the optical model, for the proton and the neutron respectively, and $n(r) = \sum_1 (n_1^p - n_1^n)|\varphi_1|^2$. In this case the cross section integrated in the resonance region over the neutron spectrum connected with the excitation of the analog state ("sum rule") is equal to

$$\frac{d\sigma}{d\Omega_k} = \frac{1}{(2\pi)^2}\frac{(Mf'V)^2}{(N - Z)\rho_0^2}\frac{k}{k'}\left|\int \varphi_k^* \varphi_{k'} n(r)\, d\vec{r}\right|^2, \qquad (6)$$

where M is the nucleon mass and $\epsilon_k = \epsilon_{k'} - \omega_a$.

Let φ_{λ_0} be the wave function of the odd neutron on the Fermi surface in the nucleus (N + 1, Z). Then the matrix element corresponding to absroption of a proton by a nucleus (N, Z) with excitation of a state analogous to the ground state of the nucleus (N + 1, Z) is obtained from (7) by replacing φ_k with φ_{λ_0}. The "sum rule" for this reaction is

$$\int \sigma_{k'} d\epsilon_{k'} = 2\pi \frac{(f'V)^2}{(N - z)\rho_0^2}\frac{M}{k'}\left|\int \varphi_{k'}^* \varphi_{\lambda_0} n(r)\, d\vec{r}\right|^2, \qquad (7)$$

where $\epsilon_{k'} = \omega_a - E_b^p$, and E_b^p is the binding energy of the proton in the nucleus (Z + 1, N).

From the point of view of the microscopic description, other collective **excitations**, of the proton-neutron-hole type, can exist besides the analog state. Interest attaches to states with energy lower than ΔE_C. The state 2^+, and also a 0^+ excitation with another density matrix that does not reduce to a constant, may be observed in this energy region.

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DENIAL OF SU(3) SYMMETRY IN STRONG INTERACTIONS

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The philosophy underlying the modern application of group theory to strongly-interacting particles can be formulated as follows: The Lagrangian (or some other unknown formulation of dynamics) has a definite symmetry. A complete dynamic claculation is beyond the limits of modern theory. However, divergences or similar difficulties which hinder exact calculation do not break the symmetry, all of the consequences of which should be satisfied in real physical processes. Violations of symmetry are small and can be regarded essentially as first-order perturbations estimated from the eigenstates of the symmetrical theory.

In this note we formulate most positively a contrary point of view: Quarks exist, but there is no similarity or symmetry whatever between the strange λ quark and the p and n quarks $^{1)}$.

The basis for this point of view is an analysis of the masses of the mesons and baryons [1], which leads to the conclusion that the spin-spin interaction between λ and p or n is smaller than the spin-spin interaction between p and n by a factor of almost 1.7.

The annihilation interaction $\lambda\bar{\lambda} \to p\bar{p}$ or $\lambda\bar{\lambda} \to n\bar{n}$ is approximately one-fourth as weak as the similar interactions $p\bar{p} \to n\bar{n}$ or $p\bar{p} \to n\bar{n}$ and $n\bar{n} \to n\bar{n}$.

Finally, we can assume in weak interactions that the (λp) transformation has a matrix element smaller by a factor 3.6 than the (np), $(\mu\nu)$, or $(e\nu)$ interactions, which do not differ from one another. Cabibbo's brilliant idea [2] cannot be regarded as proved in any manner in that part where it is assumed that (np) enters with a coefficient $\cos\theta$, since the difference is $1 - \cos\theta \cong 0.03 \ll 1$, and an effect of the same order can be obtained from electromagnetic corrections $^{2)}$.

Here is a curious numerical coincidence: we can assume that the λ-quark interaction is one-third as weak as that of the p and n quarks, and compare this with the fact that the electromagnetic interactions of the λ and n quarks (their charge) is one-third as weak as that of muons and electrons. The deviation of $\sin\theta \sim 0.27$ from $1/3$, just as the deviation of the other already mentioned coefficients from $1/3$, is small and can be due to extraneous causes.

The main difficulty of the proposed hypothesis lies in the fact that the quark mass m is assumed to be much larger than the baryon mass $^{3)}$ M, meaning that the mass defect δ, which depends on the main interaction of the quarks, is always close to the mass of the quark. This means that either $m_\lambda \cong m_p \approx m_n$ and $\delta_\lambda \cong \delta_p = \delta_n$, or especially $m_\lambda - \delta_\lambda \cong m_p - \delta_p = m_n - \delta_n$ when $m_\lambda \neq m_p$, which seems little likely at first glance. The approximate equality of the masses to δ is the equivalent of the assumption that the main part of the interaction (including neither the spin-spin nor the annihilation interaction) is symmetrical.

Assume that the quark masses are 5 - 10 BeV; a unity change in strangeness changes the mass of mesons and baryons by approximately 0.2 BeV. It follows from this, it seems, that the masses and the interaction (δ) of λ and p or n differ by only 2 - 4%.

It is possible, however, that the analysis of the asymptotic scattering cross sections at high energies, made by Sokoloff and Ahmedzadeh [5] on the basis of assumed additivity [6], also leads to the conclusion that the contribution made to the cross section by the strange quark interacting with p or n is appreciably different (by a factor 1.5 - 2) from the contribution of the p or n quarks interacting with each other.

Lipkin [6] notes that the predictions based on the assumed additivity of the contributions of the quarks to the scattering is satisfied in experiment much more accurately than the predictions that follow from unitary symmetry.

In this case, a role should certainly be played by the "main" or "very strong" interaction (with regards to which it is usually assumed that it is strictly symmetrical), and not by the "medium-strong" interaction, which may not be symmetrical and may cause mass splitting, etc. Consequently, the result of [5] confirms the proposed hypothesis.

Thus, in this hypothesis the observed symmetry of the hadrons would be the consequence of definite properties of the dynamics. In this sense, the hypothesis is contrary to the point of view of primary symmetry, and a fortiori to the theory of spontaneous symmetry breaking [7]. The direct proof of the hypothesis would be a large difference between the mass and the interaction of the free λ quark from the values for the p and n quarks.

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1) The symmetry of the properties of the p and n quarks, which is the basis of isotopic invariance, is not subject to doubt. The similarity of λ to p or n is confined to the equal spin 1/2 and to the equal baryon number.

2) Full allowance for these corrections at the np vertex is difficult, since the λ and n, p mass differences also are corrections of this kind. The natural hypothesis that the weak interaction is not completely universal was expressed in its time by Kobzarev and Okun' [3].

3) The suggestion by Freund and Predazzi [4] that the mass m is of the order of 0.5M can hardly be correct: creation of a large number of quarks in the statistical fireball equilibrium cannot be prevented by a centrifugal barrier. By way of a historical analogy, we recall that unsuccessful attempts were also made to explain the slow decay of Λ by means of a centrifugal barrier.