Lepton Flavour Violating tau and muon decays induced by SUSY

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Flavour in the Era of the LHC, CERN, Feb. 6-8 2006

Why LFV processes

⋆ Lepton Flavour Violation (LFV) does not happen in the SM ($m_\nu = 0$)

⋆ Very supressed in SM + massive neutrinos $\begin{cases} \text{do no exist at tree level} \\ \text{highly supressed at one-loop} \end{cases}$

⋆ Very restrictive experimental upper bounds, for instance,

$$\begin{aligned}
BR(\tau^- \to \mu^-\mu^-\mu^+) &< 1.9 \times 10^{-7} \text{ (BaBar 05)} \\
BR(\tau^- \to e^-e^-e^+) &< 2.0 \times 10^{-7} \text{ (BaBar 05)} \\
BR(\mu^- \to e^-e^-e^+) &< 1.0 \times 10^{-12} \text{ (SINDRUM 88)} \\
BR(\tau \to \mu\gamma) &< 6.8 \times 10^{-8} \text{ (BaBar 05)} \\
BR(\tau \to e\gamma) &< 1.1 \times 10^{-7} \text{ (BaBar 05)} \\
BR(\mu \to e\gamma) &< 1.2 \times 10^{-11} \text{ (MEGA 99)}
\end{aligned}$$

⋆ Window for new physics

⋆ Very sensitive to SUSY: if Majorana ν, Y_ν can be $\mathcal{O}(1)$
Large Y_ν induce, via SUSY loops, large LFV rates

⋆ Severe restrictions on SUSY parameters

Our Work: Prediction of LFV rates

for all processes $l_j \to 3l_i$ and $l_j \to l_i\gamma$ (hep-ph/0510405)

(also $h_0, H_0, A_0 \to l_i\bar{l}_j$, Phys.Rev.D71,035011(2005))

in Constrained MSSM (CMSSM)

$+ \; 3\nu_R$ (Majorana) $+ \; 3\tilde{\nu}_R$

we use: 1) seesaw mechanism for ν mass generation

2) universal conditions at $M_X = M_{\text{GUT}}$

3) full RGEs (no leading log approx.)

It is a full one-loop computation of BR's

Seesaw mechanism with $3\,\nu_R$

After EW breaking: $m_D = Y_\nu < H_2 >$; $< H_2 >= v \sin\beta$; $v = 174$ GeV

$$-L^\nu_{mass} = \frac{1}{2}(\overline{\nu^0_L}, \overline{(\nu^0_R)^C}) M^\nu \begin{pmatrix} (\nu^0_L)^C \\ \nu^0_R \end{pmatrix} + h.c.; \quad M^\nu = \begin{pmatrix} 0 & m_D \\ {m_D}^T & m_M \end{pmatrix}.$$

Seesaw: large separation between mass scales $\Rightarrow m_D \ll m_M$

$$U^{\nu T} M^\nu U^\nu = \hat{M}^\nu = diag(m_{\nu_1}, m_{\nu_2}, m_{\nu_3}, m_{N_1}, m_{N_2}, m_{N_3}).$$

$$m^{diag}_\nu = {U_{MNS}}^T m_\nu U_{MNS} \qquad m^{diag}_N = m_N$$

$$\begin{cases} m_\nu \approx -m_D {m_M}^{-1} {m_D}^T \text{ (light)} \\ m_N \approx m_M \text{ (heavy)} \end{cases}$$

1 gen. with $Y_\nu \sim 1$ and $m_M \sim 10^{14}$ GeV $\to m_\nu \sim 0.1$ eV, $m_N \sim 10^{14}$ GeV

$$U_{MNS} = \begin{pmatrix} c_{12}c_{13} & s_{12}c_{13} & s_{13}e^{-i\delta} \\ -s_{12}c_{23} - c_{12}s_{23}s_{13}e^{i\delta} & c_{12}c_{23} - s_{12}s_{23}s_{13}e^{i\delta} & s_{23}c_{13} \\ s_{12}s_{23} - c_{12}c_{23}s_{13}e^{i\delta} & -c_{12}s_{23} - s_{12}c_{23}s_{13}e^{i\delta} & c_{23}c_{13} \end{pmatrix} \times diag(1, e^{i\alpha}, e^{i\beta})$$

Maki-Nakagawa-Sakata matrix (unitary): θ_{12}, θ_{13}, θ_{23}, δ, α, β

Seesaw parameters versus neutrino data

$$\begin{cases} m_N = m_N^{diag} \approx m_M \\ m_\nu \approx -m_D (m_N^{diag})^{-1} {m_D}^T \\ m_\nu^{diag} = {U_{MNS}}^T m_\nu U_{MNS} \end{cases}$$

$$R \equiv \left[-i (m_N^{diag})^{-\frac{1}{2}} {m_D}^T U_{MNS} (m_\nu^{diag})^{-\frac{1}{2}} \right]$$

$${m_D}^T = {Y_\nu}^T v_2 = i (m_N^{diag})^{\frac{1}{2}} R (m_\nu^{diag})^{\frac{1}{2}} U^+_{MNS}$$

R is a 3×3 complex matrix and orthogonal (Casas and Ibarra 01)

$$R = \begin{pmatrix} c_2 c_3 & -c_1 s_3 - s_1 s_2 c_3 & s_1 s_3 - c_1 s_2 c_3 \\ c_2 s_3 & c_1 c_3 - s_1 s_2 s_3 & -s_1 c_3 - c_1 s_2 s_3 \\ s_2 & s_1 c_2 & c_1 c_2 \end{pmatrix}, \; c_i = \cos\theta_i \;, \; s_i = \sin\theta_i \;, \; \theta_{1,2,3} \text{ complex}$$

Parameters: m_D,m_M with $m_D << m_M$ (18) $\leftrightarrow$ θ_{ij},δ,α,β,m_{ν_i},m_{N_i},θ_i (18)

2 Scenarios

- A: Quasi-degenerate light, degenerate heavy ν's

$$m_{\nu_1} = 0.2\, eV \,, m_{\nu_2} = m_{\nu_1} + \frac{\Delta m^2_{sol}}{2 m_{\nu_1}} \,, m_{\nu_3} = m_{\nu_1} + \frac{\Delta m^2_{atm}}{2 m_{\nu_1}},$$

$$m_{N_1} = m_{N_2} = m_{N_3} = m_N$$

- B: Hierarchical light and heavy ν's

$$m_{\nu_1} \simeq 0\, eV \,, m_{\nu_2} = \sqrt{\Delta m^2_{sol}} \,, m_{\nu_3} = \sqrt{\Delta m^2_{atm}},$$

$$m_{N_1} \leq m_{N_2} < m_{N_3}$$

Our choice of input parameters

CMSSM $+3\nu_R + 3\tilde{\nu}_R +$ seesaw

- MSSM with universal parameters at $M_X \sim M_{GUT} \sim 2 \times 10^{16}\, GeV$

$$\left.\begin{cases} M_0 = \text{universal scalar mass} \\ M_{1/2} = \text{universal gaugino mass} \\ A_0 = \text{universal trilinear coupling} \\ \tan\beta = \langle H_2 \rangle / \langle H_1 \rangle \text{ (at EW scale)} \\ \text{sign}(\mu) \ (\mu \text{ derived from EW breaking}) \end{cases}\right\} \text{mSUGRA parameters}$$

- Seesaw parameters m_D (or Y_ν), m_M derived from $\begin{cases} m_{\nu_{1,2,3}} \text{ (set by data)} \\ m_{N_{1,2,3}} \\ U_{MNS} \text{ (set by data)} \\ R(\theta_1, \theta_2, \theta_3) \end{cases}$

