СООБЩЕНИЯ
ОБЪЕДИНЕННОГО
ИНСТИТУТА
ЯДЕРНЫХ
ИССЛЕДОВАНИЙ
ДУБНА

E2 - 8586

R.M.Muradyan

EMPIRICAL MASS RATIO OF HADRONS

1975

E2 - 8586

R.M.Muradyan

EMPIRICAL MASS RATIO OF HADRONS

There exists a simple and accurate relation between the masses in the baryon octet, namely,

$$m_p : m_\Lambda : m_\Sigma : m_\Xi \quad 1 : \sqrt[4]{2} : \sqrt[3]{2} : \sqrt{2} .$$

It may be noted (Table I), that the ratio $\frac{m_\Lambda}{m_p}$ $\sqrt{2}$ is almost exact, while the masses of Σ and Ξ are reproduced within several MeV, corresponding to electromagnetic mass differences.

Table I. Baryon octet *

Baryon	Ratio $\frac{m}{m_p}$		Mass m (MeV)	
	Theory	Expt.	Theory	Expt.
p	1	1	938.28	938.28
Λ	$\sqrt[4]{2}$	1.189	1115.61	1115.60
Σ^+	$\sqrt[3]{2}$	1.267	1182.23	1189.37
Ξ^-	$\sqrt{2}$	1.408	1326.73	1321.29

* Experimental masses are taken from Ref. [1]. Note that $\sqrt[4]{2} = 1.189$, $\sqrt[3]{2} = 1.260$ and $\sqrt{2} = 1.414$.

The ratio $\frac{m_\Xi}{m_N} = \sqrt{2}$ has previously been noticed by Takabayasi [2], who also proposed the empirical relation

$$m_N^2 + m_\Xi^2 = m_\Lambda^2 + m_\Sigma^2 .$$

This relation is fulfilled almost identically by our "theoretical" masses

$$1 + 2 = 3; \quad \sqrt{2} + (\sqrt[3]{2})^2 = 3.002 .$$

It is interesting to note, that Gell-Mann-Okubo relation

$$\frac{m_N + m_\Xi}{2} = \frac{3m_\Lambda + m_\Sigma}{4}$$

is fulfilled exactly:

$$\frac{1 + \sqrt{2}}{2} = 1.207 = \frac{3\sqrt[4]{2} + \sqrt[3]{2}}{4} .$$

Finally, we note, that the masses of new neutral vector bosons $\psi(3105)$ and $\psi(3695)$ [3] are connected by

$$\frac{m_{\psi(3695)}}{m_{\psi(3105)}} = \sqrt[4]{2}$$

or numerically,

$$1.190 \approx 1.189 .$$

Empirical relations, considered in this note, have striking simplicity and high numerical precision. It may happen, that they are not simply accidental and have yet unknown physical foundation.

References

1. Particle Data Group. Review of Particle Properties. Physics Letters, 50B, N. 1 (1974).
2. T.Takabayasi. Progr.Theor.Phys., 29, 474 (1963).
3. J.J.Aubert et al. Phys.Rev.Lett., 33, 1404 (1974); J.-E.Augustin et al. Phys.Rev.Lett., 33, 1406 (1974).

Received by Publishing Department
on February 6, 1975.