Outline

- Relativistic Kinematics
  - (4-momentum)2 invariance, invariant mass
  - Hypothesis testing, production thresholds
  - Cross-sections, flux and luminosity, accelerators
  - Particle lifetime, decay length, width
- Classification of particles
  - Fermions and bosons
  - Leptons, hadrons, quarks
  - Mesons, baryons
- Quark Model
  - Meson and baryon multiplets
  - Isospin, strangeness, c, b, t quarks
- Particle Interactions
  - Colour charge, QCD, gluons, fragmentation, running couplings
  - Strong and weak decays, conservation rules
  - Virtual particles and range of forces
  - Parity, charge conjugation, CP
  - Weak decays of quarks
  - Charmonium and upsilon systems
- Electroweak Interactions
  - Charged and neutral currents
  - W, Z, LEP experiments
  - Higgs and the future
- LHC Experiments
- Future – introduction to accelerator physics

Today

- Lecture 13 (4 slides/page) - Quark flavour conservation, CKM matrix
  - Griffiths, pp. 74-77, 324-329.
  - Williams not the best for this topic

Previous lecture

- Lecture 12 (4 slides/page) - Strong and weak decays, conservation rules
  - Griffiths, pp. 66-71,79-82, 84-85.

Strange Particle Production

- Properties of SI, WI important in production/decay of strange and heavier quarks
- Production requires strong (or EM) to give large cross-section. Requires ss production to conserve strangeness
  - Strange hadrons created in pairs - so-called "associated production"
- SI decay 13 orders magnitude faster than WI, so WI decays only observed when SI/EM forbidden by (e.g.) flavour conservation rules.
- Heavier strange hadrons (i.e. excited states) decay to lighter strange hadrons by SI
  - Conserves flavour and other quantum numbers
  - Typical lifetime of strong decays ~10^{-22}-10^{-23}s, called resonances
- Process continues until arrive at lightest strange hadrons (kaons), which are stable under SI because of strangeness conservation