SUSY 2008

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LFV and eEDM in a SUSY flavour model

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mainly based on

LC, J. Jones-Perez, O. Vives arXiv:0804.4620 [hep-ph]

Motivations

- Neutrino oscillations show that lepton family numbers are not conserved
- CP is violated in the hadronic sector
- LFV in the charged leptons sector? CPV in the leptonic sector?
- LFV suppressed to negligible rates within the SM, eEDM < $O(10^{-38})$ e cm
- Model dependent and so complementar to direct searches of new physics

LFV Experiments:

Running: **BaBar**, **Belle**, **MEG**

Future: **SuperKEKB** (2012)

PRISM/PRIME (next decade)

Super Flavour factory (?)

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Observable	Present Bound	Future Sensitivity	Experiment
$BR(\mu \to e\gamma)$	$< 1.2 \times 10^{-11}$	$\mathcal{O}(10^{-13})$	MEG
$BR(\tau \to \mu\gamma)$	$< 4.5 \times 10^{-8}$	$\mathcal{O}(10^{-9})$	SFF
$BR(\tau \to e\gamma)$	$< 1.1 \times 10^{-7}$	$\mathcal{O}(10^{-9})$	SFF
eEDM (d_e)	$< 1.4 \times 10^{-27}$ e cm	$\mathcal{O}(10^{-29} - 10^{-31})$	Yale PbO

SUSY Flavour and CP problems

• Arbitrary entries in the soft SUSY breaking mass matrices lead to too large FCNC, LFV rates.

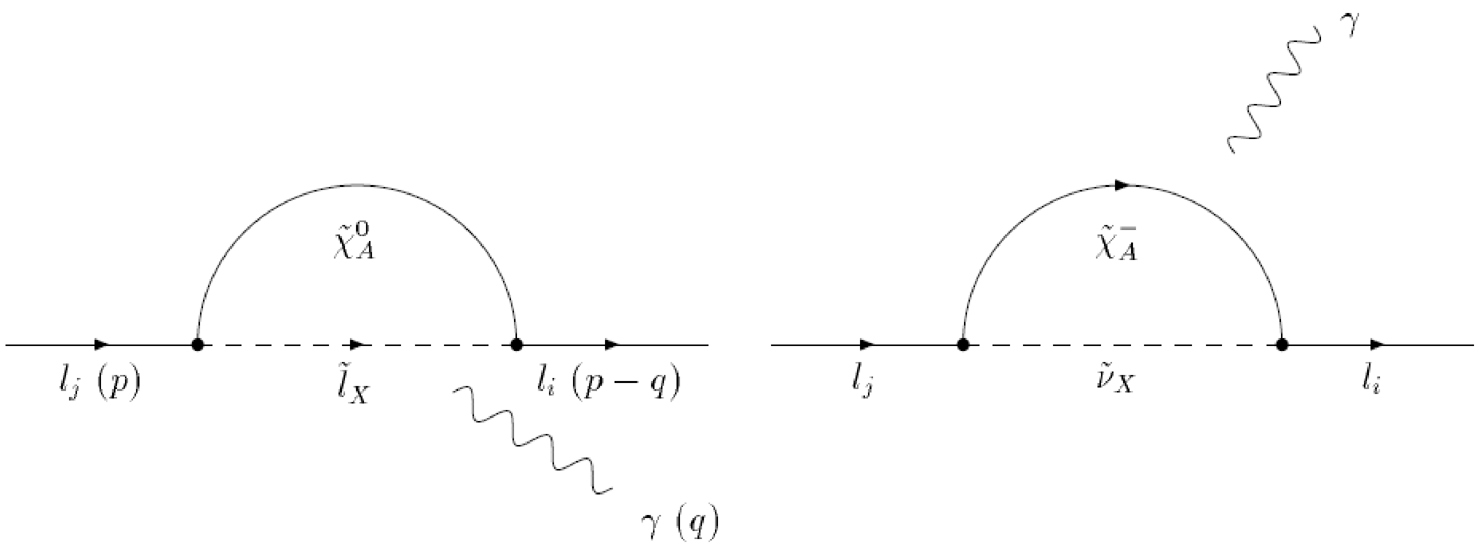
• O(1) phases (with no flavour suppression) give exceeding CPV effects (EDMs)

