
THE EIGHTFOLD WAY

Chen Wanyun

In 1961, Murray Gell-Mann introduced the so-called *Eightfold Way*. The Eightfold Way classified the hadrons and arranged the baryons and mesons into weird geometrical patterns, according to their charge and strangeness.

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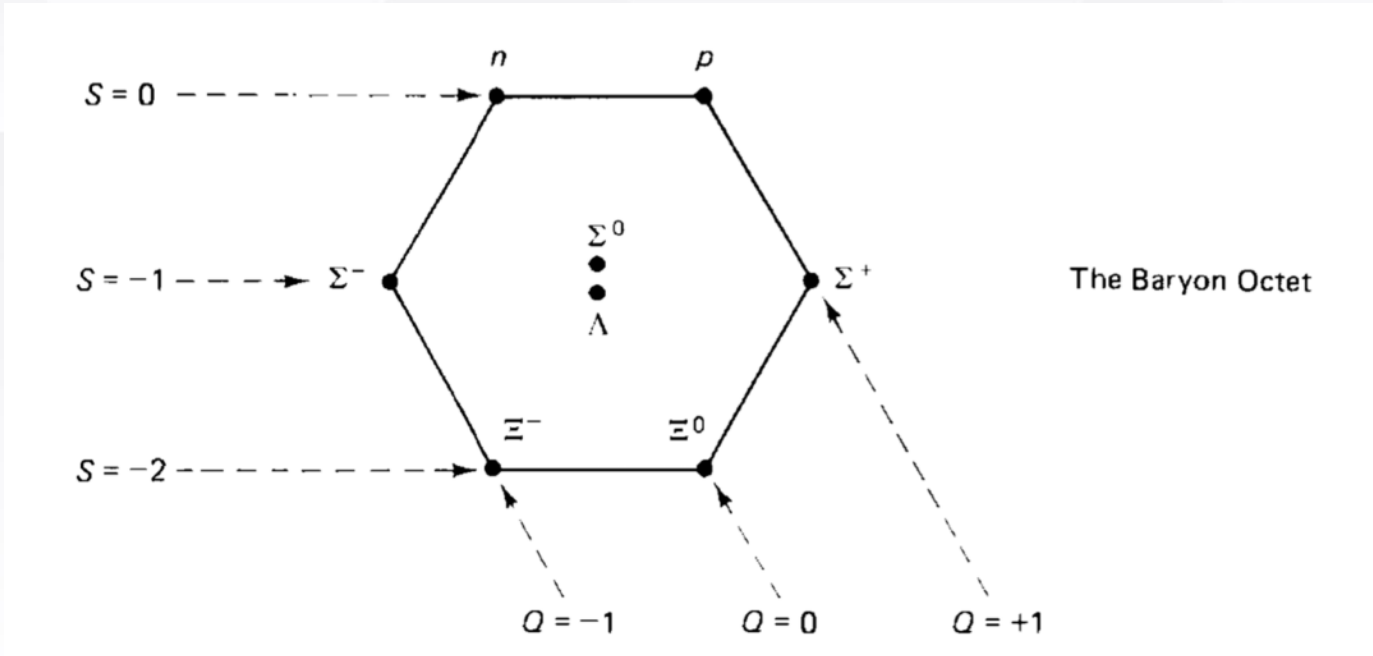
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baryons

