idence for $B^{\pm} \to \pi^{\pm} + \pi^{0}$ seems to rule out $(J=\text{odd})^{-}$ for the B. This would disagree with the experimental indication[6] of 1^{-}, but allows the theoretical predictions[7,8] of 2^{-} or 1^{+}.

On the basis of the data presented here, we cannot rule out the possibility that the peak in Fig. 1(a) is entirely due to a third resonance at this mass which is neither the f^{0} nor the B. If this were the case, then one might still argue that $f=B$.

There are, however, two more independent pieces of evidence that the f^{0} does not have $T=1$ and, therefore, in favor of $f \neq B$. These are the value ≥ 2 found for the f^{0} spin[4] and the triangle relations for the production processes. Using our $\pi^{-}p$ data[4] at 3.65 BeV/c for $\sigma(\pi^{-}+p \to f^{0}+n)$ and the La Jolla upper limit[9] at 3.5 BeV/c for $\sigma(\pi^{+}+p \to f^{+}+p)$, these triangle relations (based only on isotopic spin invariance) predict $\sigma(\pi^{-}+p \to f^{-}+p) \geq 0.25$ mb for an f^{-} with $T=1$. Our observed upper limit for this process is 0.1 mb. This seems to be strong evidence against $T=1$ for the f^{0}.

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SOME REMARKS ON THE LIFETIMES OF THE MASSIVE TRIPLETS*

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The unitary symmetry[1] model of the strong interaction, together with the assumption that the (strong) violating part of the interaction between mesons and baryons transforms like a component (F_{8}) of the eight-dimensional representation of SU(3), has received an impressive amount of experimental confirmation.[2] Concurrently, a model which seeks to explain these properties of the strong interactions on a more fundamental basis has been proposed by Gürsey, Lee, and Nauenberg.[3] In this model, the existence of two massive triplets α, β of massive bosons and fermions is postulated. These particles belong to three-dimensional representations of SU(3), and from their interaction with each other the main properties of the strong interaction follow in a natural way. As an experiment searching for such particles has already been proposed,[4] we felt it interesting to discuss what additional information can be inferred from the properties of such particles if they are to be found.

It has been suggested, moreover,[5,6] that the electromagnetic and weak interactions also transform like some components of the eight-dimensional representation of SU(3). If this is the case, then the α and β triplets can only undergo β decay among themselves, and ultimately the lightest α and β should be absolutely stable. In the following we will discuss the consequences of abandoning the above-mentioned hypothesis, and show that the lifetime for α and β decays is extremely sensitive to the nature of the interaction.

Consider first the weak interaction. The weak decays

$$\alpha \rightarrow M + M,$$

$$\beta \rightarrow B + M,$$

where M and B are the meson and baryon octets, can be induced by a weak interaction which contains terms transforming like the 3-, 6-, 15-, 24-, and 42-dimensional representations of SU(3). Assuming for this interaction a strength similar to that responsible for $\Lambda^0 \rightarrow p + \pi^-$ or $K^0 \rightarrow \pi^+ + \pi^-$,[7] the lifetime for a triplet of a mass of 5 BeV is of the order of $\approx 10^{-12}$ sec.

A more important contribution can perhaps come from the SU(3) symmetry-violating strong interaction. We recall that the main reason for assuming that the "intermediate strong" interaction transforms like the F_8 generator of SU(3) comes from the success of the mass formulas. These formulas are, however, verified only to a few percent; the discrepancy can be and has been attributed to the use of first-order perturbation theory.

We could assume, instead, that this discrepancy is due to an additional small term in the interaction Hamiltonian which has no definite transformation properties under SU(3). This is the same as saying that this additional term can be decomposed into many parts which transform like various SU(3) tensors. In particular, if terms are present which transform like the 3-, 6-, 15-, 24-, and 42-dimensional representations (and adjoint ones) of SU(3), these terms induce again the transitions

$$\alpha \rightarrow M + M,$$

$$\beta \rightarrow B + M,$$

with a lifetime for the α and β triplets which can make them completely unobservable as particles. In fact, if we assume this interaction to be of the order of 1% of the ordinary strong (pion-nucleon) interaction, the lifetime will be of the order of 10^{-21} sec.

Since the proposed experiments are looking for long-lived particles ($\geq 10^{-8}$ sec), their discovery would automatically prove the absence of the abovementioned term and lend support to the idea that we have found in strong interaction (and possibly in electromagnetic and weak as well) a new absolute symmetry principle. If, however, the α and β triplets are not found in their experiments, it could be due to the presence of very small terms of the type discussed above. In this case only more direct experiments (like production in a hydrogen bubble chamber with very high-energy protons) could prove the existence of the α and β triplets and give us information on the symmetry properties of interactions.

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