Is this related to our incomplete understanding of the SM flavour sector?

$$Y_d \propto \begin{pmatrix} 0 & \bar{\varepsilon}^3 & \bar{\varepsilon}^3 \\ \bar{\varepsilon}^3 & \bar{\varepsilon}^2 & \bar{\varepsilon}^2 \\ \bar{\varepsilon}^3 & \bar{\varepsilon}^2 & 1 \end{pmatrix} \qquad Y_u \propto \begin{pmatrix} 0 & \varepsilon^3 & \varepsilon^3 \\ \varepsilon^3 & \varepsilon^2 & \varepsilon^2 \\ \varepsilon^3 & \varepsilon^2 & 1 \end{pmatrix}$$

$\bar{\varepsilon} \sim 0.15 \qquad \varepsilon \sim 0.05$ Roberts, Romanino, Ross, Velasco-Sevilla '01

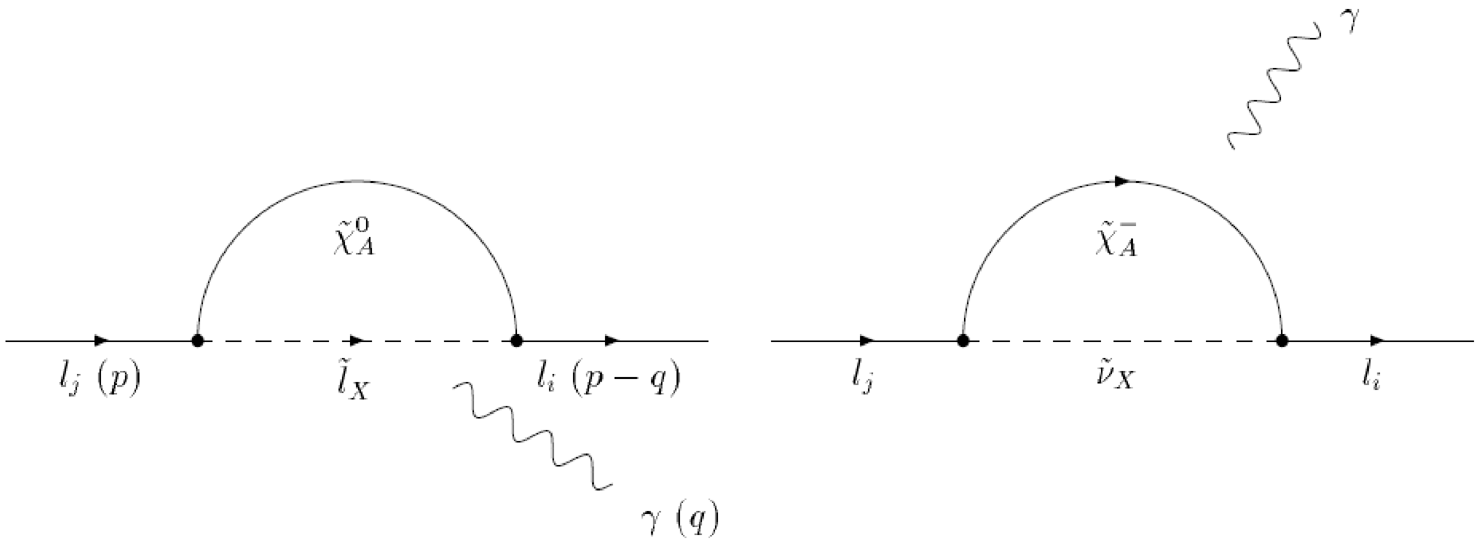
SUSY induced LFV



$$\mathcal{M}_e^2 = \begin{pmatrix} (m^2_{\tilde{L}})_{ij} + (m^2_e)_{ij} + \mathcal{O}(g^2)\ \delta_{ij} & A^{e\,*}_{ji}\ v_d - (m_e)_{ji}\ \mu \tan\beta \\ A^e_{ij}\ v_d - (m_e)_{ij}\ \mu^* \tan\beta & (m^2_{\tilde{E}})_{ij} + (m^2_e)_{ij} + \mathcal{O}(g^2)\ \delta_{ij} \end{pmatrix}$$

mSUGRA boundary conditions (at M_X): $m^2_{\tilde{f}} = m_0^2\ \mathbf{1} \qquad A^f = A_0\ Y^f$

