TRIUMF Summer Institute 2006
Questions for "Beyond the Standard Model" lectures 4 and 5
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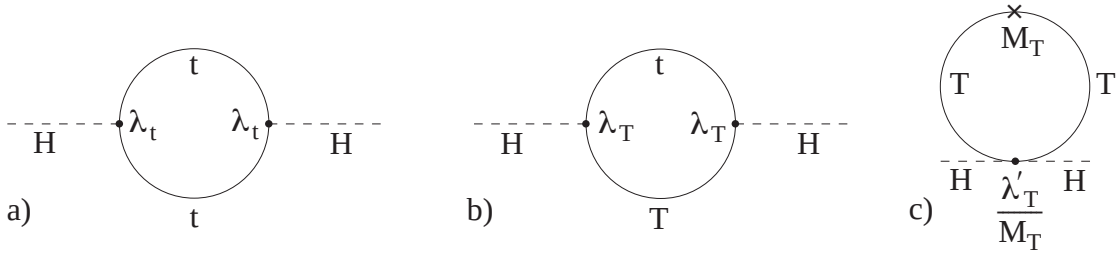
(a) is a quick "comprehension question", designed to check that the material is understood.
(b) is a "calculational question" meant to be marked.

1. (Lecture 4, Thursday July 20)

   (a) Why might the T-odd heavy gauge bosons in Little Higgs models with T-parity be harder to discover than the heavy gauge bosons in models without T-parity? How would you go about searching for the T-odd heavy gauge bosons? Draw a few Feynman diagrams for their production and decay at the LHC.

   (b) Derive the sum rule for the cancellation of the quadratically divergent Higgs mass corrections from top quark loops in Little Higgs models:

$$\lambda_t^2 + \lambda_T^2 = \lambda'_T$$



   The relevant Feynman rules for the vertices are:

$$\begin{aligned} H\bar{t}t: &\quad i\lambda_t \\ H\bar{t}T: &\quad i\lambda_T P_R \\ H\bar{T}t: &\quad i\lambda_T P_L \\ HH\bar{T}T: &\quad i\lambda'_t/M_T, \end{aligned}$$

   where $P_{R,L} = (1 \pm \gamma_5)/2$ are the right- and left-projection operators. As in the homework for Lecture 1, you need only keep the leading $\int d^4p/p^2$ part of the loop integrals.

2. (Lecture 5, Friday July 21)

   (a) In the ADD model, the graviton KK modes couple to SM particles with the extremely weak gravitational strength, and thus you need the huge multiplicity of KK states to get any visible signal. In the RS model, on the other hand, I showed a plot of individual graviton KK-mode resonances. Why do these couple strongly enough to be detected individually?

   (There is no part (b) for Lecture 5. Have a good trip home!)