- For numerical estimates, assume scenarios A and B with:

$$(\Delta m^2)_{12} = \Delta m^2_{sol} = 6.4 \times 10^{-5} \text{ eV}^2$$
$$(\Delta m^2)_{23} = \Delta m^2_{atm} = 2.5 \times 10^{-3} \text{eV}^2$$
$$\theta_{12} = 30^o;\ \theta_{23} = 45^o;\ \theta_{13} = \delta = \alpha = \beta = 0$$

some results also for $0 < \theta_{13} < 10^o$

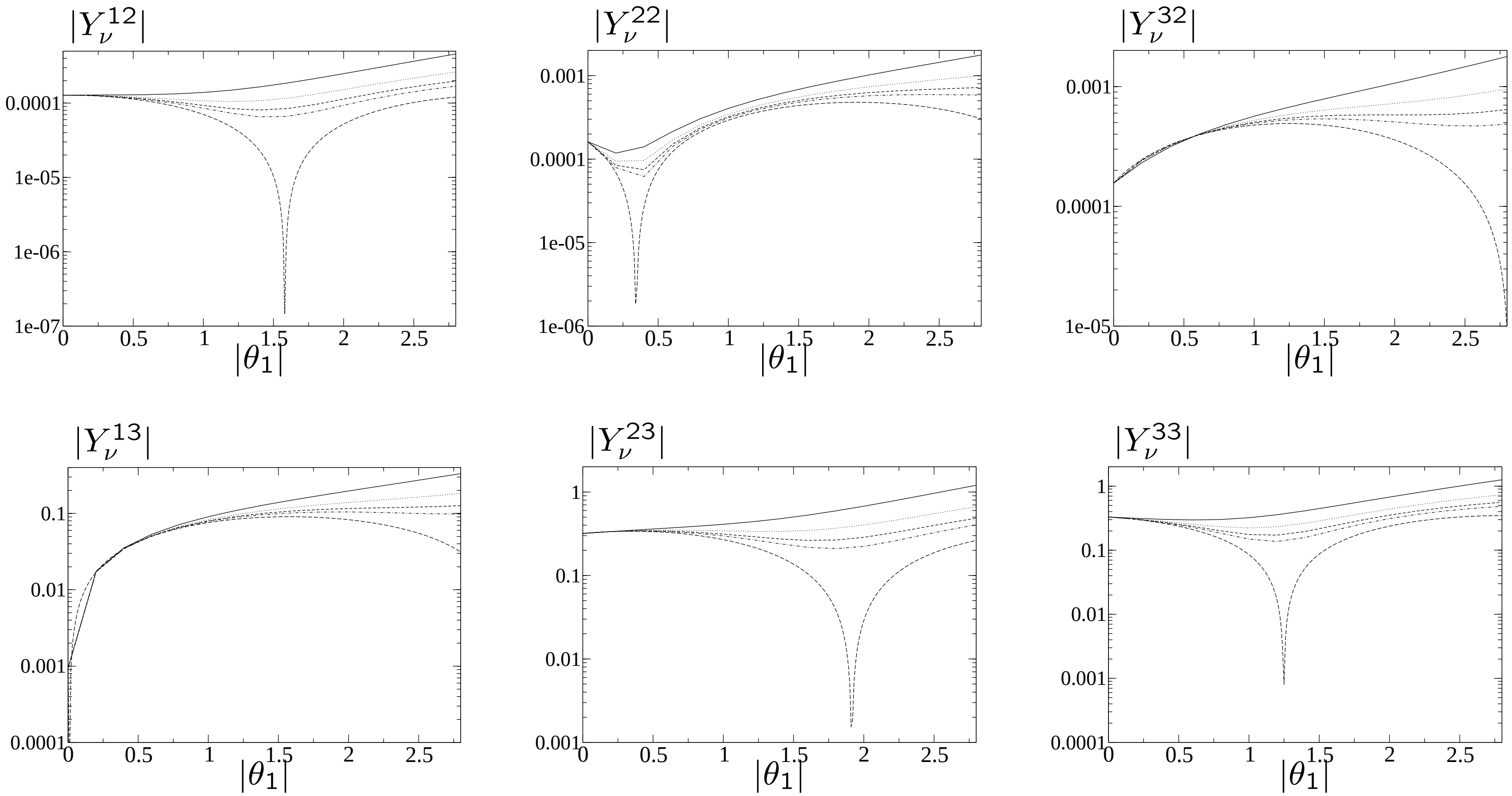
- slepton mixing induced in charged sector by RGE running from M_X to m_N and due to $Y_\nu \Rightarrow$ **LFV rates (output)**

Getting large $|Y_\nu|$

Example: Hierarchical m_{N_i} and complex $R(\theta_1, \theta_2, \theta_3)$

$(m_{N_1}, m_{N_2}, m_{N_3}) = (10^8, 2\times 10^8, 10^{14})$ GeV, $\arg(\theta_1) = 0, \pi/10, \pi/8, \pi/6, \pi/4$ $(\theta_2 = \theta_3 = 0)$

$\tan\beta = 50$



⋆ These results include also running effects on light neutrino masses and mixings

⋆ Large $|Y_\nu^{33}|$ and $|Y_\nu^{23}| \sim 0.1 - 1$ for most θ_1 (including 0). Similar results for $\theta_{2,3}$.

Lepton flavor mixing in SUSY-seesaw

• misalignment slepton-lepton: generated by RGE-running and due to Y_ν

In the $(\tilde{e}_L, \tilde{e}_R, \tilde{\mu}_L, \tilde{\mu}_R, \tilde{\tau}_L, \tilde{\tau}_R)$ basis:

$$M_{\tilde{l}}^2 = \begin{pmatrix} M_{LL}^{ee\,2} & M_{LR}^{ee\,2} & M_{LL}^{e\mu\,2} & M_{LR}^{e\mu\,2} & M_{LL}^{e\tau\,2} & M_{LR}^{e\tau\,2} \\ M_{RL}^{ee\,2} & M_{RR}^{ee\,2} & M_{RL}^{e\mu\,2} & M_{RR}^{e\mu\,2} & M_{RL}^{e\tau\,2} & M_{RR}^{e\tau\,2} \\ M_{LL}^{\mu e\,2} & M_{LR}^{\mu e\,2} & M_{LL}^{\mu\mu\,2} & M_{LR}^{\mu\mu\,2} & M_{LL}^{\mu\tau\,2} & M_{LR}^{\mu\tau\,2} \\ M_{RL}^{\mu e\,2} & M_{RR}^{\mu e\,2} & M_{RL}^{\mu\mu\,2} & M_{RR}^{\mu\mu\,2} & M_{RL}^{\mu\tau\,2} & M_{RR}^{\mu\tau\,2} \\ M_{LL}^{\tau e\,2} & M_{LR}^{\tau e\,2} & M_{LL}^{\tau\mu\,2} & M_{LR}^{\tau\mu\,2} & M_{LL}^{\tau\tau\,2} & M_{LR}^{\tau\tau\,2} \\ M_{RL}^{\tau e\,2} & M_{RR}^{\tau e\,2} & M_{RL}^{\tau\mu\,2} & M_{RR}^{\tau\mu\,2} & M_{RL}^{\tau\tau\,2} & M_{RR}^{\tau\tau\,2} \end{pmatrix}$$

⇒LF mixing in slepton sector

generates LFV via SUSY loops

• CMSSM in the leading-log approximation

$$M_{LL}^{ij2} = = -\frac{1}{8\pi^2}(3M_0^2 + A_0^2)(Y_\nu^* L Y_\nu^T)_{ij}$$

$$M_{LR}^{ij2} = -\frac{3}{16\pi^2} A_0 \frac{v_1}{\sqrt{2}} Y_{l_i} (Y_\nu^* L Y_\nu^T)_{ij}$$

$$M_{RR}^{ij2} = 0 \ ; \ L_{kl} \equiv \log\left(\frac{M_X}{m_{M_k}}\right)\delta_{kl} \ ; \ (i \neq j)$$

• We use instead SPheno program (Porod 03):

To integrate numerically two-loop RGEs from M_X down to M_Z

Mass eigenstates in the slepton sector

- We solve numerically RGEs at two loops

with SPheno code and full 3×3 flavour structure in soft param. etc.

- Then diagonalize to find physical sleptons

⋆ Slepton diagonalization

$$M_{\tilde{l}}^2 = \begin{pmatrix} M_{LL}^{ee\,2} & M_{LR}^{ee\,2} & M_{LL}^{e\mu\,2} & M_{LR}^{e\mu\,2} & M_{LL}^{e\tau\,2} & M_{LR}^{e\tau\,2} \\ M_{RL}^{ee\,2} & M_{RR}^{ee\,2} & M_{RL}^{e\mu\,2} & M_{RR}^{e\mu\,2} & M_{RL}^{e\tau\,2} & M_{RR}^{e\tau\,2} \\ M_{LL}^{\mu e\,2} & M_{LR}^{\mu e\,2} & M_{LL}^{\mu\mu\,2} & M_{LR}^{\mu\mu\,2} & M_{LL}^{\mu\tau\,2} & M_{LR}^{\mu\tau\,2} \\ M_{RL}^{\mu e\,2} & M_{RR}^{\mu e\,2} & M_{RL}^{\mu\mu\,2} & M_{RR}^{\mu\mu\,2} & M_{RL}^{\mu\tau\,2} & M_{RR}^{\mu\tau\,2} \\ M_{LL}^{\tau e\,2} & M_{LR}^{\tau e\,2} & M_{LL}^{\tau\mu\,2} & M_{LR}^{\tau\mu\,2} & M_{LL}^{\tau\tau\,2} & M_{LR}^{\tau\tau\,2} \\ M_{RL}^{\tau e\,2} & M_{RR}^{\tau e\,2} & M_{RL}^{\tau\mu\,2} & M_{RR}^{\tau\mu\,2} & M_{RL}^{\tau\tau\,2} & M_{RR}^{\tau\tau\,2} \end{pmatrix}$$