2

mesons

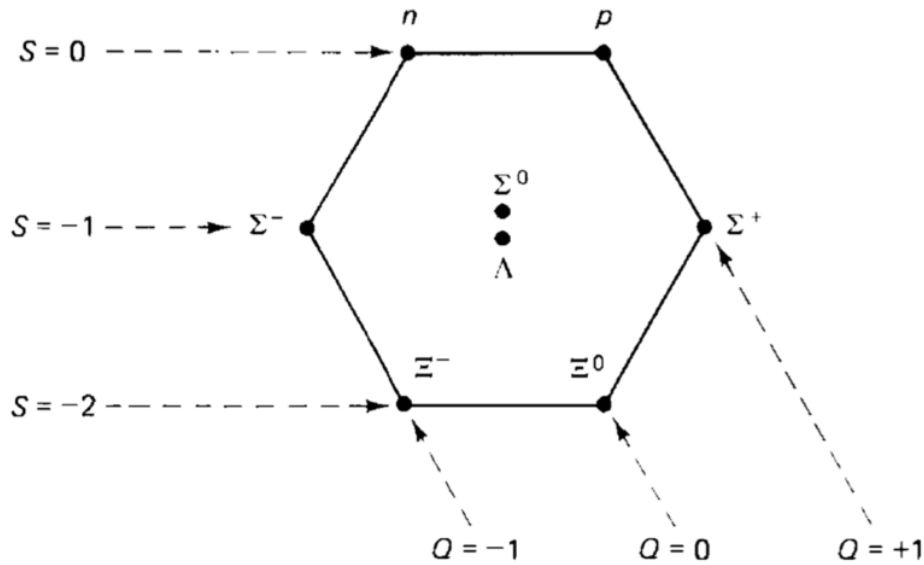
The eight lightest baryons fit into a hexagonal array, with two particles at the center:



This group is known as the *baryon octet*.

Particles of like charge lie along the downward-sloping *diagonal* lines:

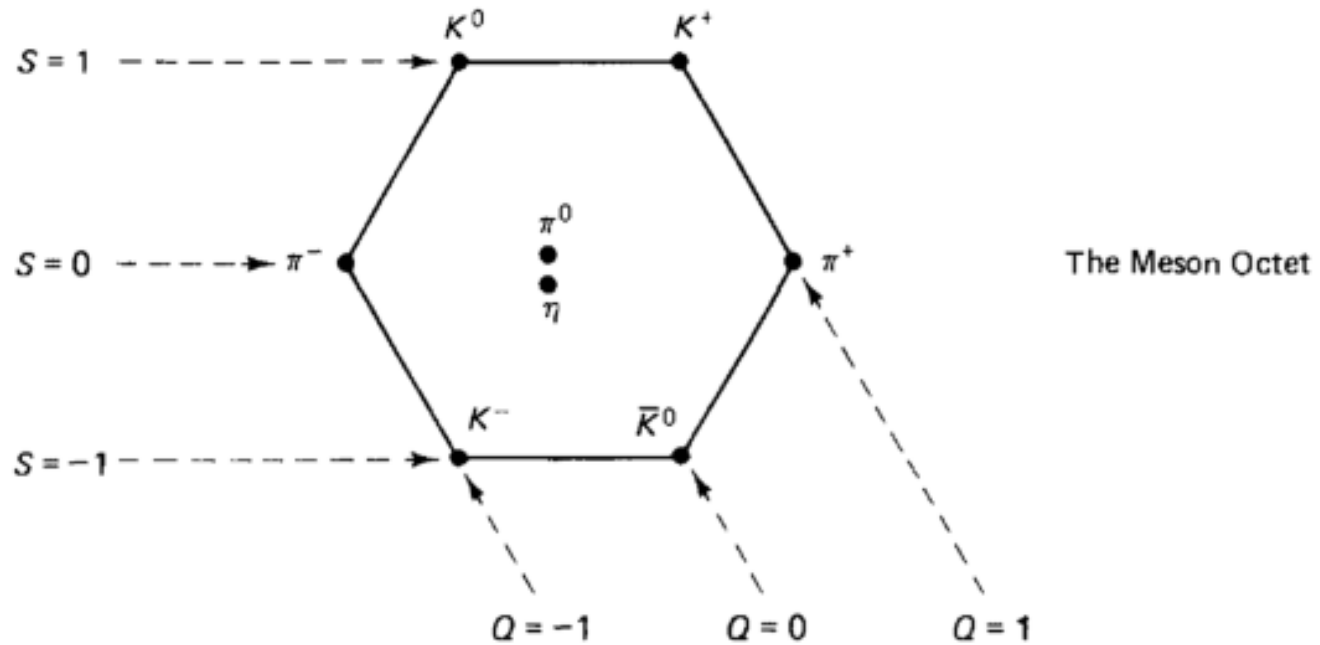
- $Q=+1$ for the proton and the Σ^+ ;
- $Q=0$ for the neutron ,the lambda,the Σ^0 and the Ξ^0 ;
- $Q=-1$ for the Σ^- and the Ξ^- .

