

gauge mediation with Flavor violation

SUSY (MSSM)

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pros 😊

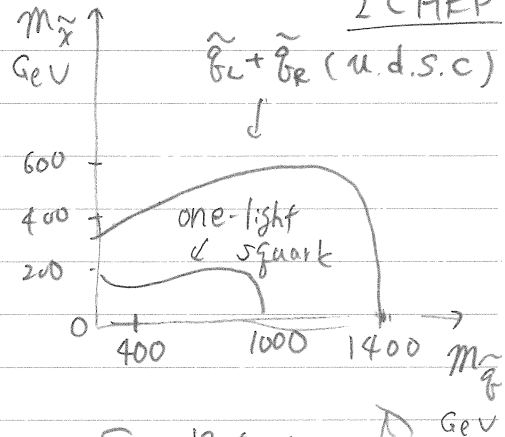
cons 😞

• not found yet

(LHC severely constraints)

• too many parameters

• CPV, LFV



$$\begin{aligned}
 \mathcal{L}_{\text{SUSY}} = & [\tilde{m}_Q^2]_{ij} \tilde{Q}_i^\dagger \tilde{Q}_j + [\tilde{m}_U^2]_{ij} \tilde{U}_i^\dagger \tilde{U}_j \\
 & + [\tilde{m}_D^2]_{ij} \tilde{D}_i^\dagger \tilde{D}_j + [A_u]_{ij} H_u \tilde{Q}_i \tilde{U}_j^\dagger + [Y_u]_{ij} \\
 & + [A_d]_{ij} H_d \tilde{Q}_i \tilde{D}_j^\dagger + [Y_d]_{ij}
 \end{aligned}$$

• constrained MSSM ("mSUGRA")

$$\begin{aligned}
 \tilde{m}_Q^2 = \tilde{m}_U^2 = \tilde{m}_D^2 = & \begin{pmatrix} m_0 & 0 \\ 0 & m_0 \\ 0 & m_0 \end{pmatrix} \\
 A_u = A_d = & \begin{pmatrix} A_0 & 0 \\ 0 & A_0 \\ 0 & A_0 \end{pmatrix}
 \end{aligned}$$

at higher-energy scale (GUT scale)

$$\rightarrow m_{\tilde{g}_L} \sim m_{\tilde{g}_R}$$

"good" because CPV & LFV is avoided

"bad" because { ad-hoc treatment

{ captureable parameter space too small

★ Possibility of single- \tilde{q} discovery } Should be considered.
(would be theoretically interesting)

• Why LFV is suppressed in SM?

• How single \tilde{q} can be lighter?

• Any models with split \tilde{q} spectrum

consistent with SM flavor constraints?



• Gauge-mediated SUSY breaking (GMSB)

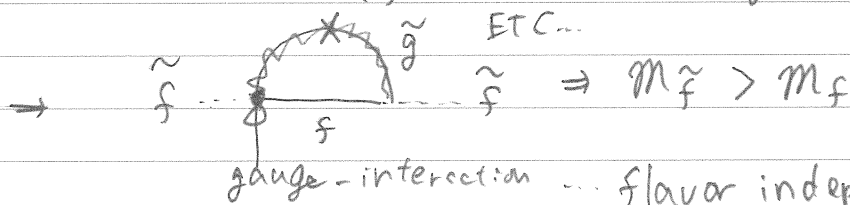
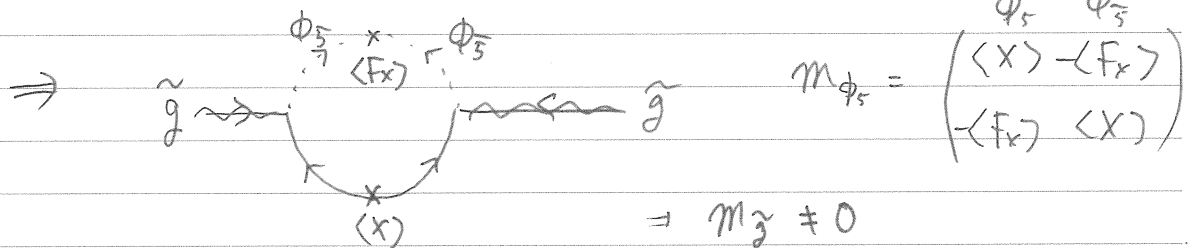
MSSM + "messenger" $5 \bar{5}$ in $SU(5)$

$$W = X \bar{5} \bar{5} + H_u Q Y_u \bar{U} + H_d Q Y_d \bar{D} + H_e L Y_e \bar{E}$$

$$-L = -\langle X \rangle^2 \phi_5^* \phi_5 - \langle X \rangle^2 \phi_{\bar{5}}^* \phi_{\bar{5}} + \langle X \rangle (\psi_5 \psi_{\bar{5}} + \text{h.c.}) + \langle F_X \rangle \phi_5 \phi_{\bar{5}}$$

ϕ
 somehow $\neq 0 \Rightarrow m_{\phi_5} \neq m_{\psi_5}$

~~SUSY~~



• good because CPU & LFU avoided
 • some justification

→ "Flavored Gauge Mediation"

