$$\rho_{12}(x_1, x_2, P_{1\perp}^2, P_{2\perp}^2) \doteq \frac{\rho_1(x_1, P_{1\perp}^2)\rho_2(x_2, P_{2\perp}^2)}{8\pi g_a g_b} \quad . \tag{7}$$

If the optical theorem is not satisfied for reggeon-reggeon scattering at large s', but σ' assumes a constant value at the same time, then B_{12} in (5) is a certain decreasing function of the variables t_1 and t_2, and can be represented at small $|t_1|$ and $|t_2|$ in the form $B_{12} = B_{12}^0 \exp[2(R_1^2 t_1 + R_2^2 t_2)]$.

If the particles a and 1 (or b and 2) are identical, then the main contribution in Figs. 2a and 2b is made by the P reggeon (R = P). It can be shown in this case [10] that the vertex $r_1(t_1)$ or $r_2(t_2)$ should annihilate, respectively, as $|t_1| \to 0$ or $|t_2| \to 0$. An experimental investigation of this effect, and also of the optical theorem for reggeon-reggeon scattering, is of great interest to the theory.

The authors are grateful to Professor Schopper for an interesting discussion.

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CONCERNING RESONANCES IN A THREE-NUCLEON SYSTEM AT LOW ENERGIES

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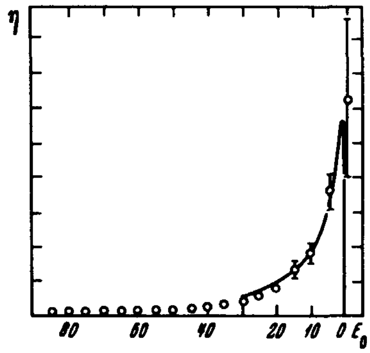
A considerable number of recent experimental papers report observation of a resonant behavior of the differential corss sections, say, in the process $\pi^- + {}^3He \to \pi^+ + (3n)$ [1] or $p + {}^3He \to n + (3p)$ [2], as functions of the kinetic energy of the three-nucleon system. The authors conclude for the most part from the obtained data that a three-particle resonance or an excited state of ^3He exists [1 - 3]. Such conclusions based on the observation of only the energy behavior of the cross sections may be too hasty. Phillips [4] was the first to call attention to the fact that in the reaction

$$\pi^- + {}^3He \to \pi^+ + 3n \tag{1}$$

the resonant behavior of the cross section may be due to interaction of two neutrons in the final state. The results obtained in [4], however, are based in essence on a large number of approximations connected with dynamics of the process (1), and cannot be simply generalized to cover other reactions of similar type.

It seems to us that in the study of process (1) or of (p, n) reactions on ^3He and ^3H [2] it is necessary to separate first (after comparison with the four-particle phase volume) the contribution made to the cross sections of



Ratio η of the differential cross section of process (1), divided by the four-particle phase volume, vs. the kinetic energy E_0 of three neutrons. The experimental points were taken from [1].

these processes by the interaction of two nucleons in the final state, i.e., to take into account the Migdal-Watson effect. We shall show below, using reaction (1) as an example, that by assuming the vertex function of the interaction between the π^- meson and the ^{3}He nucleus to be constant and taking into account only the resonant interaction of two neutrons in the singlet state, it is possible to explain the resonance obtained in [1] in the region of low energies of the 3n system. The nn-interaction amplitude is taken in the usual form $f = (\kappa + ik_{ij})^{-1}$, where $\kappa^2 = M\varepsilon$, $\varepsilon = 0.067$ MeV, and k_{ij} is the relative momentum of the i-th and j-th neutrons. Then the cross section of the process (1), taking the Pauli principle into account, is written in the form

$$d\sigma = A\left[\frac{1}{\epsilon + E_{12}} - \frac{\epsilon + \sqrt{E_{13}E_{23}}}{(\epsilon + E_{13})(\epsilon + E_{23})}\right] d\mathbf{p}_1 d\mathbf{p}_2 d\mathbf{p}_3 d\mathbf{p}_4$$

$$\times\, \delta(\mathbf{p}_1 + \mathbf{p}_2 + \mathbf{p}_3 + \mathbf{p}_4 - \mathbf{p})\,\delta(E_1 + E_2 + E_3 + E_4 - E). \qquad (2)$$

