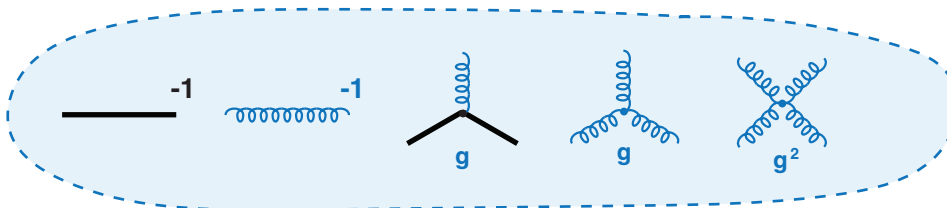


NPStrong @ LIP: Strong Interaction Theory

NPStrong group: 5 permanent members + several PhD and master students

Hadrons: strongly interacting particles - **Baryons** (p, n, Δ , Λ , ...) and **Mesons** (π , K, J/ψ , ...)

- Understand hadrons through the fundamental theory of the strong interaction - QCD
- QCD is the quantum field theory of **quarks** and **gluons**
- Hadrons live in the **strong coupling** regime – everything is complicated!



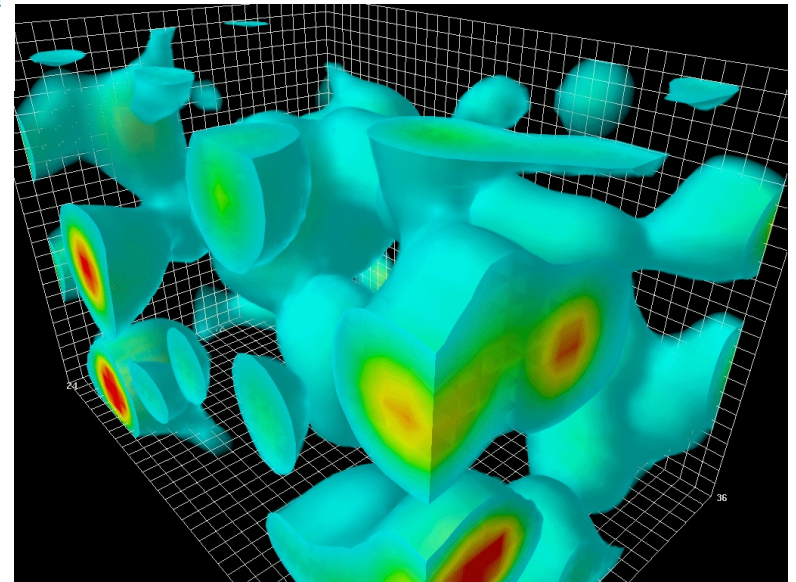
Quarks and gluons are confined inside hadrons

How exactly does **Confinement** work?

In QCD even the zero-body problem is complicated

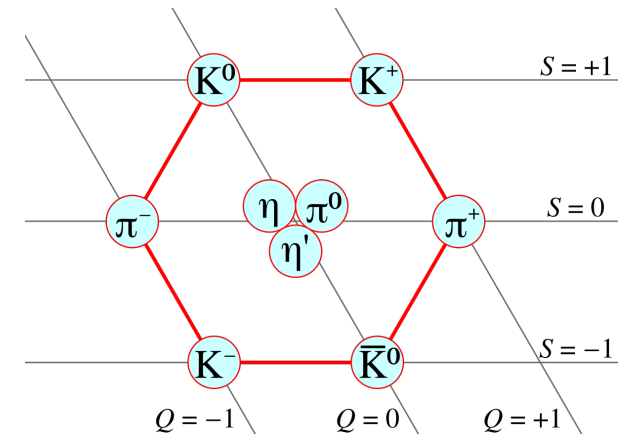
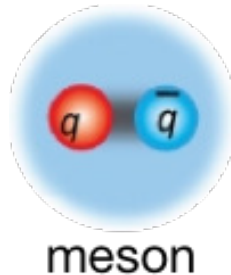


QCD vacuum action density

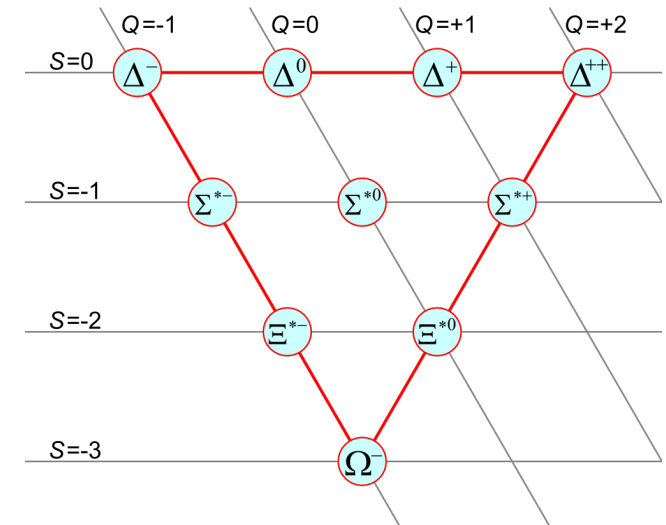


NPStrong @ LIP: Strong Interaction Theory

Mesons: Bound states of quarks and antiquarks



Baryons: Bound states of three quarks



- Which hadrons exist?
- What are their masses?
- What is their structure?
- How do they form?
- How do they decay?
- How do they interact with other particles?