⋆ Sneutrino diagonalization

$$M_{\tilde{\nu}}^2 = \begin{pmatrix} M_{LL}^{11\,2} & M_{LL}^{12\,2} & M_{LL}^{13\,2} \\ M_{LL}^{21\,2} & M_{LL}^{22\,2} & M_{LL}^{23\,2} \\ M_{LL}^{31\,2} & M_{LL}^{32\,2} & M_{LL}^{33\,2} \end{pmatrix}$$

- mass eigenstates: $\tilde{l}_i\,(i = 1,..,6)$, $\tilde{\nu}_i\,(i = 1,2,3)$

- Flavor mixing derived parameters: $\delta^{ij}_{LL,RR,LR} \equiv \frac{M^{ij2}_{LL,RR,LR}}{\tilde{m}^2}$

$$\tilde{m}^2 = \left(m^2_{\tilde{l}_1} \ldots m^2_{\tilde{l}_6}\right)^{1/6}$$

Predicted spectrum in CMSSM-seesaw

Hierarchical m_{N_i} with $(m_{N_1}, m_{N_2}, m_{N_3}) = (10^8, 2 \times 10^8, 10^{14})$ GeV

- **Example 1:** Moderately heavy spectrum

$M_0 = 400$ GeV, $M_{1/2} = 300$ GeV, $A_0 = 0$, $\tan\beta = 50$, sign$(\mu) > 0$
$\theta_2 = 2.8 e^{i\frac{\pi}{4}}$, $\theta_1 = \theta_3 = 0$

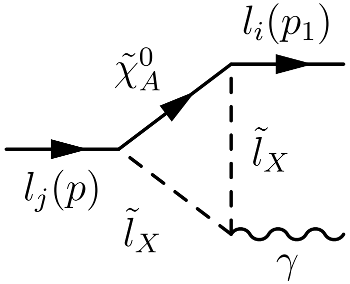
$m_{\tilde{l}_1} = 230$ GeV	$m_{\tilde{\chi}_1^0} = 122$ GeV	$m_{h^0} = 114$ GeV
$m_{\tilde{l}_2} = 356$ GeV	$m_{\tilde{\chi}_2^0} = 232$ GeV	$m_{H^0} = 455$ GeV
$m_{\tilde{l}_3} = 413$ GeV	$m_{\tilde{\chi}_3^0} = 481$ GeV	$m_{A^0} = 455$ GeV
$m_{\tilde{l}_4} = 417$ GeV	$m_{\tilde{\chi}_4^0} = 490$ GeV	$m_{\tilde{\nu}_1} = 296$ GeV
$m_{\tilde{l}_5} = 436$ GeV	$m_{\tilde{\chi}_1^-} = 232$ GeV	$m_{\tilde{\nu}_2} = 422$ GeV
$m_{\tilde{l}_6} = 448$ GeV	$m_{\tilde{\chi}_2^-} = 492$ GeV	$m_{\tilde{\nu}_3} = 441$ GeV

- **Example 2:** Moderately light spectrum

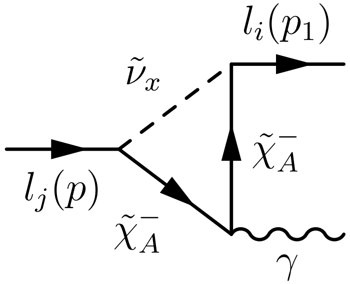
$M_0 = 250$ GeV, $M_{1/2} = 150$ GeV, $A_0 = 0$, $\tan\beta = 50$, sign$(\mu) > 0$
$\theta_1 = 2.8 e^{i\frac{\pi}{4}}$, $\theta_2 = \theta_3 = 0$

$m_{\tilde{l}_1} = 94$ GeV	$m_{\tilde{\chi}_1^0} = 58$ GeV	$m_{h^0} = 108$ GeV
$m_{\tilde{l}_2} = 218$ GeV	$m_{\tilde{\chi}_2^0} = 107$ GeV	$m_{H^0} = 269$ GeV
$m_{\tilde{l}_3} = 258$ GeV	$m_{\tilde{\chi}_3^0} = 284$ GeV	$m_{A^0} = 269$ GeV
$m_{\tilde{l}_4} = 259$ GeV	$m_{\tilde{\chi}_4^0} = 296$ GeV	$m_{\tilde{\nu}_1} = 143$ GeV
$m_{\tilde{l}_5} = 272$ GeV	$m_{\tilde{\chi}_1^-} = 107$ GeV	$m_{\tilde{\nu}_2} = 247$ GeV
$m_{\tilde{l}_6} = 273$ GeV	$m_{\tilde{\chi}_2^-} = 300$ GeV	$m_{\tilde{\nu}_3} = 261$ GeV

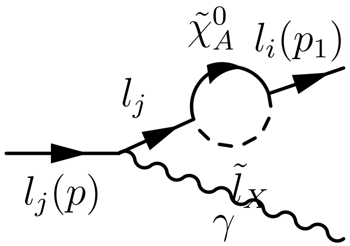
SUSY contributions to $l_j^- \to l_i^- l_i^- l_i^+$ decays (I)



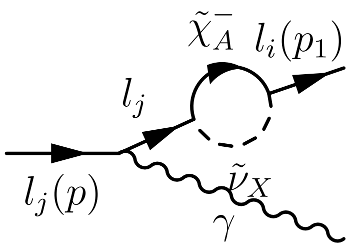
(G1)



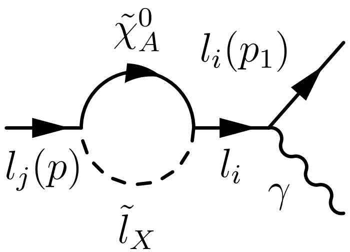
(G2)



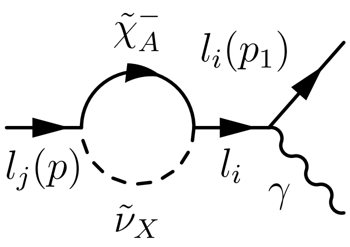
(G3)



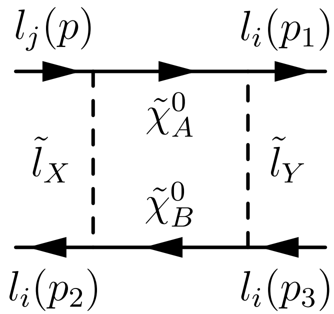
(G4)



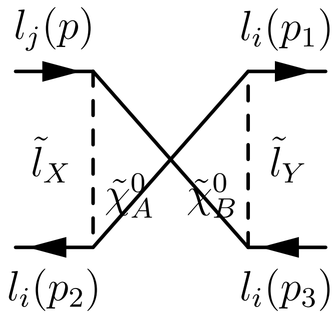
(G5)



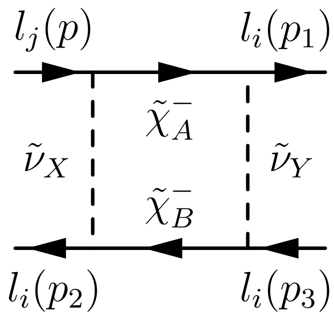
(G6)



(B1)

