

5/19/16 Lecture 15 outline / summary

- Today: evidence for $SU(3)_C$.
- Recall the $j = 3/2$ baryons, they were completely symmetric in spin and $SU(3)_F$.

But quarks are fermions and the complete wavefunction should be fully antisymmetric. $SU(3)_C$ fixes this: the baryons are made up of 3 quarks, each in the 3 of $SU(3)_C$, combined into a color neutral object using $\epsilon_{c_1 c_2 c_3}$. More on the $SU(3)$ multiplication rules.

- More evidence: $e^+e^- \rightarrow \gamma \rightarrow q\bar{q} \rightarrow \text{jets}$. Compute tree-level amplitude and motivate $\sigma = (\pi/3)(Q\alpha/E)^2$ and hence $R = \sigma(e^+e^- \rightarrow \text{jets})/\sigma(e^+e^- \rightarrow \mu^+\mu^-) = N_c \sum Q_i^2$. Experimentalists measure this, and thereby show that $N_c = 3$.

- More about \mathcal{L}_{QCD} and $U(1)_{QED}$ vs $SU(3)_C$ gauge invariance.