SUSY flavor structure of generic 5D supergravity models


**Introduction**

**Motivation**
- Mass Hierarchy
  - $m_{h} \sim 1.7 - 3.3 \times 10^{-3}$ GeV
  - $m_{\tau} \sim 4.1 - 5.8 \times 10^{-3}$ GeV
  - $m_{\nu} \sim 1.27$ GeV
  - $m_{\nu} \sim 1.01 \times 10^{-3}$ GeV
- SUSY flavor problem
  - in the gravity-mediated SUSY breaking scenario
- Tachyonic squark and slepton problem in the 5D SUGRA on $S^{1}/Z_{2}$

**Visible sector contents**

MSSM matter contents

$V_{i}, V_{h}, \nu_{i}$ : gauge vector multiplets

$Q_{i}, H_{D}$ : quark chiral multiplets

$C_{i}, \nu_{i}$ : lepton chiral multiplets

$H_{u}, H_{d}$ : Higgs chiral multiplets

Yukawa couplings (at only the y = 0 brane)

\[
y_{Y} = \frac{\lambda_{Y}^{2}}{\sqrt{\lambda_{Y}^{2}Y_{Q}Y_{u}}} > Y_{Q}^{2}(c_{Y}^{q}) = 1 - e^{-2\Delta_{q}}
\]

**Moduli couplings**

$\Delta_{q} = (m_{u}, m_{d}) \sim (1.2, 1.2, 0.5)$

$\Delta_{e} = (m_{u}, m_{d}) \sim (0.4, 0.4, 0.4, 0.4)$

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**Hidden(Mediation) sector contents**

Hidden sector : $\chi^{i}$ (chiral multiplet from a 5D Hypermultiplet)

Mediation sector : $f^{(p = 1, 2, 3)}$ (moduli multiplets from 5D Vector multiplets)

Norm function

$N \propto (T_{e}^{0})^{N} (T_{e}^{3})$ (moduli multiplets from 5D Vector multiplets)

Soft terms

$\mathcal{L}_{\text{soft}} = \sum_{i} m_{i}^{2} \phi_{i}^{2} - \frac{1}{2} \sum_{i} M_{i} \epsilon_{i}^{2}$

$A_{i} = \text{const} \phi_{i}^{2}$

$\alpha_{F} = \frac{A^{(1, 1, 1)}}{\phi_{1}^{2}}$

**The Structure of soft mass**

$\beta(m_{\phi}^{2}) = \log \frac{m_{\phi}^{2}}{\beta_{m_{\phi}^{2}}^{2}}$

$\alpha_{F} = \frac{A^{(1, 1, 1)}}{\phi_{1}^{2}}$

Typical scale of SUSY breaking

$M_{\text{soft}} \equiv (K_{X})^{1/2} F_{X}$

**Conclusion**

We can avoid the SUSY flavor problem and tachyonic sfermion problem while realize the hierarchically structures of the Yukawa couplings.

$M_{\text{soft}} = 10^{4} \text{GeV}$, $\alpha_{1} = 0.1$, $\alpha_{2} = 0.1$, $\alpha_{3} = 0.1$, $M_{i} = 3 \times 10^{5} \text{GeV}$, $\tan \beta = 4$

$M_{\text{soft}} = 2 \times 10^{5} \text{GeV}$, $\alpha_{1} = 0.1$, $\alpha_{2} = 0.1$, $\alpha_{3} = 0.1$, $M_{i} = 3 \times 10^{5} \text{GeV}$, $\tan \beta = 4$

The allowed region ($\mu \rightarrow e + \gamma$) is much wider.