- GMSB extended w. flavor-violation → split \tilde{g} spectrum
- FLV & CPU automatically suppressed → compatible w. SM flavor bound

based on realistic model (to me)

What I'd like to say

generates A-term
to raise M_H

✓ LHC limits ^{often} ← simplest cases (good as far as
we are aware of)

✓ LHC starts to exclude models w. single \tilde{g}

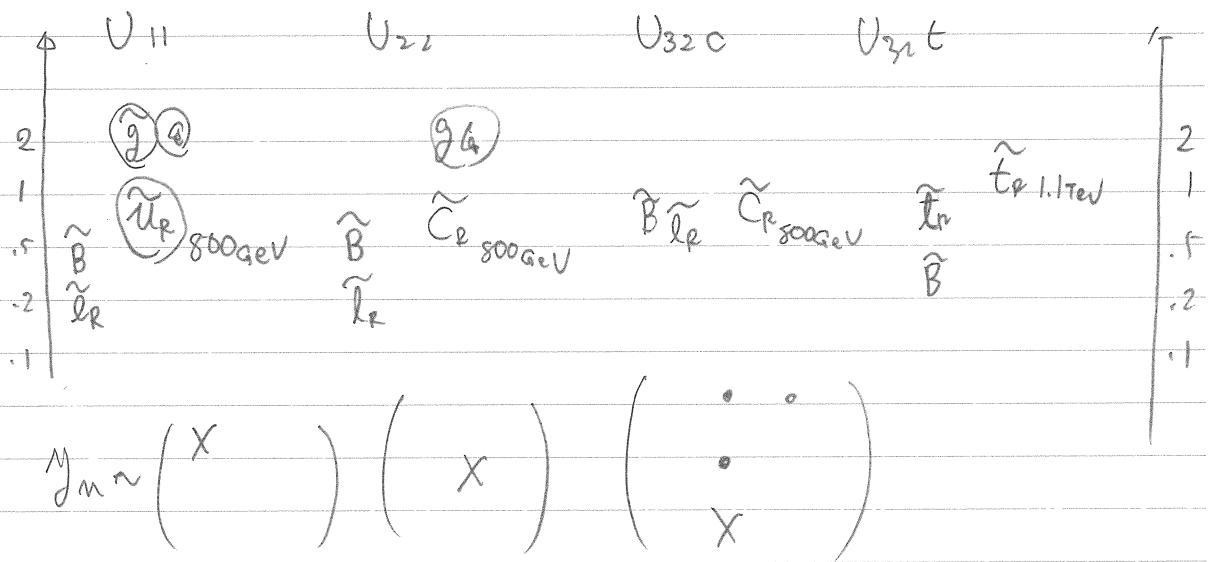
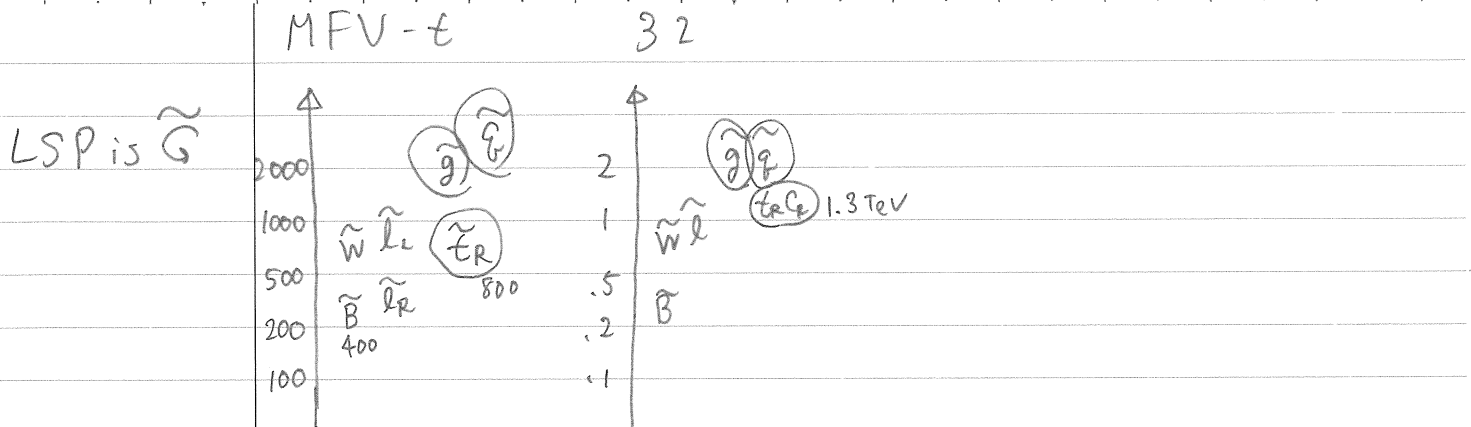
→ We may discover single \tilde{g} (split spectrum)

→ Models? Yes, FGM.

• What is FGM?

• Example spectrum (Benchmark points)

Only
for
↓



Single \tilde{g} found "EFT of 10^{10-16} GeV physics"
 ↓
 parameter determination