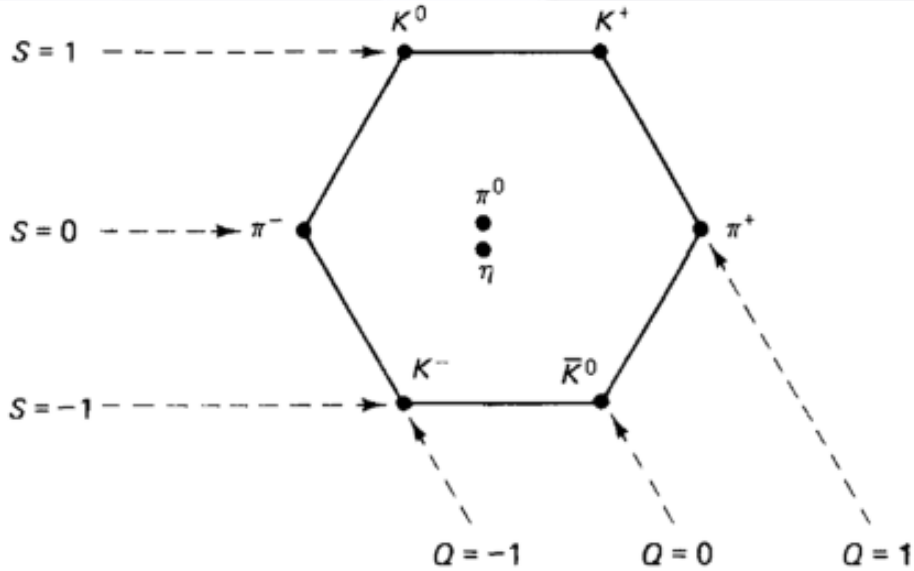


Horizontal lines associate particles of like strangeness:

- $S=0$ for the proton and the neutron
- $S=-1$ for the middle lines ;
- $S=-2$ for the two Ξ 's.

The eight lightest mesons fill a similar hexagonal pattern, forming the *meson octet*:





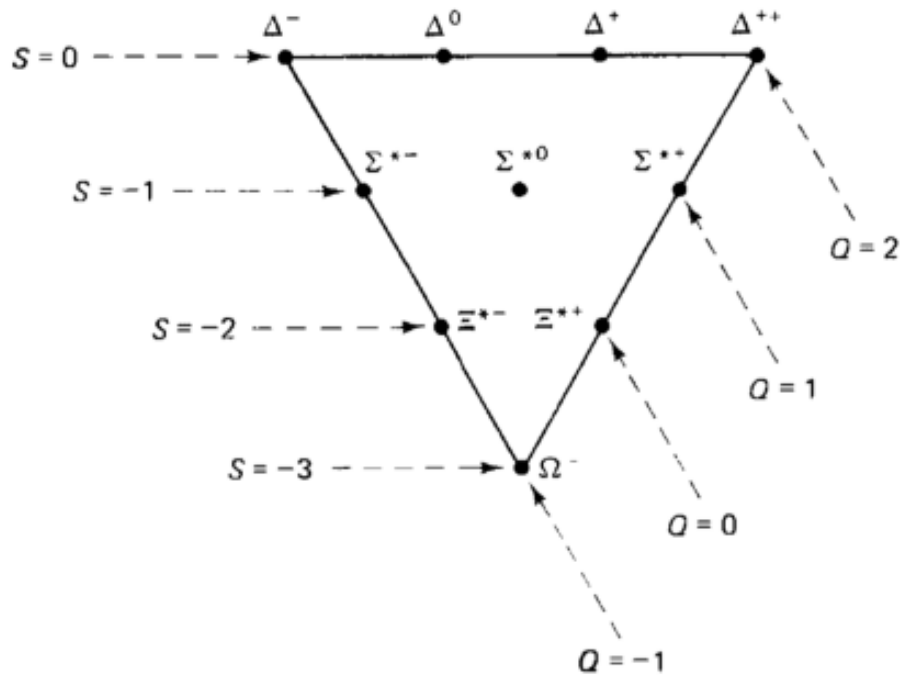
Particles of like charge lie along the downward-sloping *diagonal* lines:

- $Q=+1$ for the K^+ and the π^+ ;
- $Q=0$ for the K^0 ,the \bar{K}^0 ,the π^0 and the η ;
- $Q=-1$ for the K^- and the π^- .