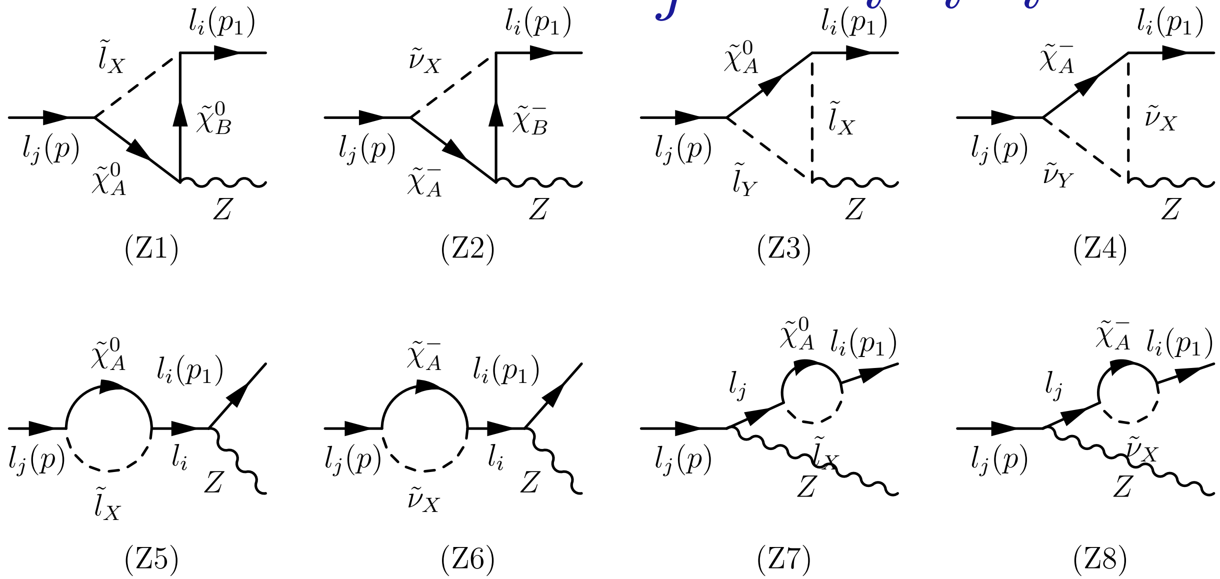


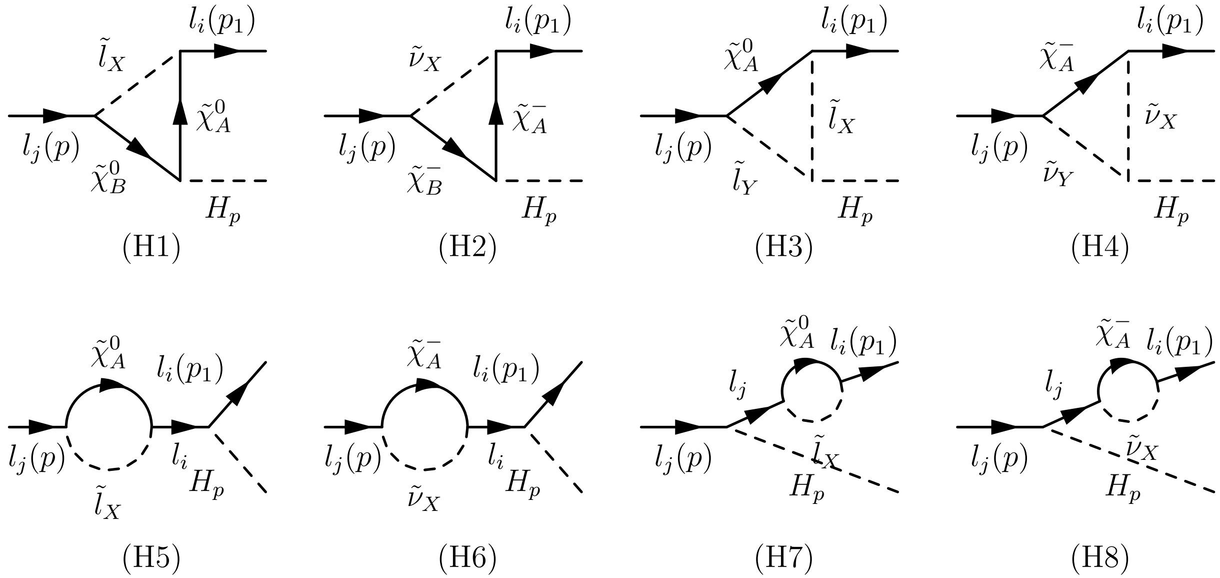
(B2)



(B3)

SUSY contributions to $l_j^- \to l_i^- l_i^- l_i^+$ decays (II)





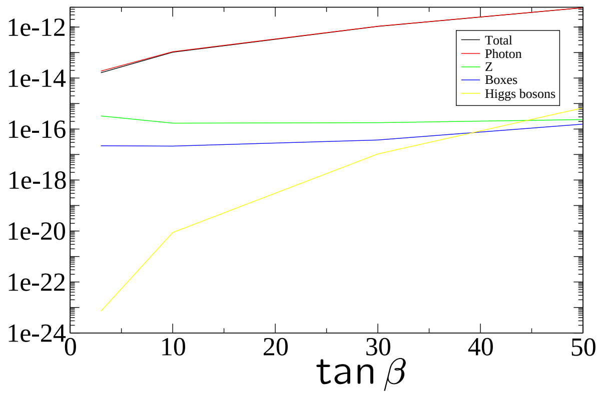
Results for degenerate neutrinos

Branching ratios dependence with $\tan\beta$

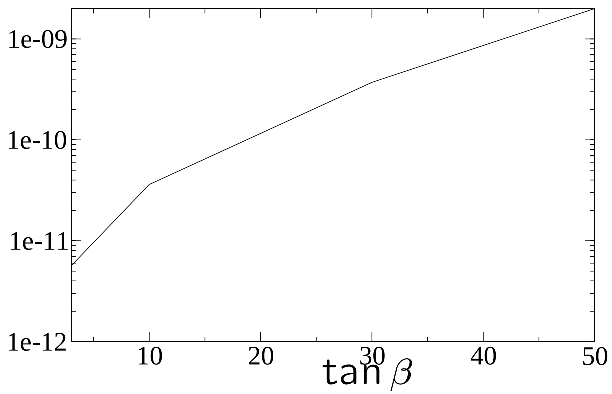
Degenerate m_{N_i} and real R

Chosen values: $m_N = 10^{14}$ GeV, $(M_0, M_{1/2}, A_0) = (400, 300, 0)$ GeV

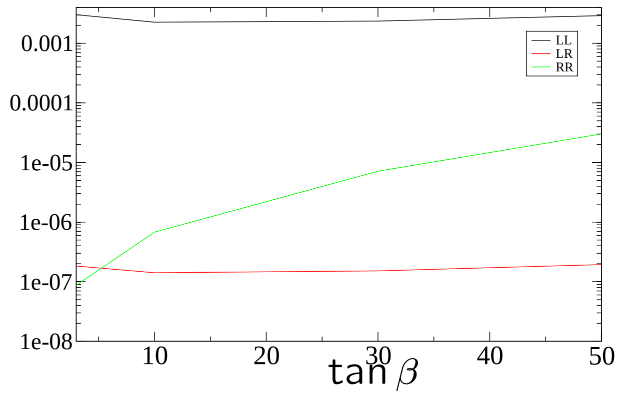
$BR(\tau \to 3\mu)$



$BR(\tau \to \mu\gamma)$



$|\delta^{23}_{LL,LR,RR}|$



⋆ Fast growing with $\tan\beta$

⋆ $BR(\tau^- \to \mu^-\mu^-\mu^+)^{\text{max}} \sim 3 \times 10^{-11}$, $BR(\tau \to \mu\gamma)^{\text{max}} \sim 10^{-8}$

⋆ All rates below experimental limits for $3 < \tan\beta < 50$

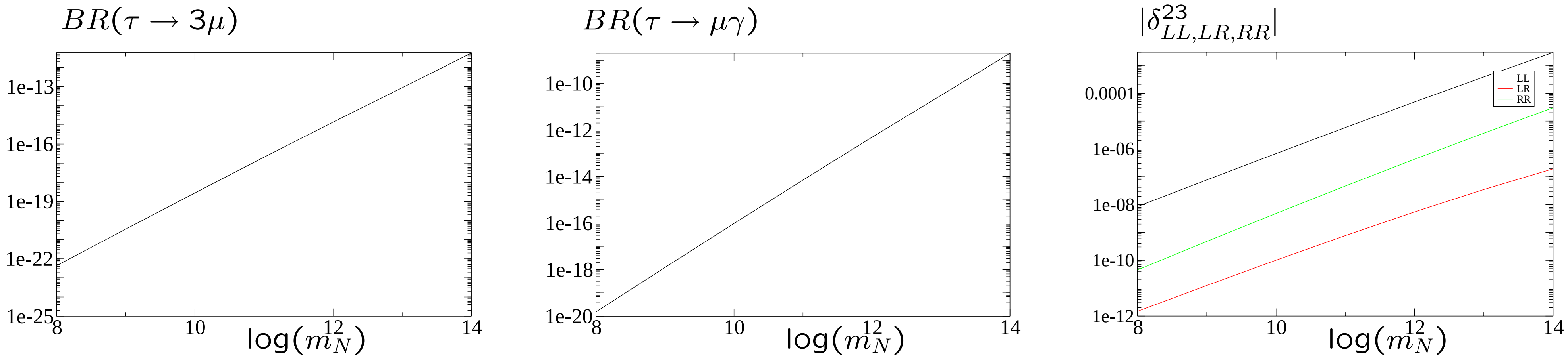
⋆ $BR(\tau^- \to \mu^-\mu^-\mu^+)/BR(\tau \to \mu\gamma) \simeq 1/440$,$\gamma$-penguin dominance for all $\tan\beta$

⋆ $|\delta^{23}_{LL}|$ much larger than $|\delta^{23}_{LR}|, |\delta^{23}_{RR}|$ but $|\delta^{23}_{RR}| >> |\delta^{23}_{LR}|$ in contrast to lead. log. approx.

