izing the degree of CP-parity nonconservation and M_d is the CP-odd part of the direct photon emission amplitude. Analogous remarks apply also to the decays $K^{*\pm} \rightarrow \pi^\pm K^0(\bar{K}^0)\gamma$ and $K^{*\pm} \rightarrow K^\pm \pi^0 \gamma$. We note only that the difference in the form of the spectrum of the particles and antiparticles is large in the case of $K^\pm$ mesons, since M_b for $K^\pm \rightarrow \pi^\pm \pi^0 \gamma$ has an additional degree of smallness, due to the rule BT = 1/2.

The authors are deeply grateful to L. B. Okun' for many valuable remarks.

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ON THE MASSES OF PARTICLES (RESONANCES) WITH STRANGENESS S = -4 AND S = +1

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Harari and Lipkin [1] considered several properties of a hypothetical baryon 35-plet, which according to the SU(3) symmetry contains particles with strangeness from $S = -4$ ($Y = -3$) up to $S = +1$ ($Y = +2$).

In the quark model, this supermultiplet differs in the fact that it is made up of four quarks and one antiquark (see the Table below). We should therefore expect a non-monotonic variation of the particle mass as a function of the strangeness S or hypercharge Y. In fact, in the 35-plet the excited nucleon state 1) with isospin $5/2^-$, N_5^* is made up of quarks, such as $4p, \bar{n}$; $3pn, \bar{n} + 4p, \bar{p}$; ..., $4n, \bar{p}$, i.e., without participation of strange quarks and antiquarks λ and $\bar{\lambda}$.

The state X_1 ($S = -4$, $I = 1/2$) is constructed like $4\lambda\bar{p}$; $4\lambda\bar{n}$ and it is natural to assume that X_1 is heavier than N_5^*, just as Ω is heavier than Δ in the decuplet, and just as Ξ is heavier than N in the octet; an intuitive common cause is the assumption that λ is heavier than n and p.

Thus, we expect a normal dependence of the mass on S or Y in the series $N_5 \ldots X_1$.

Let us turn to the state I_4 ($S = +1$, $I = 2$), which in terms of quarks is represented by $4p\bar{\lambda}$; . . .; $4n\bar{\lambda}$.

If λ is heavier than p and n, then $\bar{\lambda}$ is also heavier than $\bar{p}$ and $\bar{n}$ and we can therefore expect I_4 to be heavier than N_5^*; consequently, the quark model predicts here for the mass a strangeness dependence opposite from that which takes place in the octet and decuplet of baryons (but similar to the situation in mesons). However, such a situation does not contradict the existing concepts concerning mass splitting.

Within the framework of the Gell-Mann--Okubo formula

$$M = a + bY + c[I(I + 1) - 1/4\, Y^2] \tag{1}$$

simultaneous satisfaction of the conditions $M(X_1) > M(N_5^*)$; $M(I_4) > M(N_5^*)$ is possible, but requires that $c < 0$; in the quark model this is characteristic of the 35-plet. Experimentally, for the baryon octet, as is well known, $c = +39$ MeV, is positive, and is not connected with the difference in mass between λ and n or p.

We can offer one more qualitative argument in favor of the assumption that $c < 0$ in the 35-plet: let us compare N_3^* and N_5^*. The states N_5^* consist only of p, n, $\bar{p}$, and $\bar{n}$ (for example, $N_5^{*++} = (4/5)3pn,n + (1/5)4p\bar{p}$ - we present here the squares of the Clebsch-Gordan coefficients). This is seen from the fact that they are obtained by isotopic rotation from $N_5^{*+++} = 4p,\bar{n}$.

The states N_3^* contain also λ and $\bar{\lambda}$. Since λ and $\bar{\lambda}$ are heavier than p, $\bar{p}$, n, or $\bar{n}$, we expect N_3^* to be heavier than N_5^*, corresponding to $c < 0$. On the other hand, in the octet the state with the larger isospin Σ is heavier than the state with the smaller isospin Λ for equal S and Y, i.e., $c > 0$.

We assume that the mass difference between λ and n or p plays the principal role $^{2)}$, and put $m_\lambda - m_{n,p} = \mu$, and also $m(N_5^*) = m_0$, $m(X_1) = m_0 + 4\mu$, and $m(I_4) = m_0 + \mu$.

Comparing with (1), we obtain

$$6b = 3c = -\mu. \tag{2}$$

From consideration of the decuplet we obtain $\mu = 146$ MeV, while consideration of the octet yields $\mu = 191$ MeV.