Here $E_{ij} = k_{ij}^2/M$ is the energy of relative motion of the i-th and k-th neutrons, A is a constant, E and p are the energy and momentum of the entire system, and the index 4 pertains to the emitted π^+ meson. E_0 denotes the kinetic energy of the three neutrons in their c.m.s. We consider $E_0 \gg \varepsilon$. We can then readily calculate from (2) the differential cross section $d\sigma/d\Omega_4 dE_4$. We present here the ratio of this cross section to the four-particle phase volume (SP)

$$\frac{1}{(SP)}\frac{d\sigma}{d\Omega_4 dE_4} \equiv \eta = C\frac{1}{E_0}\left(1 - 3\sqrt{\frac{\epsilon}{E_0}},\right) \quad \epsilon \ll E_0. \qquad (3)$$

The figure shows a comparison of the ratio η obtained in the experiment [1] and calculated from formula (3). We see that the theoretical curve calculated under very simple assumptions fits the experimental data well (C = 24 in arbitrary units). The maximum of η lies at $E_{max} = 1.36$ MeV.

It is obvious from (2) that when $E_0 \ll \varepsilon$ the cross section of the process tends to zero (like E_0^3).

We can take analogously the Migdal-Watson effect into account for the reaction p + ^{3}H → n + (2np) [2], the amplitude of which contains several resonant terms.

We wish to exphasize that whereas allowance for the interaction of two nucleons in the final state can explain the "resonances" in the energy dependence of the cross sections [1, 2], to reveal the truly characteristic resonance in the three-nucleon system it is necessary to carry out investigations similar to those carried out in the physics of baryon resonances. These include study of the asymmetry of the decay products, study of the Dalitz plot, of the polarizations, etc. Only experimental investigations of this kind can serve as undisputed proof of the existence of truly three-nucleon resonances at low energies.

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MECHANISM OF INCLUSIVE REACTIONS AND INELASTIC SCREENING IN THE DEUTERON

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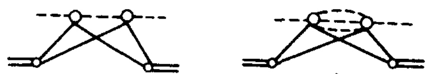
The purpose of this paper is to estimate the contribution of different elastic mechanisms to the shadow correction $\Delta = \sigma_p + \sigma_n - \sigma_d$ in the scattering of a hadron of high energy, $E_{lab} > 10$ GeV, by a neutron. The shadow correction contains contributions of the elastic screening $\Delta_{el} = (4\pi)^{-1} \langle R^{-2} \rangle \sigma_p \sigma_n$ [1] (Fig. a) and of inelastic screening Δ_{inel} [2 - 4] (see Fig. b): $\Delta = \Delta_{el} + \Delta_{inel}$. In the calculation of Δ_{inel} we shall use the experimental data on inclusive reactions $a + N \to X + N$ and the Regge phenomenology [5][1].

If an inclusive process $a + N \to X + N$ is described by interfering contributions of several reggeons (the reasoning is given below), then the inelastic shadow correction Δ_{inel} is represented in the form



a b

$$\Delta_{inel} = 2 \int dt\, ds' F(t) \sum_i \xi_i \frac{d^2\sigma^i(s_1, s', t)}{dt\, ds'}, \qquad (1)$$

where $d^2\sigma^i(s_1, s', t)/dtds'$ is the differential cross section for the production of a beam of particles with mass $M = \sqrt{s'}$ as a result of exchange of the i-th reggeon, $s_1 = (p_a + p_N)^2$, $F(t) = \exp(at)$ is the form factor of the deuteron, and $a = 40$ GeV^{-2}. The factor ξ_i is determined by the phase of the amplitude for the production of a given beam of particles and is equal to $\xi_i = -\sigma_i \cos\pi\alpha_i(t)$, where $\sigma_i = \pm 1$ and $a_i(t)$ is the signature and the trajectory of the i-th Regge pole.

In the estimates of Δ_{inel} in [2, 4] it was assumed that the amplitude of the inclusive reaction $a + N \to X + N$ is determined entirely by the contribution of the vacuum pole P, and that $\xi_i = 1$. This assumption, however, contradicts the available experimental data on inelastic spectra. As shown in [7], the contribution of the P-pole (or of diffraction dissociation) to the cross section of the process $p + p \to p + X$ is a small fraction (about 10%) of the total inelastic cross section σ_{inel} and is concentrated mainly in the region of small masses, $M \leq 2$ GeV. At the same time, at very high energies, $s_1 \gg m^3\sqrt{a}$, an appreciable contribution to Δ_{inel} can be made in accord with (1), by inter-

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[1] An interesting qualitative analysis of different inelastic contributions to Δ_{inel} for Nd scattering was performed within the framework of the Regge scheme and the hypothesis of duality in the mean in [6].