Branching ratios dependence with m_N

Degenerate m_{N_i} and real R

Chosen values: $\tan\beta = 50$, $(M_0, M_{1/2}, A_0) = (400, 300, 0)$ GeV

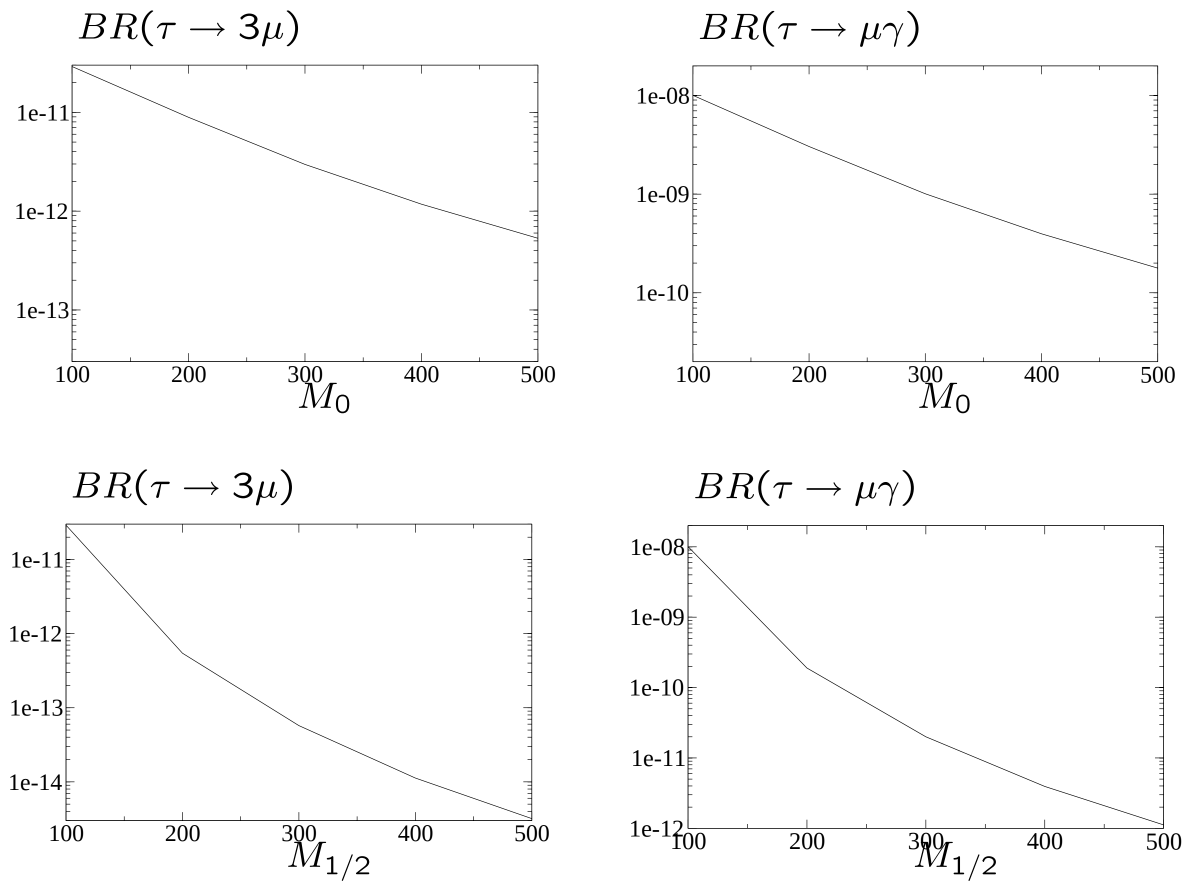


- ⋆ Decay rates grow as $|m_N \log(m_N)|^2$. Heavy neutrinos do not decouple in SUSY
- ⋆ All rates below experimental limits for $10^8\,\text{GeV} < m_N < 10^{14}\,\text{GeV}$
- ⋆ Again $|\delta^{23}_{LL}| >> |\delta^{23}_{RR}| >> |\delta^{23}_{LR}|$

Branching ratios dependence with M_0 and $M_{1/2}$

Degenerate m_{N_i} and real R

Explored values: $\tan\beta = 50$, $m_N = 10^{14}$ GeV, $A_0 = 0$



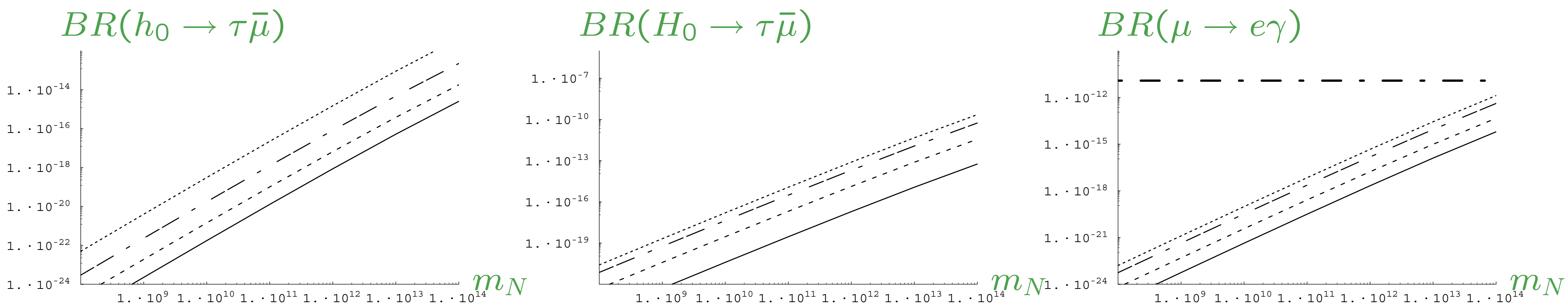
- ⋆ Rates very suppresed for large M_0 or $M_{1/2}$
- ⋆ Decoupling behaviour of SUSY particles in the dominant loops

Predictions for Higgs boson LFV decays

Degenerate m_{N_i} and real R

Explored values: $10^8 \leq m_N(GeV) \leq 10^{14}$, $(M_0, M_{1/2}, A_0) = (400, 300, 0)GeV$

$\tan\beta = 3$ (solid), 10 (dashed), 30 (dashed-dotted), 50 (dotted)



- ⋆ Grow with $m_N(GeV)$ as $(m_N \log(m_N))^2$
- ⋆ Higgs decays as $(\tan\beta)^4$; lepton decays as $(\tan\beta)^2$
- ⋆ $BR(H^0, A^0 \to \tau\bar{\mu})^{max} \sim 10^{-10}$, $BR(h^0 \to \tau\bar{\mu})^{max} \sim 10^{-12}$>> $BR(H_{SM} \to \tau\bar{\mu})^{max} \sim 10^{-44}$!!
- ⋆ $BR(l_j \to l_i\gamma)$ Below exp. limits for $m_N < 10^{14} GeV$
- ⋆ $BR(\tau\bar{\mu})/BR(\tau\bar{e}) = 4 \times 10^3, BR(\tau\bar{\mu})/BR(\mu\bar{e}) = 1.2 \times 10^6, \tan\beta = 50$

