Crystal	Longitudinal elastic wave			Transverse elastic wave		
	Δλ, Å	v, m/sec (measured)	(calculated)	Δλ, Å	v, m/sec (measured)	(calculated)
NH_4Cl + Co	0.228 ± 0.001	4650 ± 25	4430	0.117 ± 0.001	2380 ± 25	2110
NaCl	0.204 ± 0.002	4450 ± 50	4480			
KCl	0.169 ± 0.003	3820 ± 70	3830			

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RELATIVISTIC GENERALIZATION OF SU(6) SYMMETRY AND PRODUCTION OF BARYON RESONANCES

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1. Stodolsky and Sakurai advanced the hypothesis [1] that the principal role in isobar production reactions in meson-nucleon collisions

$$M_1 + B_1 \to B^* + M_2, \qquad B^* \to M_3 + B_2 \tag{1}$$

is played by vector-meson exchange, with the vertex VB*B described, in analogy with the photon, by the magnetic-dipole transition [2]. The consequences of this model were checked most thoroughly in reactions (2) and (3) [3-11]:

$$K^+ + p \to N^{*++} + K^0 \tag{2}$$

$$\pi^+ + p \to N^{*++} + \pi^0 \tag{3}$$

In all cases, with the exception [7] of k_L = 1.1 - 1.27 BeV/c in reaction (3), the observed angular distribution of the isobar decay products were in good agreement with the predictions of the Stodolsky-Sakurai model, whereas the dependence of the cross section on s and t contradicts (see [10]) the model of [1,12].

In the present note we consider the production of the isobar pertaining to the decuplet on the basis of $\tilde{U}(12)$ symmetry of strong interactions [13]. We show that in reaction (2) the predicted angular distribution coincides with that obtained in [1]. In reaction (3) the angular correlations have the same form, provided the principal role is played in the t-channel by exchange of states with T = 1 and not 2. These deductions are not connected with assumption regarding the peripheral character of the interaction. The relativistic generalization of SU(6) symmetry, considered by Beg and Pais [14], leads to the same results.

2. The baryon octet and decuplet enter into a single 364-plet, which is described by the symmetrical tensor $\Psi_{ABC}(A, B, C = 1, \ldots, 12)$, and the octet of pseudoscalar mesons belongs to the representation $\{145\}M^A_B$. All the processes (143) + (364) → (143) + (364) are determined by the four amplitudes A_1 - A_4, with A_1 making no contribution to (1):

$$A_1(s,t)\bar{\Psi}^{ABC}\Psi_{ABC}M^D_{1F}M^F_{2D}, \qquad A_2(s,t)\bar{\Psi}^{ABC'}\Psi_{ABC}M^D_{1C'}M^C_{2D}$$

$$A_4(s,t)\bar{\Psi}^{AB'C'}\Psi_{ABC}M^B_{1B'}M^{C'}_{2C}, \qquad A_3(s,t)\bar{\Psi}^{ABC'}\Psi_{ABC}M^C_{1D}M^D_{2C'}$$

Using the explicit form of the tensors Ψ_{ABC} and M^A_B, [13] we can easily find that the following processes (4) are described by the amplitudes A_2 and A_3, but not by A_4:

$$\begin{array}{ll} K^+ + p \to N^{*++} + K^0, & K^- + p \to N^{*+} + K^- \\ K^+ + p \to N^{*+} + K^+, & K^- + p \to N^{*0} + \bar{K}^0 \end{array} \tag{4}$$

We confine ourselves here to reactions with two charged particles in the initial state.

There exists also a group of reactions (5), to which only the amplitude A_4 makes a contribution:

$$\begin{array}{ll} \pi^- + p \to N^{*-} + \pi^-, & K^- + p \to \Xi^{*0} + K^0 \\ \pi^- + p \to Y_1^{*-} + K^+, & K^- + p \to Y_1^{*-} + \pi^+ \\ & K^- + p \to \Xi^{*-} + K^+ \end{array} \tag{5}$$

Finally, the reactions (6) are determined by all the amplitudes A_2 - A_3:

$$\begin{array}{ll} \pi^+ + p \to N^{*++} + \pi^0 & \pi^+ + p \to Y^{*+} + K^+ \\ K^- + p \to Y_1^{*+} + \pi^- & \pi^- + p \to N^{*+} + \pi^- \\ \pi^- + p \to N^{*0} + \pi^0 & K^- + p \to Y_1^{*0} + \pi^0 \\ \pi^+ + p \to N^{*+} + \pi^+ & \end{array} \tag{6}$$