The authors of [1] identified N_5^* with the resonance near 2400 MeV, and N_3^* with the resonance near 1500 MeV.

Actually, however, they apparently observed (see [2]) the resonance at 1560 ± 20 MeV with decay to $p + \pi^+ + \pi^+$, thus relating it to N_5^* (the maximum charge in N_3^* is obviously +2). Using the values obtained above for the constants b and c in formula (1), we get the following mass table:

Particle	Y	S	I	M, MeV	Decay	Threshold, MeV
I_4	+2	+1	2	1716-1760	$K\pi N$	1570
N_5^*	+1	0	5/2	1570	$\pi\pi N$	1210
N_3^*	+1	0	3/2	1814-1890	$\pi\pi N$	1210
Y_4	0	-1	2	1716-1760	$\pi\pi\Lambda$	1385
Y_2	0	-1	1	1910-2015	$\pi\pi\Lambda$	1385
Ξ_3^*	-1	-2	3/2	1863-1951	$\pi\pi\Xi$	1590
Ξ_1^*	-1	-2	1/2	2009-2141	$\pi\pi\Xi$	1590
Ω_2^*	-2	-3	1	2009-2141	$\pi\Omega$	1820
Ω_0^*	-2	-3	0	2106-2270	$\pi\pi\Omega$	1950
X_1'	-3	-4	1/2	2155-2332	$\bar{K}\Omega$	2180

In column M are given two values in MeV, corresponding to the two assumptions concerning μ. The last columns contain the decay schemes allowed by SU(3) symmetry, as given by Harari and Lipkin [1], and the corresponding thresholds.

We see from the comparison that only X_1 has a chance of being stable to the strong decay.

Along with the search for X_1 ($S = -4$), the greatest interest is attached to searches for a baryon with positive strangeness I_4 ($S = +1$). The expected threshold of the reaction

$$N + N = I_4 + \Sigma$$

in the laboratory system (one of the N is at rest) is of the order of $p_N = 4$ BeV/c, and for $\pi + N = I_4 + K$ the threshold is $p_\pi = 2.2$ BeV/c.

A reaction of particular interest is

$$\pi^+ + p = I_4^{+++} + K^-, \qquad I_4^{+++} = p + \pi^+ + K^+.$$

I take the opportunity to thank L. B. Okun' for a discussion.

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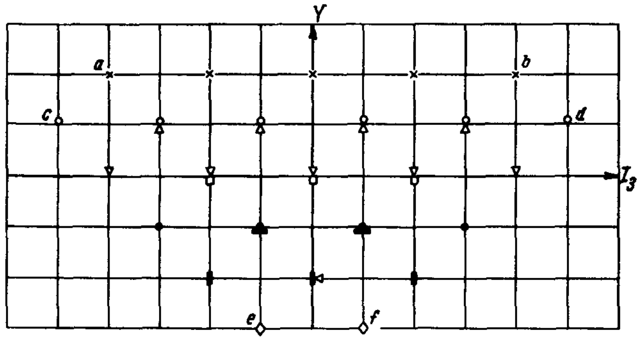
1) The index is equal to double the isospin (2I) throughout.

2) The example of an octet with splitting $m(\Sigma) - m(\Lambda) = 78$ MeV shows that the foregoing assumption is of rather low accuracy; all the mass estimates presented below are quite crude.

APPENDIX

For reference purposes, we present in coordinates I_3 and Y the 35-plet scheme of [1]. The particle designations and compositions are listed in the caption, where the parentheses contain the electric charges of the particles.



× - $I_4(+3_{go}-1)$; ○ - $N_5^*(+3_{go}-2)$; △ - $N_3^*(+2_{go}-1)$; ▽ - $Y_4(+2_{go}-2)$; □ - $Y_2(+1_{go}-1)$;
● - $\Xi_3^*(+1_{go}-2)$; ▬ - $\Xi_1^*(0,-1)$; ▮ - $\Omega_2(0_{go}-2)$; ◁ - $\Omega_0(-1)$; ◇ - $X_1(-1,-2)$
$a = 4n\bar{\lambda}$; $b = 4p\bar{\lambda}$; $c = 4n\bar{p}$; $d = 4p\bar{n}$; $e = 4\lambda\bar{p}$; $f = 4\lambda\bar{n}$

SPLITTING OF EPR LINES OF Cr^{3+} IN $ZnWO_4$ BY AN EXTERNAL ELECTRIC FIELD

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The paramagnetic ion Cr^{3+} in xinc tungstate replaces the Zn^{2+} ion [1]. The position of the Zn^{2+} ion in the crystal [2] is not a symmetry center relative to inversion (point group