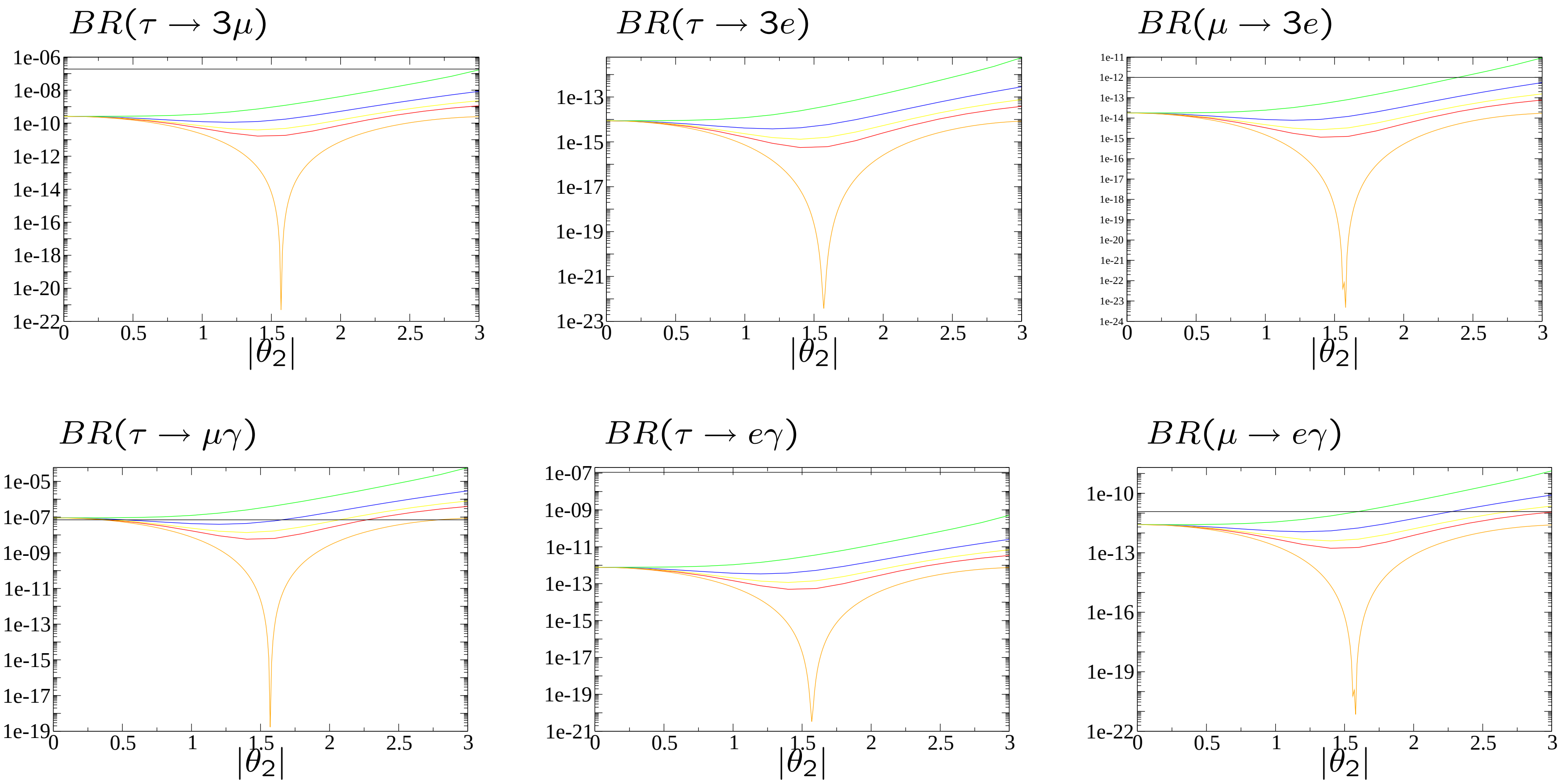
Results for hierarchical neutrinos

Branching ratios dependence with $|\theta_2|$

Hierarchical m_{N_i} and complex R

$(m_{N_1}, m_{N_2}, m_{N_3}) = (10^8, 2\times 10^8, 10^{14})$ GeV, $\arg(\theta_2) = 0, \pi/10, \pi/8, \pi/6, \pi/4\ (\theta_1 = \theta_3 = 0)$

$\tan\beta = 50$, $(M_0, M_{1/2}, A_0) = (400, 300, 0)$ GeV



★ $BR(\tau \to 3\mu)$, $BR(\tau \to 3e)$ and $BR(\tau \to e\gamma)$ below experimental bounds

★ $BR(\tau \to \mu\gamma)$ and $BR(\mu \to e\gamma)$ $BR(\mu \to 3e)$ get restrictions

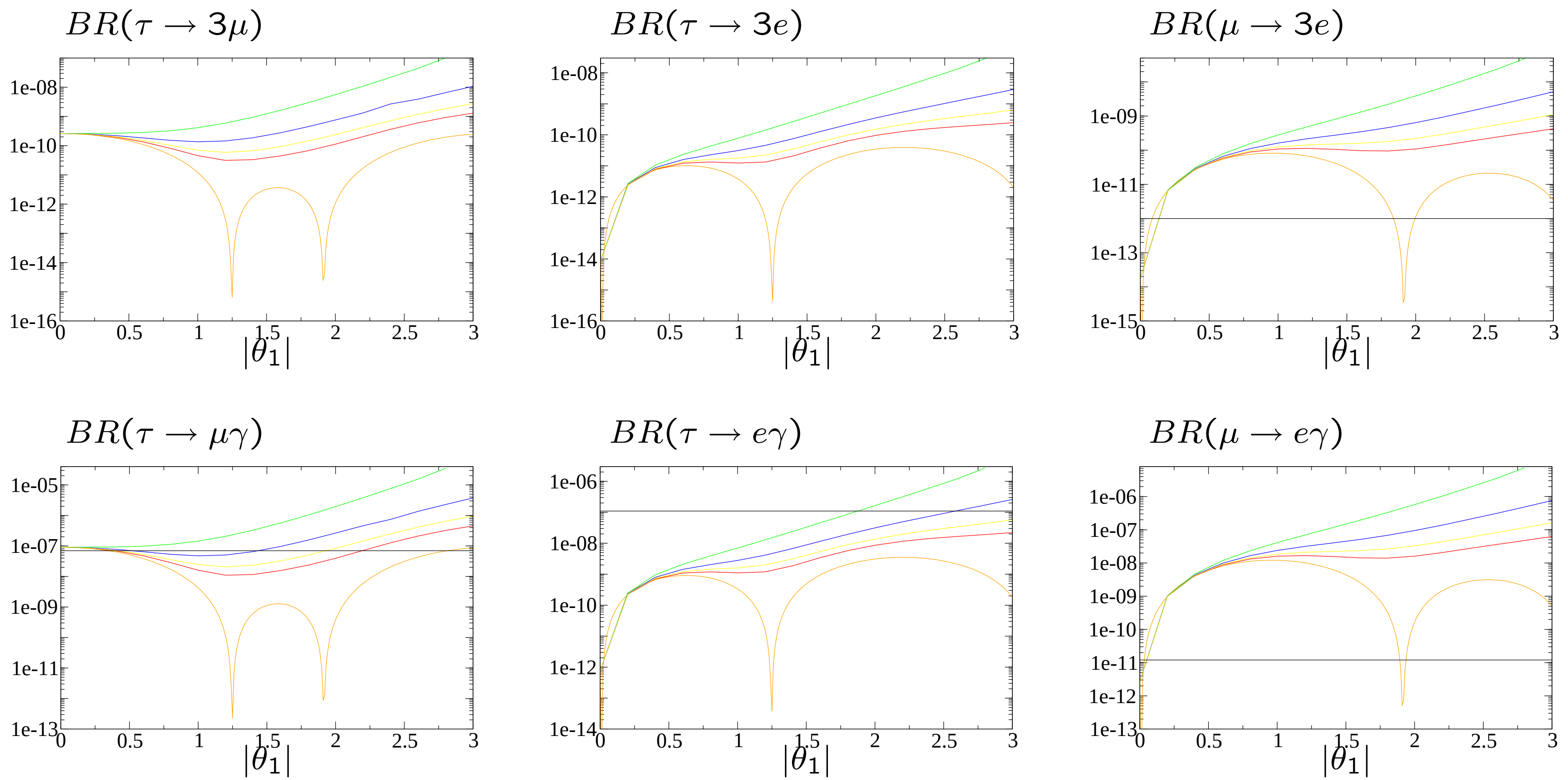
$BR(\tau \to \mu\gamma)$ allows just real θ_2 or complex θ_2 close to the dip

Branching ratios dependence with $|\theta_1|$ (I)

Hierarchical m_{N_i} and complex R

$(m_{N_1}, m_{N_2}, m_{N_3}) = (10^8, 2\times 10^8, 10^{14})$ GeV, $\arg(\theta_1) = 0, \pi/10, \pi/8, \pi/6, \pi/4$ $(\theta_2 = \theta_3 = 0)$

