the quantity $d^2\sigma/dtdM^2$ at fixed $M^2 >> M_0^2$ and small t should decrease logarithmically with increasing s. Measurement of the proton spectra at high energies in the region of small t (<0.1 $(GeV/c)^2$) is therefore of considerable interest.

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ALLOWANCE FOR FINAL-NUCLEUS INSTABILITY IN QUASIELASTIC KNOCKOUT OF PROTONS FROM Li^6 NUCLEUS

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There are two points in which the experimental data on the quasielastic knockout of protons from the Li^6 nucleus do not agree with the concepts of the dominant role of the pole mechanism (Fig. 1a) at small momentum transfers: (a) The angular distributions in the reaction $Li^6(p, 2p)$, unlike the reactions with other light nuclei, cannot be satisfactorily described by a scheme in which the contribution of all the diagrams other than the pole diagram is assumed to be a slowly varying function of the momentum transfer and is approximated by a certain constant [1] (a similar result is obtained also in the impulse approximation with disotrted waves). The theory leads to a sharp minimum in the angular distribution, while experiment shows only a noticeable dip (see below). Nor is it possible to explain the asymmetry in the distribution with respect to the excitation energy of the residual nucleus [2]. (b) An investigation of the reaction $Li^6(\pi^-, \pi^-p)$ [3] has revealed that although a number of the distributions that are sensitive to the reaction mechanism agree well with the predictions based on diagram 1a, the values of the reduced proton widths θ_p^2 and θ_s^2 differ noticeably from the reduced widths obtained from data on other reactions, if it is assumed that all the p-wave events pertain to a transition to the ground state of He^5, while all the s-state pertain to higher excitation energies.

Since the indicated deviations are observed only in reactions with Li^6, it is natural to attempt to find an explanation in the singularities connected with this nucleus. When a proton is knocked out of Li^6, the produced He^5 is unstable against decay into $He^4 + n$. It can therefore be assumed that an appreciable contribution is made by a diagram with direct breakup of Li^6 into three particles ($He^4 + n + p$), for then the singularity with respect to the momentum transferred from the initial nucleus to the final nuclear system $He^4 + n$ is closer than in the diagram of Fig. 1a. Taking the cluster character of the Li^6 nucleus into account ($\alpha + d$), it is natural to choose for the vertex $Li^6 \to He^4 + n + p$ the model $Li^6 \to He^4 + d$, $d \to n + p$. The advantage of this mechanism is that it leads, in accord with the experimental data [3], to an isotropic distribution relative to the Treiman-Yang angle (owing to the s-wave character of both nuclear vertices).

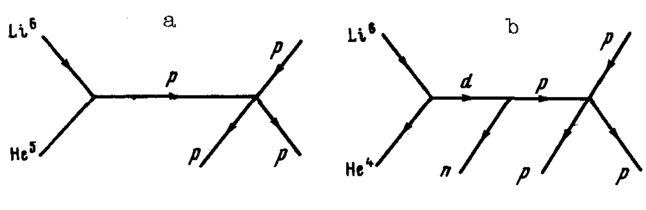

Fig. 1

If we assume for $\alpha + d$ in Li^6 a Gaussian wave function with parameter $\gamma = (1/36\ MeV/c)^2$

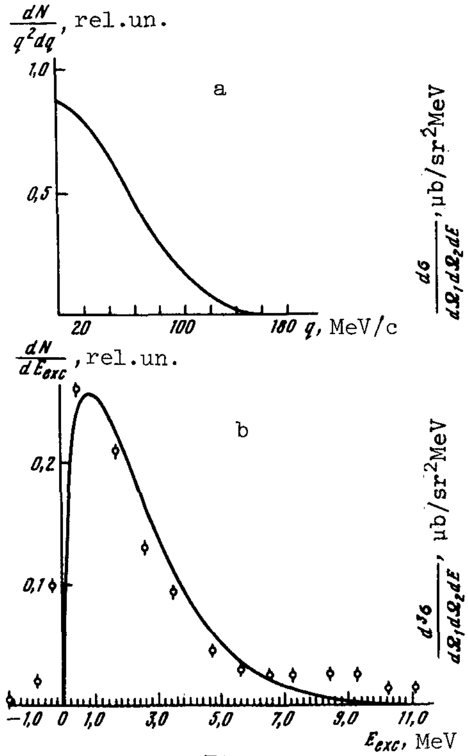

Fig. 2

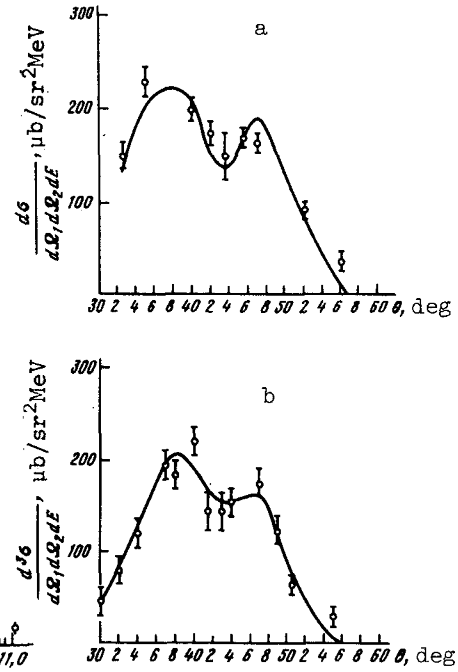

Fig. 3

Fig. 2. Distributions with respect to q and E_{exc}, given by the diagram of Fig. 1b.

