lelism of the fields (in favor of such an explanation are the locations of the irregularities on the curves, and the fact that the irregularities increase with increase of the angle between the fields).

The results presented in Ref. 6 and in the present note can not be explained within the framework of Shaposhnikov's theory if the spin relaxation time is considered to be independent of the value of the constant field. The problem of a theoretical explanation of these results requires further study.

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On the Theory of "Strange" Particles

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IN GELL-MANN'S THEORY,[1] which successfully describes the formation and decay of many heavy unstable particles recently discovered, the quantum number S (the strangeness) is introduced by its relation to the electric charge Q, namely

$$Q = I_3 + (n/2) + S/2, \tag{1}$$

where I_3 is the projection of the isotopic spin, and n is the total baryon number of the system (we shall henceforth call n the nucleon charge of the system). Gell-Mann's scheme is in good agreement with experiment, though it should be complemented with a theory which gives an interpretation to the "strangeness" S.

Among the various attempts to interpret the strangeness, of particular interest is the mathematical formulation of Gell-Mann's scheme which has been suggested by d'Espagnat and Prentki[2]. These authors postulate that the particles with semi-integral isotopic spin can be described by spinors of the first and second kind[3] in isotopic spin space. These spinors differ from each other under inversion in isotopic spin space: the first are multiplied by $+i$ (or $-i$), and the second by $-i$ (or $+i$). The existing particles are called isofermions (nucleons, θ-particles, anti-Ξ-particles) and anti-isofermions (antinucleons, anti-θ-particles, Ξ). Further, it is postulated that the Lagrangian which describes strong and electromagnetic interactions (using Gell-Mann's terminology) is invariant with respect to inversion in isotopic spin space.

It is not difficult to see that the Lagrangian obtained on the basis of these assumptions is invariant under simultaneous changes of the wave functions of all iso- and anti-isofermions according to

$$\varphi \to \varphi e^{i\alpha}, \quad \varphi' \to \varphi' e^{-i\alpha}, \tag{2}$$

where φ and φ' are the wave functions of all the iso- and anti-isofermions, respectively. From this follows a conservation law for the "isofermionic charge" u, which is equal to the number of isofermions minus the number of anti-isofermions. The isofermionic charge u differs from the nucleonic charge n in that n is conserved in all interactions, but u is conserved only in strong and electromagnetic interactions. It is then found that Eq. (1) can be written[2]

$$Q = I_3 + u/2. \tag{3}$$

It thus follows from (1) and (3) that

$$S = u - n, \tag{4}$$

so that the strangeness is interpreted as the difference between the isofermionic and nucleonic charges of the system.

We should like to make some remarks ,with reference to the theory of d'Espagnat and Prentki. Similarly as with the nucleonic charge, the isofermionic charge u of a single particle can take on only the values +1 (for an isofermion), −1 (for an anti-isofermion), or 0 (for an isoboson).* From this and

*When $|u| > 1$ there arise difficulties which can be eliminated only by dropping some terms in the interaction Lagrangian[7]. In this case, however, the ambiguity that arises essentially eliminates the value of the d'Espagnat-Prentki-theory.

from Eq. (4) it follows that for a single particle

$$|S| \leqslant 2, \tag{5}$$

so that according to the d'Espagnat-Prentki theory the strangeness cannot have an absolute value greater than 2.

Relation (2) is of interest in connection with the slow secondary particles recently observed in K^--meson decay[4-6]. The analysis of these events shows quite definitely that they are the decays of some kind of negative "superheavy" mesons or hyperons, whose mass is greater than $M(K) \approx 965\, m_e$ and $M(\Xi) \approx 2586\, m_e$.

If we do not consider isotopic multiplets containing particles with charges greater than unity, then by using Eq. (1) it is not difficult to show that the only negative metastable particle heavier than the mesons and hyperons known at present can be the following isotopic singlets: the meson ω^- (with $S = -2$) and the hyperon Ω with $S = -3$). Expression (5) excludes the latter possibility.

Thus according to the d'Espagnat-Prentki theory, the observed[4-6] K^--meson decays may be considered the decays of "superheavy" ω^--mesons with strangeness $S = -2$. Applying the selection rule $\Delta S = \pm 1$, suggested by Gell-Mann for slow processes[1], one may suppose that in the decay of the ω^--meson, there appears in addition to the K^--meson a particle with strangeness $S = -1$. If the existence of negative metastable hyperons heavier than Ξ is nevertheless proved, this will mean either that the d'Espagnat-Prentki[2] interpretation of Gell-Mann's model is invalid, or that this hyperon belongs to an isotopic multiplet containing particles with charge greater than 1.

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The Interaction Cross Section of π-Mesons and Nucleons at High Energies

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IT IS WELL KNOWN that at high energies the interaction cross section of π-mesons with nucleons approaches a constant limit, which is a result of the finite dimensions of the nucleon (neglecting the Coulomb interaction). In order to calculate this limit let us make use of dispersion relations which connect the imaginary and real parts of the scattered amplitude for zero scattering angle. For instance, for scattering of negative mesons by protons we have[1]

$$\operatorname{Im} f_-(\omega) = \frac{1}{2}\operatorname{Im} f_-(\mu)\left(1+\frac{\omega}{\mu}\right)+\frac{1}{2}\operatorname{Im} f_+(\mu)\left(\frac{\omega}{\mu}-1\right)$$
$$+\frac{\omega^2-\mu^2}{\pi}\,\mathrm{P}\int_0^\infty \frac{d\omega'}{\omega'^2-\mu^2}\left[\frac{\operatorname{Re} f_+(\omega')}{\omega'+\omega}-\frac{\operatorname{Re} f_-(\omega')}{\omega'-\omega}\right] \tag{1}$$
$$-\pi\sum_k \delta(\omega_k-\omega)\operatorname{Res} f_-(\omega_k);$$

here we have accounted for the fact that the amplitude may have poles at the points ω_k (we have made use of the fact that the residues $\operatorname{Res} f_-$ are real). The symbol P indicates that we take the principal part of the integral not only at those points where the denominator vanishes but at all poles of the functions $f_\pm$. Letting ω approach infinity in Eq. (1), we obtain

$$\sigma_\infty = 4\mathrm{P}\int_0^\infty \frac{d\omega}{\omega^2-\mu^2}\operatorname{Re}\left[f_+(\omega)+f_-(\omega)-f_+(\mu)-f_-(\mu)\right]. \tag{2}$$

Eq. (2) is symmetric with respect to f_+ and f_-, so that in the limit the cross sections for positive and negative mesons are equal[2]. In deriving Eq. (2), we have used the well known relation $\sigma = (4\pi/\omega)\operatorname{Im} f(\omega)$, as well as the condition $\operatorname{Im} f_\pm(\mu) = 0$. The term $\operatorname{Re}[f_+(\mu) + f_-(\mu)]$ is added for convenience (this clearly does not destroy the equality since $\mathrm{P}\int_0^\infty d\omega/(\omega^2-\mu^2) = 0$).

Let us break up the integral in Eq. (2) into two integrals over the regions $0 \leq \omega \leq \mu$ and $\mu \leq \omega \leq \infty$. In the first region we make use of the relation[1]