$\tan\beta = 50$, $(M_0, M_{1/2}, A_0) = (400, 300, 0)$ GeV



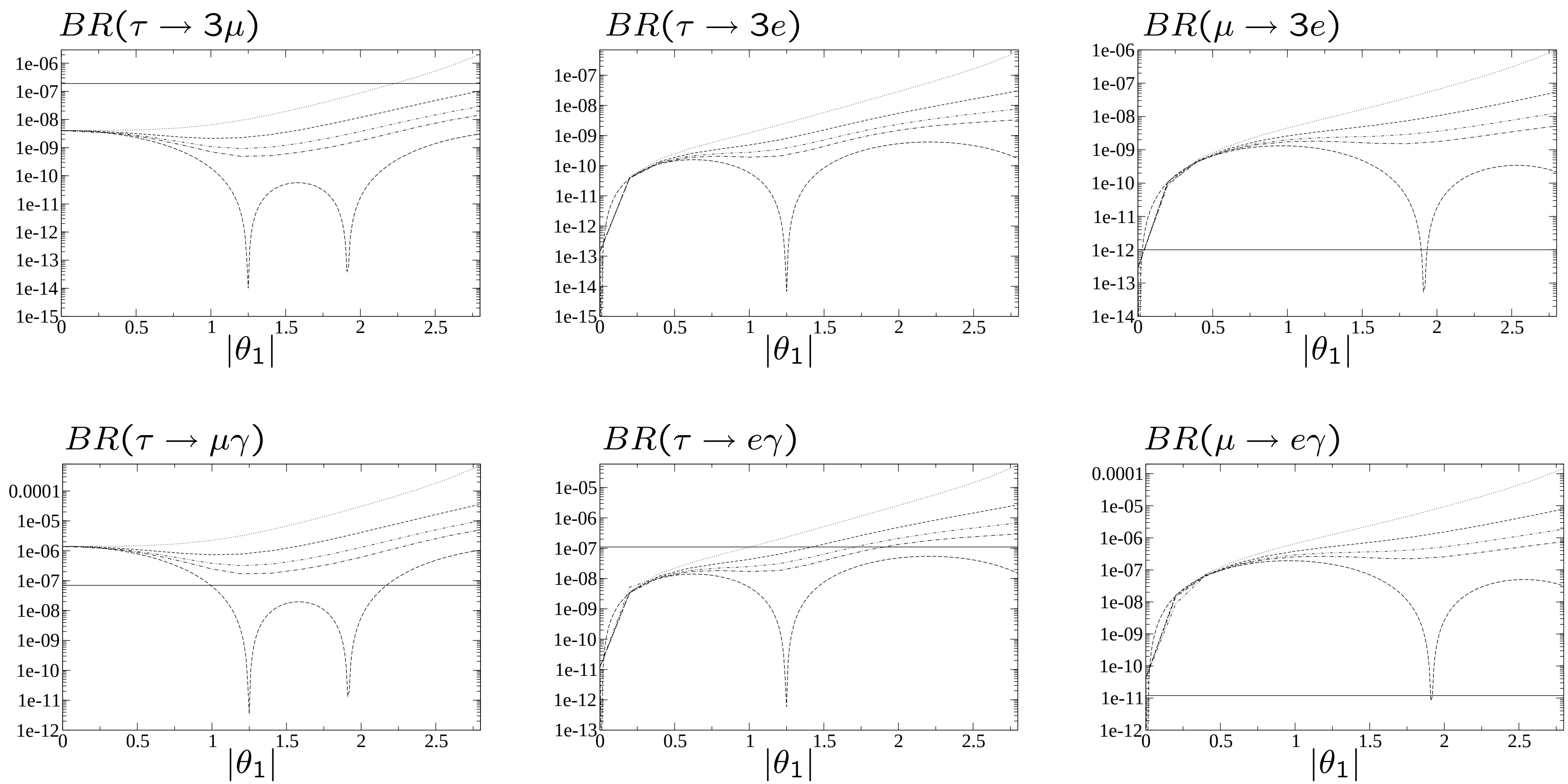
- ⋆ All rates cross exp. bound except $\tau \to 3\mu$ and $\tau \to 3e$
- ⋆ $BR(\mu \to e\gamma)$ practically excluded by data

Branching ratios dependence with $|\theta_1|$ (II)

Hierarchical m_{N_i} and complex R

$(m_{N_1}, m_{N_2}, m_{N_3}) = (10^8, 2\times 10^8, 10^{14})$ GeV, $\arg(\theta_1) = 0, \pi/10, \pi/8, \pi/6, \pi/4$ $(\theta_2 = \theta_3 = 0)$

$\tan\beta = 50$, $(M_0, M_{1/2}, A_0) = (250, 150, 0)$ GeV



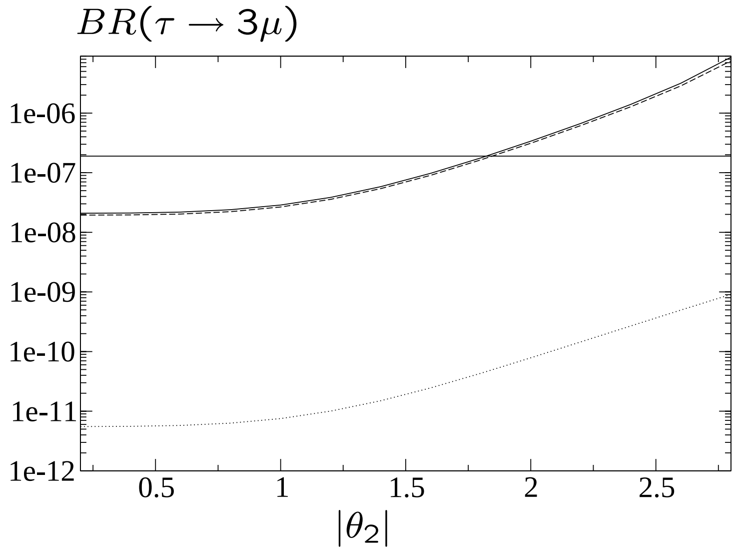
- ⋆ Restrictions on all channels except $\tau \to 3e$
- ⋆ $BR(\mu \to e\gamma)$, $BR(\mu \to 3e)$ excluded by data

Branching ratios dependence with m_{N_i}

Hierarchical m_{N_i} and $arg(\theta_2) = \pi/4$

upper $(m_{N_1}, m_{N_2}, m_{N_3}) = (10^8, 2 \times 10^8, 10^{14})$ GeV
medium $(m_{N_1}, m_{N_2}, m_{N_3}) = (10^{10}, 2 \times 10^{10}, 10^{14})$ GeV
lower $(m_{N_1}, m_{N_2}, m_{N_3}) = (10^8, 2 \times 10^8, 10^{12})$ GeV

$\tan\beta = 50$, $(M_0, M_{1/2}, A_0) = (200, 100, 0)$ GeV

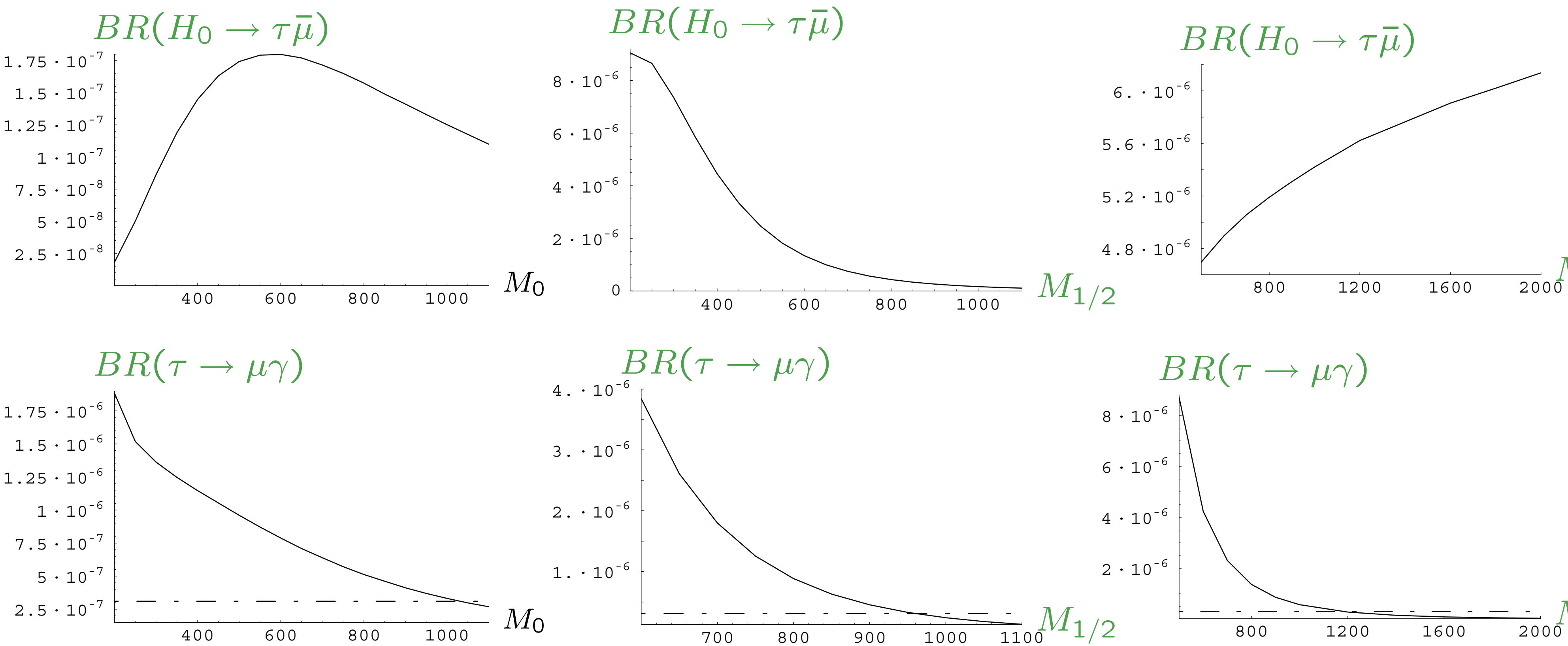


- ⋆ The relevant mass is the heaviest m_{N_3}
- ⋆ The scaling with m_{N_3} is approx. as in the degenerate case

