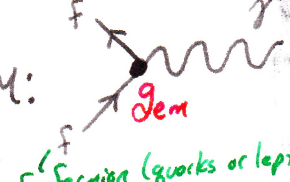
Feynman Diagrams: Hand Out

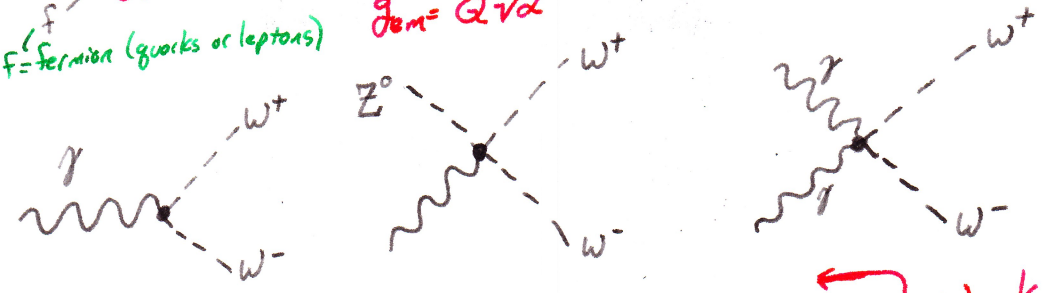
Allowed Vertices:

EM: 

f = fermion (quarks or leptons)

g = Coupling Strength

$g_{em} = Q\sqrt{\alpha}$

EM + Weak: 

Weak: 

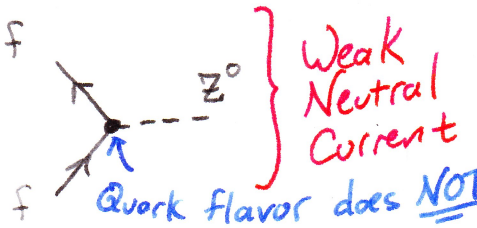
ℓ = leptons

Quark Flavor changes!

Weak Charge Currents

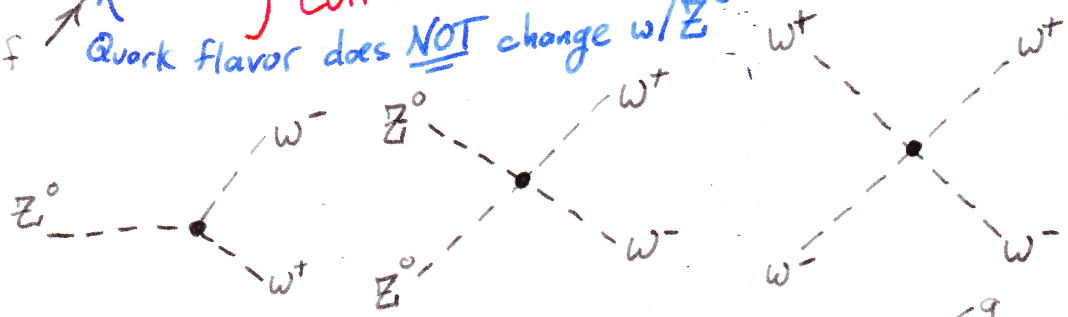
Cabibbo

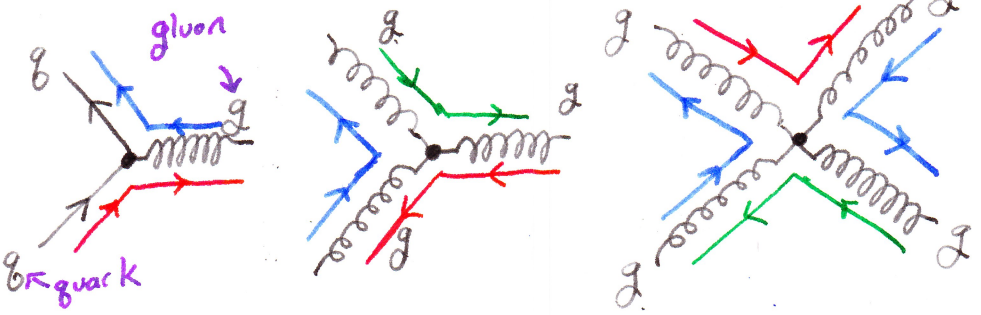
If change in same family → Favored
Crosses 1 family → Suppressed
Crosses 2 families → Doubly Suppressed



Weak Neutral Current

Quark flavor does NOT change w/ Z°



Strong: 

g = quark

Quantum Numbers & Conservation

Conserved

- Electric Charge (Q)
- Baryon Number (B)
- Lepton Number (L)
- Total Angular Momentum (J)
- Color Charge

Approximately Conserved

- Quark Flavor → Not conserved with $W^\pm$ interactions
- Lepton Flavor/Family → Not conserved in neutrino oscillations
- Parity → Can be violated in weak interactions

How to Draw Feynman Diagrams: Handout

(or "How to Determine if Process is Allowed)

Nuclear Physics

1) Write down initial & final states, noting quark content of all hadrons. Initial & final states must be colorless.
2) Draw the simplest diagram using Standard Model vertices.
3) Make sure entire system conserves Energy, Momentum, Charge, Baryon #, Lepton #, Angular Momentum, and Color.
4) Make sure "approximate conservation" is broken only in interactions where it is allowed.
5) Check symmetry for identical particles in the final state.

- If steps 1-5 are satisfied, processes will occur via Strong, EM, & Weak Interactions (favored in that order)

Note: Typically, full diagrams have an even # of vertices except in certain special cases

FORBIDDEN VERTICES

↳ These vertices are never allowed