Goals and Literature List for Cycle 8 of Phenomenology and Experiment of Particle Physics.

Literature

John F. Donoghue, Eugene Golowich and Barry R. Holstein, *Dynamics of the Standard Model* (1994), Cambridge University Press, sections VIII.2, Chapter IX and XIV.2-6.

A very extensive review is A. Buras et al., Rev.Mod.Phys.68:1125-1144,1996 hep-ph/9512380 and the Les Houches lectures of A. Buras, hep-ph/9806471. There are also the various more recent lectures by A. Buras,hep-ph/0505175, R. Fleischer, hep-ph/0608010 and I. Bigi, hep-ph/0601167, hep-ph/0701273. The latter makes for interesting reading.

A more experimentally oriented overview (of new physics reaches) is the talk by M. Schmelling available via http://weblib.cern.ch/abstract?CERN-LHCB-2005-090

A first introduction to some aspects of flavour physics you have already had in the first SME cycle. In particular, there you did learn how phases can be measured experimentally. In this cycle the goal is to cover several aspects of flavour physics concentrating on the nonleptonic sector. The main goal is to understand how the various measurements are related to the underlying standard model (or beyond) parameters. This involves several steps, removing the really heavy (weak scale or heavier) degrees of freedom. Then using the renormalization group to bring the resulting effective theory down to the relevant scale for the decaying particle and finally estimating the hadronic matrix element or finding observables that depend on the same hadronic matrix-element, possibly after using symmetry arguments.

Goals

- Understanding the way strong interactions and especially the large logarithms are included in the theoretical description.
- How are the heavy quark flavours detected.
- Differences between dedicated flavour experiments and the more general ones.
- Understanding the place of flavour physics in the general LHC and particle physics program.

Exercises

- How much of the $\Delta I = 1/2$ rule comes from short-distance? Give arguments why you think this is the correct number.
- Which processes are Penguin dominated and which are not; can you explain why? $B^0 \to \mu^+\mu^-$, $B^0\pi^0K^0$, $B^0 \to \pi\pi$, $B_s^0 \to D_s\pi$.
- Explain why B_s measurements are a good complement to B_0 and K_0 studies.
- Recently D^0-$\overline{D}^0$ mixing has been observed. Explain why the standard model contribution is expected to be small.
- Compare the way ATLAS/CMS and LHCb intend do to B-physics, i.e. the identification and which physics they might be able to do.