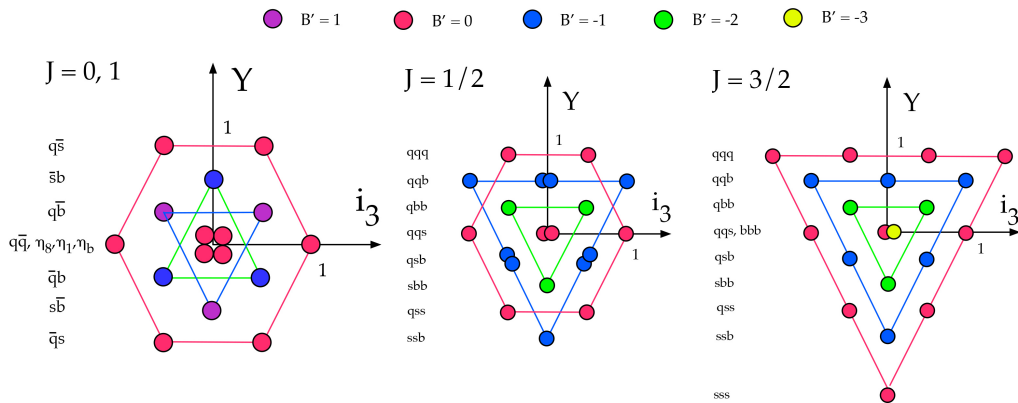


The Quark Structure of Hadrons

Prof. C. Amsler (SMI)



Multiplets containing the u, d, s and b quarks (q stands for u or d). Left: 16-plet of the ground state pseudoscalar and vector mesons. Middle and right: 20-plets of the ground state spin- $\frac{1}{2}$ and $\frac{3}{2}$ baryons.

In these lectures (7 × 2 hours) we will discuss the spectrum of light and heavy mesons and baryons composed of the u, d, s, c and b quarks and derive some of their properties based on symmetries, such as masses and angular distributions in scattering or decays, and compare with experiments. The lectures are phenomenologically oriented and are intended as complementary material to the introductory courses in particle physics.

Provisional programme:

- Introduction: P-, C- and G-parity, classification of hadrons and nomenclature.
- Spin and isospin, SU(2), charge independence. Coupling of two spin- $\frac{1}{2}$ (or isospin $\frac{1}{2}$) particles, Young tableaux. Coupling of three spin- $\frac{1}{2}$ particles.
- SU(3) flavor, SU(3) wave functions. Applications: magnetic moments of baryons, ideal mixing, mass formulae.
- Extension to SU(4), bottom and charm hadrons.
- States beyond the simple quark model. Brief review on gluonic states, tetraquark and pentaquark states.
- General method to determine the spins of hadrons from angular distributions (helicity formalism).

Bibliography:

- Review of Particle Physics, Chinese Physics C38 (2014) 09001 and 2016 update
 C. Amsler, Nuclear and Particle Physics, IOP Publishing (2015)
 D. Flamm and F. Schöberl, Quark Model of Elementary Particles, Gordon and Breach (1982)
 F. E. Close, An Introduction to Quarks and Partons, Academic Press (1979)
 W.S.C. Williams, An Introduction to Elementary Particles, Academic Press (1971)
 C. Amsler and N. Törnqvist, Physics Reports 389 (2004) 61

25.5.2016