Predictions for Higgs boson LFV decays

Hierarchical neutrinos $(m_{N_1}, m_{N_2}, m_{N_3}) = (10^8, 2\times 10^8, 10^{14})\,GeV$

$\tan\beta = 50$, $M_{1/2} = 300GeV$, $M_0 = 400GeV$, $M = M_0 = M_{1/2}(GeV)$, $\theta_2 = \pi e^{0.4i}$ two plots on the left, $\theta_2 = \pi e^{0.8i}$ four plots on the right



- ⋆ Non-decoupling of SUSY particles in $BR(H_0 \to \tau\bar{\mu})$ for $M = M_0 = M_{1/2}$
- ⋆ Higgs boson decay ratios up to $\mathcal{O}(10^{-5})$ for large $M_0 = M_{1/2}$

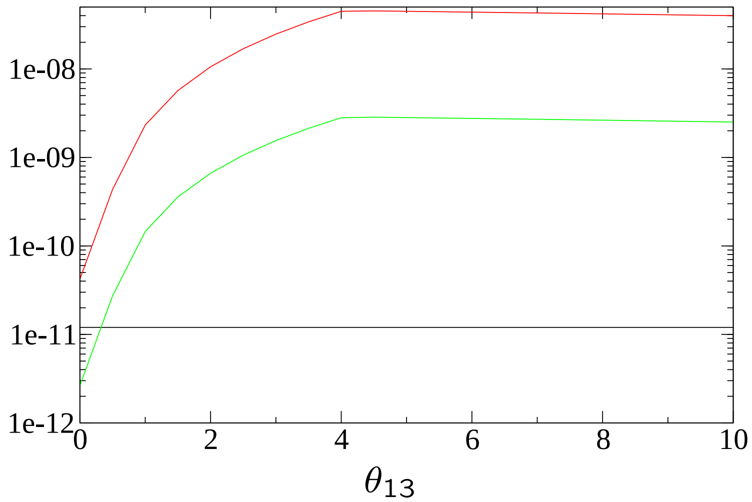
Branching ratios dependence with θ_{13}

Hierarchical m_{N_i} and $R = 1$ $(m_{N_1}, m_{N_2}, m_{N_3}) = (10^8, 2\times 10^8, 10^{14})$ GeV

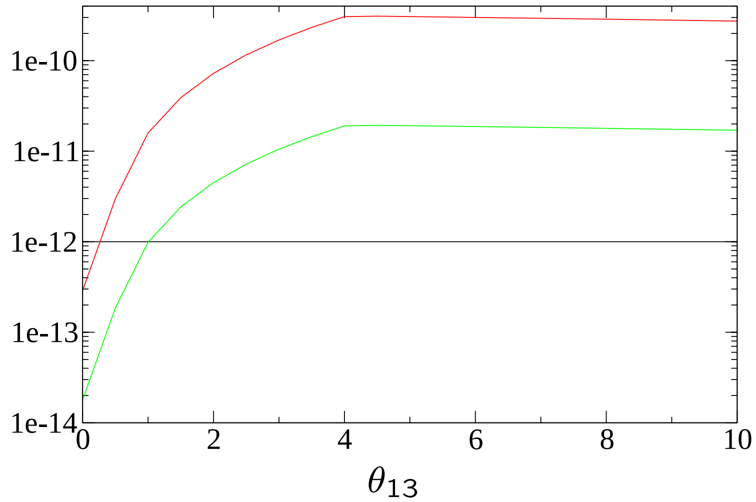
upper $(M_0, M_{1/2}, A_0) = (250, 150, 0)$ GeV, lower $(M_0, M_{1/2}, A_0) = (400, 300, 0)$ GeV

$\tan\beta = 50$

$BR(\mu \to e\gamma)$

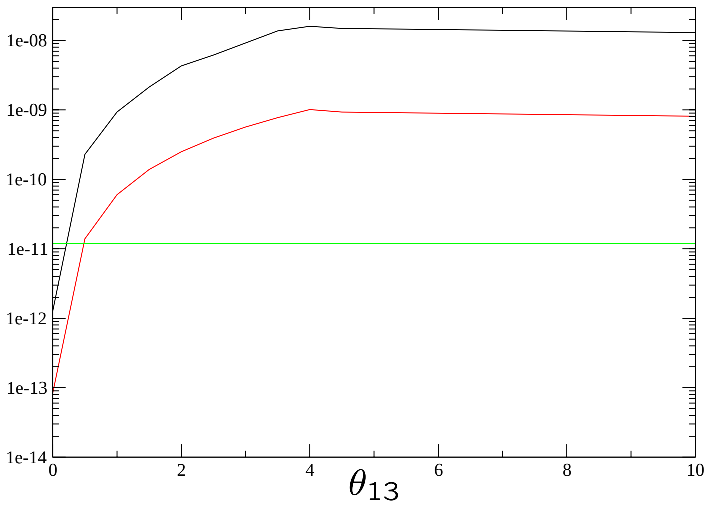


$BR(\mu \to 3e)$

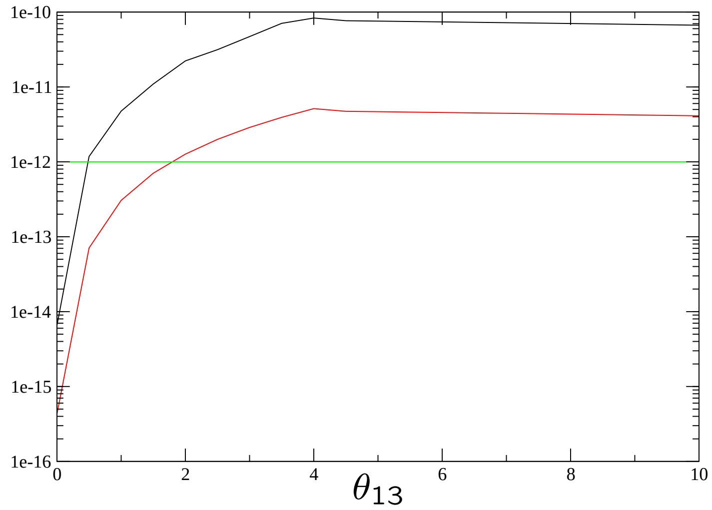


$\tan\beta = 30$

$BR(\mu \to e\gamma)$



$BR(\mu \to 3e)$



Conclusions

- Supersymmetry $\Rightarrow$ candidate physics beyond SM
- Seesaw mechanism $\Rightarrow$ candidate for ν physics

- SUSY loops generate relevant LFV muon and tau decay rates

- Analyzed dependence with mSUGRA and seesaw parameters

- Largest rates found in the CMSSM-seesaw for hierar. ν's with $(m_N)_{max}$ at 10^{14} GeV and $\tan\beta = 50$:
muon and tau decay rates at the present experimental reach

- Largest rates found for LFV Higgs decays, $BR(H_0, A_0 \to \tau\bar{\mu}) \sim \mathcal{O}(10^{-5})$, also for hierar. ν's with $(m_N)_{max}$ at 10^{14} GeV and $\tan\beta = 50$
but are not at the expected LHC reach (10^{-4})

- Severe restrictions on mSUGRA and seesaw parameter space, especially from $\mu \to e\gamma$, $\mu \to 3e$ and $\tau \to \mu\gamma$

LFV τ and μ decays constitute an interesting window for a possible indirect search of Supersymmetry, and allow us to restrict severely mSUGRA and seesaw parameters.