NPStrong @ LIP: Strong Interaction Theory

Dynamical mass generation in hadrons:

Proton: uud mass 938 MeV

But quarks u, d mass only 3-5 MeV

Where does the missing mass come from?

Bare quark

Dressed quark

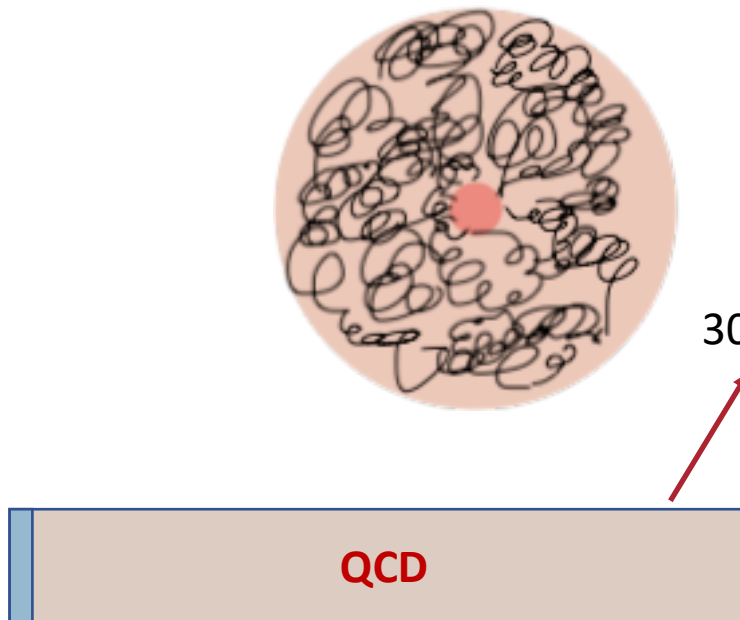
With
self-interaction!

5 MeV

300 MeV

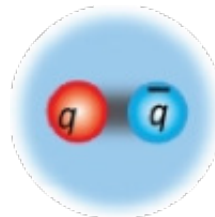
Higgs

QCD

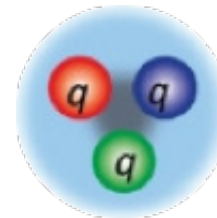


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Conventional hadrons

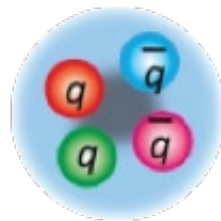


meson

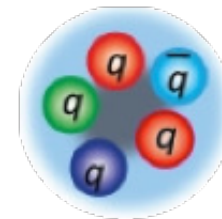


baryon

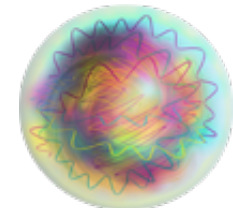
Exotic hadrons



tetraquark



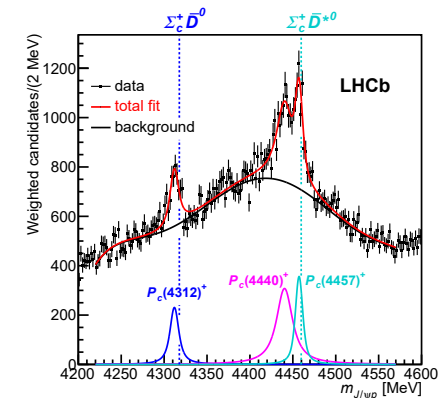
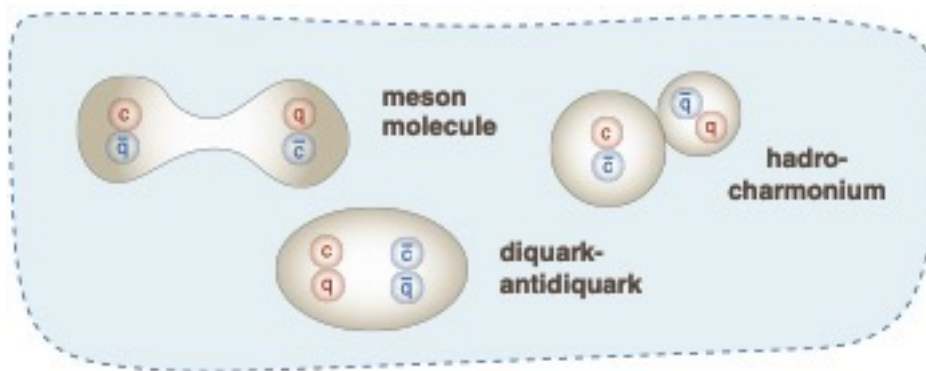
pentaquark



glueball

What is their internal structure?

Example: $c\bar{c}q\bar{q}$



Aaij et al., PRL 112 (2019)