in nuclear reactions where ^{7}Li and d clusters are involved.

In particular, we investigated some differential and integral characteristics of photoinduced processes ^{9}Be$\gamma \leftrightarrow {}^7$Lid in wide energy region (from E_{cm} ~50 KeV to 40 MeV) and realised purposely the by-component analysis of obtained results.

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HADRON SCATTERING BY ^{7}LI NUCLEUS IN THREE-PARTICLE αDN-MODEL

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Differential cross section (DCS) and analyzing power (A_y) experimental measurements at 0.2 GeV polarized proton beam scattering have been carried out at cyclotron of Indiana University (IUCF) /1/. The same experiments for 0.143, 0.164 and 0.194 GeV $\pi^{\pm}$ -meson scattering have been made at Paul Scherrer Institute (PSI) in Switzerland /2/. Within the framework of Glauber-Sitenko theory, proton and $\pi^{\pm}$ -meson differential scattering cross sections at the same energies have been calculated. By contrast to our previous computations on the same nucleus /3/, wave function of the mentioned nucleus was chosen within three-body αdn-model, calculated with realistic potentials of intercluster interaction.

Elastic and inelastic scattering DCS sections were calculated, and it was chosen that they are reproduced in a proper way within the framework of diffraction theory. Investigation the dependence of this characteristics from various three-body wave function component contribution and from different scattering multiplicities in Ω multiple scattering operator allows to conclude about both nuclear structure and various particle type interaction peculiarities. Besides, comparison of DCS calculated with three-particle αdn, cluster αt and with oscillator Ψ_{31} ^{7}Li wave functions has been carried out. It was shown the influence of real asymptotic behaviour of cluster wave functions on cross section shape at small scattering angles corresponding to large distance in co-ordinate space.

Differential cross section investigation at different energies of the scattered particles showed that intensity (a great number of maximuma and minimuma, the extending, diffraction minimum shifting to small scattering angle region) is observed for protons with

energy increasing. Another situation is observed for $\pi^{\pm}$ -mesons in the energy region 0.1-0.24 GeV. It is connected with the availability of Δ_{33}-resonance defined DCS in πN-interaction.

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THE INVESTIGATION OF LOW ENERGY NUCLEAR CLUSTER INTERACTIONS THROUGH THE RESEARCH OF PHOTOABSORPTION REACTIONS

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Interactions of electromagnetic radiation with composite nuclear systems are characterized by a selective and single action. The first feature implies appropriate selection rules relatively to the electromagnetic components, whereas the second one means applicability of the perturbation theory, provided $Z << 137$, i.e. not very heavy nuclei are under consideration.

Due to this, rather clear formulae of the physical process can be applied, for instance, for reactions of nuclear photo absorption. In the frame of this consideration, the characteristics of the nuclear system in its definite quantum states, corresponding to the components of decomposition in multiple electromagnetic transitions, play the main role. These characteristics supply and refine the data which were obtained or can be obtained from ordinary nuclear experiments and model descriptions. It concerns, in particular, determination of the nuclear wave functions derived on a base of simple cluster-cluster interactions or simple model representations.

The calculations and the analysis are performed in the frame of the effective potential of interaction between composite particles [1,2]. It has been found that the obtained inelastic scattering channel amplitudes formally coincide with the similar amplitudes occurring in the final-state interaction theory.

In many cases a structure of the inelastic transition amplitudes f_{jl} turns out to be factorized:

$$f \sim \left\langle \psi_j^- \middle| \psi_l^+ \right\rangle \left\langle \psi_l^+ \middle| O(A,\gamma) \right\rangle .$$

Here $\psi_j^{\pm}$ are the nuclear system accurate wave functions reduced asymptotically to definite final states j, and $\left\langle \psi_l^+ \middle| O(A,\gamma) \right\rangle$ is the Born amplitude for nucleus transition to a certain preferential state chosen by selection rules, in this case – in the course of nucleus interaction with a γ quantum. The gain factor $D(y) = \left\langle \psi_j^- \middle| \psi_l^+ \right\rangle$ represents an ordinary final-state