Fig. 3. Distributions with respect to the proton divergence angles in (p, 2p) reactions at 155 and 185 MeV. The abscissas are the values of half the divergence angle. The experimental data are from [2, 5]. The solid curves were obtained by a theoretical calculation.

we obtain for the cross section corresponding to the diagram of Fig. 1b

$$d\sigma \sim q^2 dq\, dE_{exc}\, \Psi(q, E_{exc}), \tag{1}$$

where q and E_{exc} are the total momentum and the energy of relative motion of the final neutron and He^4 nucleus, and

$$\Psi(q, E_{exc}) = \frac{1}{q}\left[\exp\left\{-\gamma\left(k - \frac{m_B}{m_B + m_n}q\right)^2\right\} - \exp\left\{-\gamma\left(k + \frac{m_B}{m_B + m_n}q\right)^2\right\}\right] \times \left[q^2 + \frac{2m_p(m_B + m_n)}{m_p + m_B + m_n}\left(\epsilon_p + E_{exc}\right)\right]^{-2}. \tag{2}$$

m_A, m_B, m_n, and m_p are the masses of Li^6, He^4, the neutron, and the proton, $\varepsilon_p = m_B + m_n + m_p - m_A$, $k = \sqrt{2m_B m_n E_{exc}/(m_B + m_n)}$. The distributions with respect to q and E_{exc} are obtained from (1) by integrating with respect to E_{exc} and q, respectively. Thus, the distribution with respect to the momentum q depends on the considered interval of excitation energy E_{exc}, while the distribution with respect to E_{exc} depends on the considered interval of q. Therefore the magnitude and the character of the contribution of the diagram 1b depend significantly on the experimental conditions and can differ strongly in different experiments. Figure 2a shows, by way of illustration, the distribution with respect to E_{exc} at q = 0 - 80 MeV/c. For comparison, it shows the distribution with respect to E_{exc} obtained experimentally for the reaction $Li^6(p, 2p)$ at 155 MeV [2]. It is important that the distribution with respect to the excitation energy has a maximum in the region of the ground state of He^5.

If the data on the (p, 2p) reaction are reduced with allowance for the diagram 1a and a 'background' in the form of the diagram 1b, we obtain a good description of the experimental data (see Fig. 3; $\chi^2 = 23.5$ and 15.1 on Figs. 3a and 3b, respectively; we point out for comparison that $\chi^2 = 88$ and 212, respectively, for the distributions of [1]).

From the data on (p, 2p) at 155 MeV we get for the reduced proton width $\theta_p^2 = 0.39 \pm 0.06$, and at 185 MeV $\theta_p^2 = 0.27 \pm 0.06$ (at a channel radius 4 F). When account is taken of the diagram 1b, the reduction of the data on the reaction $Li^6(\pi^-, \pi^-p)$ yields $\theta_p^2 = 0.5 \pm 0.2$. The indicated values of θ_p^2 thus agree within the limits of errors. The contradiction between the values of θ_s^2, which were found in [3] to be too large in comparison with the reduced width of the s transition to the excited level of He^5 is likewise eliminated, since it is now clear that θ_s^2 takes effectively into account some of the transitions to the state He^4 + n via a mechanism corresponding to the diagram of Fig. 1b. The effective number of deuterons in Li^6, obtained from a description of the (p, 2p) data with the aid of the diagrams of Fig. 1, is found to be of the order of 0.4, which agrees with the known data on the (p, pd) reactions (4, 6].

These facts, as well as the significantly improved description of the experimental data by taking the diagram 1b into account, enable us to hope that the proposed model corresponds to the real situation. It should then affect also the characteristics of other reactions, for example $Li^6(e, ep)$.

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SELF-CONSISTENCY CONDITIONS IN SYSTEMS WITH BROKEN SYMMETRY

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We derive the self-consistency conditions that must be satisfied by the mass operator, the density matrix, and the two-particle interaction in systems with broken symmetry.

We wish to call attention in this article to the fact that for systems with broken symmetry, which have been diligently studied of late[1], there exist self-consistency conditions that interrelate definite components of the mass operator Σ, of the density matrix ρ, and the two-particle interaction. They play an important role in the determination of the critical points and of the characteristics of the collective-excitation spectrum. We shall derive these conditions by using a generalized Ward identity. Using for the ψ operators the transformation $\psi(x) \to \exp[if(t)Q(\vec{x})]\psi(x)$, where $Q(\vec{x})$ is a certain time-independent Hermitian operator and f(t) is an arbitrary real function of the time, and using standard methods (see, e.g., [2]), we get[1]

$$\omega\mathcal{T}(x, p, \epsilon, \omega; [\overset{\circ}{j}_Q]) + \mathcal{T}(x, p, \epsilon, \omega; [D_Q]) = G^{-1}\left(x, p, \epsilon + \frac{\omega}{2}\right)Q(x) - Q(x)G^{-1}\left(x, p, \epsilon - \frac{\omega}{2}\right). \quad (1)$$

[1] We have changed over here to a mixed representation. In what follows, we shall use frequently a symbolic notation and omit the quantum numbers as well as the variables over which the summation and integration are carried out.