

Evolution of Yukawa Couplings and Quark Flavor Mixings in 5D MSSM

Supervisor: Alan. Cornell

Ammar. Abdalgabar

School of Physics and Center for Theoretical Physics, University of The Witwatersrand

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Outline

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Brief introduction

- The fermion mass spectrum tell us

$$m_u \ll m_c \ll m_t, m_d \ll m_s \ll m_b, m_e \ll m_\mu \ll m_\tau$$

- We have chosen to work with Minimal UED model, extra dimension is compactified on a circle of radius R with Z_2 orbifold will identify the fifth coordinate $y = -y$.
- In this work we study 5D Minimal Supersymmetric Standard Model(MSSM), Different possibilities for the matter fields are discussed that is where they are in the bulk or localized to the brane.

Theoretical Calculations

- The one-loop RGEs for Yukawa Couplings are

$$16\pi^2 \frac{dY_u}{dt} = Y_u \left[3\text{Tr}(Y_u^\dagger Y_u)\pi S^2 - \left(\frac{13}{15}g_1^2 + 3g_2^2 + \frac{16}{3}g_3^2 \right) S(t) \right. \\ \left. + (3Y_u^\dagger Y_u + Y_d^\dagger Y_d)\pi S^2 \right]$$

$$16\pi^2 \frac{dY_d}{dt} = Y_d \left[(3\text{Tr}(Y_d^\dagger Y_d) + Y_e^\dagger Y_e)\pi S^2 - \left(\frac{7}{15}g_1^2 + 3g_2^2 + \frac{16}{3}g_3^2 \right) S(t) \right. \\ \left. + (3Y_d^\dagger Y_d + Y_u^\dagger Y_u)\pi S^2 \right]$$

$$16\pi^2 \frac{dY_u}{dt} = Y_u \left[3\text{Tr}(Y_u^\dagger Y_u) - \left(\frac{43}{30}g_1^2 + \frac{9}{2}g_2^2 + \frac{32}{3}g_3^2 \right) S(t) \right. \\ \left. + (6Y_u^\dagger Y_u + 2Y_d^\dagger Y_d) S \right]$$

$$16\pi^2 \frac{dY_d}{dt} = Y_d \left[(3\text{Tr}(Y_d^\dagger Y_d) + Y_e^\dagger Y_e) - \left(\frac{19}{30}g_1^2 + \frac{9}{2}g_2^2 + \frac{32}{3}g_3^2 \right) S(t) \right. \\ \left. + (6Y_d^\dagger Y_d + 2Y_u^\dagger Y_u) S \right]$$

Results

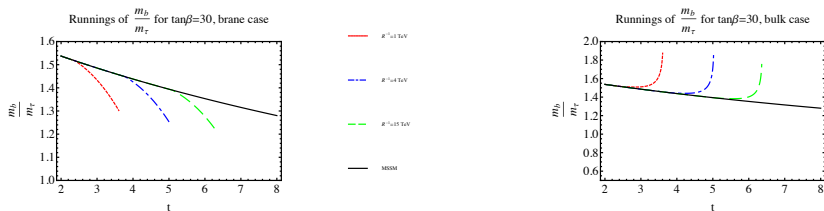


FIG. 6: Evolution of mass ratios $\frac{m_b}{m_\tau}$, as function of the scale parameter t .

Conclusions

- 5D MSSM has a substantial effects on the scaling of fermion masses for both cases, including both quark and lepton sectors.
- The scale dependence is not logarithmic any more, it shows power law behaviour
- We found that, for both scenarios the theory is valid up to the unification scale, and lead to significant renormalization group corrections

THANK YOU