1. FLAVOUR CONSTRAINTS ON NEW PHYSICS .....

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The Standard Model appears, so far, to be a good description of experimental data. Despite vast progress in the past two decades very precisely measuring quark flavour-changing processes, no flaws of the Standard Model have yet been discovered. This success of the Standard Model has consequences for extenstions to it, so-called "Beyond the Standard Model" (BSM) models.

Let us suppose there is a more accurate high-energy theory than the Standard Model, and that it has a characteristic energy scale Λ, typically much larger than the W boson mass M_W. At energies well-below Λ, BSM effects should be described by a low-energy effective field theory, of which the Standard Model Lagrangian is the leading-order term. Corrections to the Standard Model appear due to higher-order (higher-dimension) terms in the effective Lagrangian.

In your essay you should (at a minimum)

- briefly motivate the expectation of physics beyond the Standard Model;
- introduce the effective field theory which would describe BSM physics at scales of M_W and below;
- discuss constraints from experimental results on terms which can appear in the effective Lagrangian (a very important example being constraints from kaon mixing);
- give an example or two of specific BSM models or frameworks which avoid some of these experimental constraints in a "natural" way.

Relevant Courses

Essential: Standard Model

References

[1] G Isidori, Y Nir, G Perez, Ann. Rev. Nucl. Part. Sci. **60**, 355 (2010) [arXiv:1002.0900].
[2] O Gedalia and G Perez, arXiv:1005.3106.
[3] M Bona *et al.*, JHEP 0803, 049 (2008) [arXiv:0707.0636].