3. The matrix elements of reactions (4) are of the form

$$M = A(s,t)e_{\alpha\beta\gamma\delta}\bar{u}_\delta k^1_\alpha k^2_\beta p^1_\gamma \tag{7}$$

where A is a linear combination of A_2 and A_3, different for each different reaction. Here

$\bar{u}_\delta$ is the wave function of a particle with spin 3/2 in the Rarita-Schwinger formalism; k^1_α, k^2_β, and p^1_γ are 4-momenta of M_1, M_2, and B_1, respectively.

Squaring (7) and summing over the polarizations of the initial and final nucleons, we obtain in the isobar rest system

$$\overline{(1/2)|M|^2} \sim |A(st)|^2(\epsilon_1 + m)(\epsilon_2 + m)|\mathbf{k}_1 \times \mathbf{k}_2|^2|\mathbf{p}_2|^2(1 + 3\cos^2\theta) \qquad (8)$$

where ϵ_1 and ϵ_2 are the energies of the initial and final nucleons, and θ is the angle between the normal to the production plane and the direction of the momentum of the final nucleon.

We note that (7) leads to the Stodolsky-Sakurai distribution (8) without neglect of the recoil of the nucleon, in contrast with the results of [12].

The angular distribution in reactions (5), which can be due to vector-meson exchange, has the usual Adair form [16]

$$(1 + 3)[(\mathbf{k}_1\mathbf{p}_2)^2/(|\mathbf{k}_1|^2|\mathbf{p}_2|^2)]$$

The angular correlations in reactions (6) have in the general case when $A_4 \sim A_2$, A_3 a rather complicated form and coincide with (7) only for those values of s and t for which

$$A_4(st) \ll A_2(st), \quad A_3(st) \qquad (9)$$

Expression (9) can be verified independently against the isotopic relations between the different cross sections. In the case of reaction (3), for example, (9) signifies that the principal role in the t-channel is played by exchange of states with T = 1 and not 2.

The fact that a $1 + 3\cos^2\theta$ distribution is observed in reaction (3) for an incident-meson momentum $k^1_L = 0.9$ [3] and 1.14 [4] BeV/c, and does not agree [7] with the experimental data in reaction (3) when $k^1_L \approx 1.2$ BeV/c is a confirmation of the $\tilde{U}(12)$ symmetry. Thus, the predictions of $\tilde{U}(12)$ with respect to the spin structure of the amplitudes of processes (1) agree with experiment.

4. At the same time, as shown in [17,18], the polarization of the Ξ^- hyperon produced in the reaction

$$K^- + p \to \Xi^- + K^+ \qquad (10)$$

is equal to zero in the $\tilde{U}(12)$-symmetry approximation, thus contradicting the experimental data. We know of two possible explanations [17,20] of this fact within the framework of the relativistic generalizations of SU(6). First, (see [17]), the cross section of the reaction is small (of the order of 0.1 mb at $k^1_L = 1.95$ BeV/c) and it can be assumed that the symmetry is decisively broken. Such a value of the cross section corresponds to the assumption (9) that A_4 is small compared with the remaining amplitudes, since only A_4 contributes to (10). Second [20], the polarization of Ξ^- should not be equal to zero if the quantity ξ introduced by Beg and Pais [14] is complex. All the results obtained are valid for arbitrary $\xi(st)$.

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ISOTOPIC STRUCTURE OF PARITY NONCONSERVING NUCLEAR FORCES

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Blin-Stoyle and Feshbach [1] calculated the asymmetry, relative to the plane of polarization of the incident radiation, of nucleon emission in the $\gamma + d \to n + p$ reaction. This asymmetry is a result of the parity nonconserving weak interaction between nucleons, predicted by the V - A variant of the universal theory. The potential of the weak interaction in [1] corresponded to two-pion exchange [2], and its isotopic structure constituted a superposition of an isoscalar and an irreducible isotensor of second rank. Actually, however, only the isoscalar part makes a contribution to the amplitude of the considered process.

In this paper we estimate the possible contribution made to the same effect by the static isovector part of weak internucleon interaction, corresponding to a potential in the