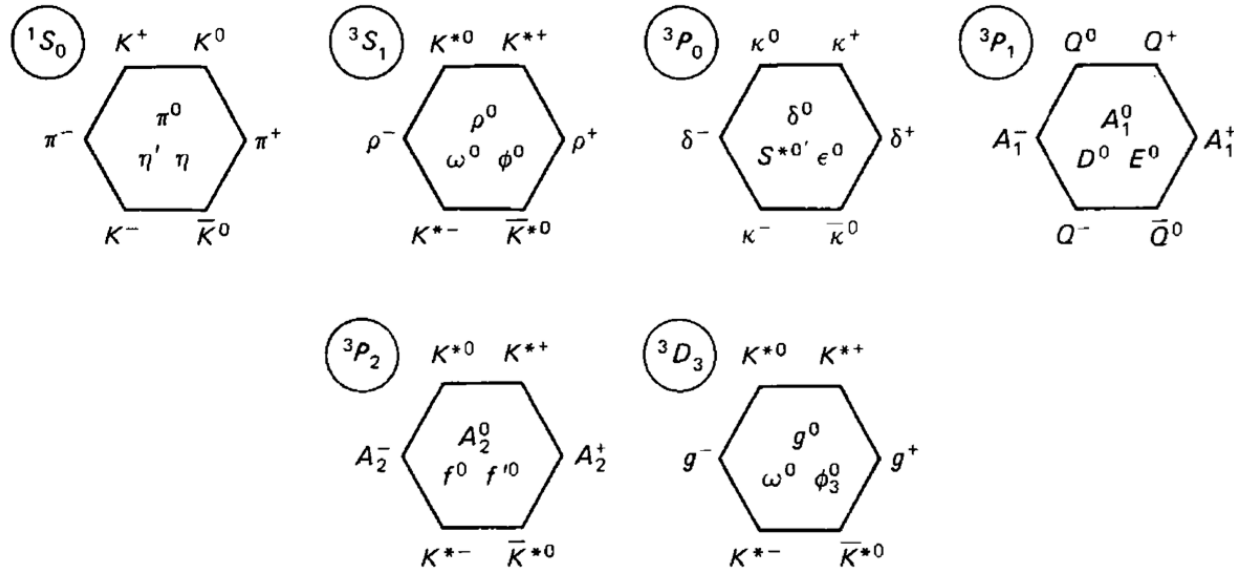
Horizontal lines associate particles of like strangeness:

- $S=1$ for the K^0 and the K^+ ;
- $S=0$ for the middle lines ;
- $S=-1$ for the K^- and the \bar{K}^0 .

Hexagons were not the only figures allowed by the Eightfold Way: there was also, for example, a triangular array, incorporating 10 heavier baryons--the *baryon decuplet*:



The Baryon Decuplet

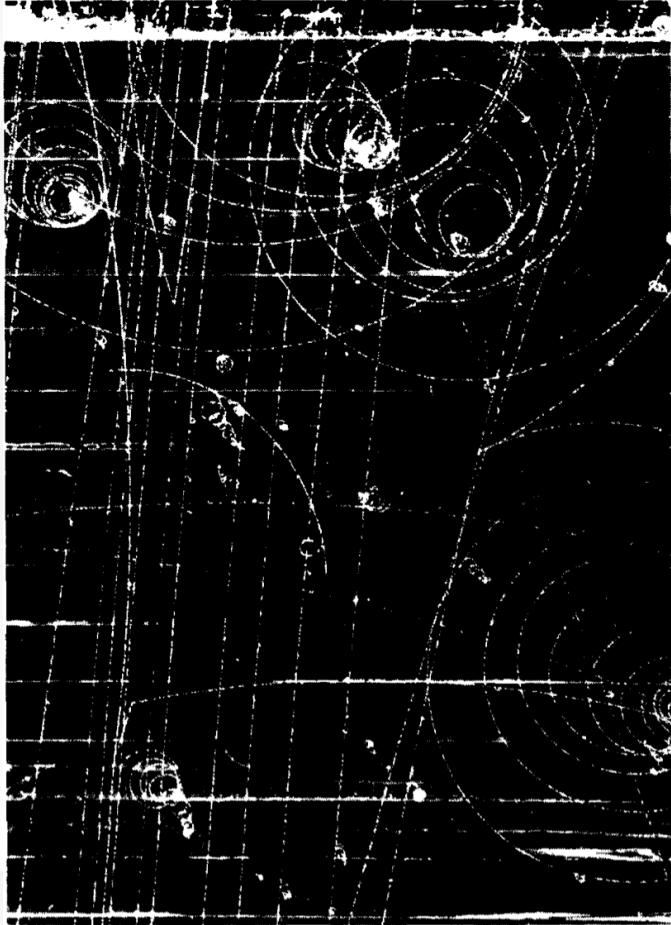


It is customary to distinguish different particles represented by the same letter by indicating the mass parenthetically, thus $K^*(892)$, $K^*(1430)$, $K^*(1650)$, and so on.

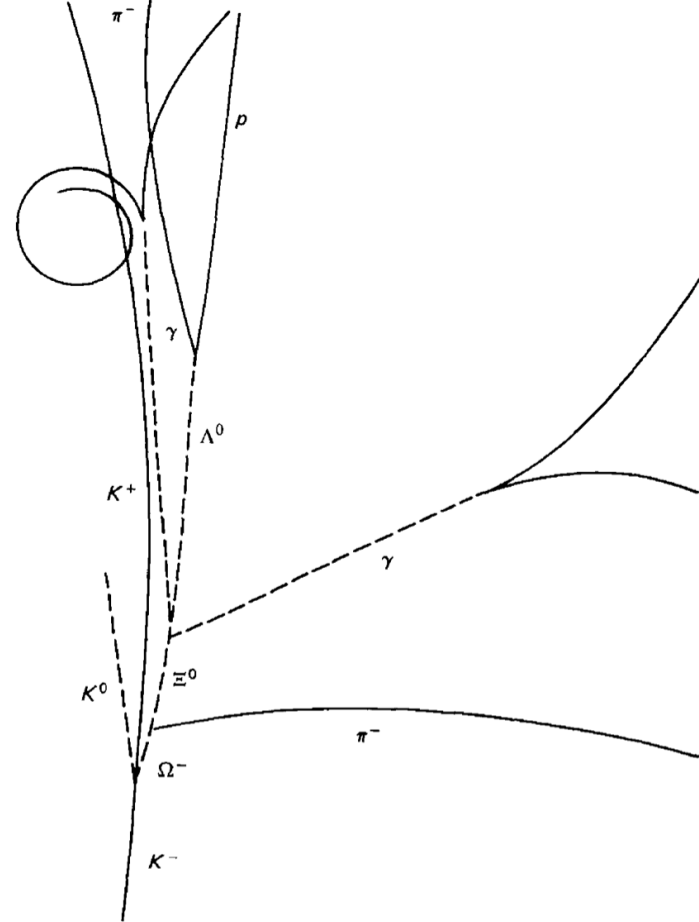
In this figure, the supermultiplets are labeled in spectroscopic notation. At present, there are no complete baryon supermultiplets beyond the octet and decuplet, although there are many partially filled diagrams.

As Gell-Mann was fitting these particles into the decuplet, nine of the particles were known experimentally, but the tenth particle--the one at the very bottom, with a charge of -1 and strangeness -3 --was missing.

He predicted that such a particle would be found, finally in 1964 the famous *omega-minus* particle was discovered.



The actual bubble chamber photograph



A line diagram of the relevant tracks

Classification is the first stage in the development of any science. The Eightfold Way did more than merely classify the hadrons, but its real importance lies in the organizational structure it provided. It's fair to say that the Eightfold Way initiated the modern era in particle physics.

Thank you!