SUSY induced LFV



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RGE induced sources of LFV:

- **GUT** ($M_X > M_{GUT}$) SU(5) :
  Barbieri, Hall '94

$$(m^2_{\tilde{E}})_{i\neq j} \simeq -3\ \frac{3m_0^2 + A_0}{8\pi^2}\ y_t^2\ V_{i3}V^*_{j3}\ \ln\left(\frac{M_X}{M_{\rm GUT}}\right)$$

- **RH neutrinos** :
  Borzumati, Masiero '86

$$(m^2_{\tilde{L}})_{i\neq j} \simeq -\frac{3m_0^2 + A_0}{8\pi^2}\ Y^\nu_{ik}\ Y^{\nu\,*}_{jk}\ \ln\left(\frac{M_X}{M_{R_k}}\right)$$

$$Q,\ L,\ u^c,\ d^c,\ e^c \sim \mathbf{3} \quad H^u,\ H^d \sim \mathbf{1}$$ $\Longrightarrow$ Yukawa couplings forbidden

SU(3) broken (in two steps) by vevs of "flavon" fields:

$$\theta_3,\ \theta_{23} \sim \bar{\mathbf{3}} \quad \bar\theta_3,\ \bar\theta_{23} \sim \mathbf{3} \qquad \langle\theta_3\rangle = \begin{pmatrix} 0 \\ 0 \\ a_3 \end{pmatrix} \quad \langle\theta_{23}\rangle = \begin{pmatrix} 0 \\ b_{23} \\ b_{23} \end{pmatrix}$$

Yukawa superpotential:

$$W_{\rm Y} = H\psi_i\psi_j^c \left[\frac{1}{M_f^2}\ \theta_3^i\theta_3^j + \frac{1}{M_f^4}\ \theta_{23}^i\theta_{23}^j\,(\theta_3\overline{\theta}_3) + \frac{1}{M_f^5}\ \epsilon^{ikl}\overline{\theta}_{23,k}\overline{\theta}_{3,l}\theta_{23}^j\,(\theta_{23}\overline{\theta}_3) + \ldots\right]$$

Froggatt-Nielsen mechanism:

$$\left(\frac{a_3}{M_f}\right) \sim \mathcal{O}(1) \quad \left(\frac{b_{23}}{M_u}\right) = \bar\varepsilon \quad \left(\frac{b_{23}}{M_d}\right) = \varepsilon \qquad Y_f = \begin{pmatrix} 0 & b\ \varepsilon^3 & c\ \varepsilon^3 \\ b\ \varepsilon^3 & \varepsilon^2 & a\ \varepsilon^2 \\ c\ \varepsilon^3 & a\ \varepsilon^2 & 1 \end{pmatrix} \left(\frac{a_3}{M_f}\right)^2$$

King, Ross '01; King, Ross '03; Ross, Vives, Velasco-Sevilla '04

SU(3) flavour model

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Soft masses:

Common for each triplet in the unbroken SU(3) limit

$$(m^2_{\tilde{f}})_{ij} = m_0^2 \Bigg(\delta_{ij} + \frac{1}{M_f^2} \left[\theta^\dagger_{3,\,i}\, \theta_{3,\,j} + \overline{\theta}^\dagger_{3,\,i}\, \overline{\theta}_{3,\,j} + \theta^\dagger_{23,\,i}\, \theta_{23,\,j} + \overline{\theta}^\dagger_{23,\,i}\, \overline{\theta}_{23,\,j} \right] + \frac{1}{M_f^4} (\epsilon^{ikl} \overline{\theta}_{3,\,k}\, \overline{\theta}_{23,\,l})^\dagger (\epsilon^{jmn} \overline{\theta}_{3,\,m}\, \overline{\theta}_{23,\,n}) + \quad \ldots \quad \Bigg)$$

After the breaking:

$$\Longrightarrow \qquad m^2_{\tilde{f}} = \begin{pmatrix} 1 + \varepsilon^2\, y_f & 0 & 0 \\ 0 & 1 + \varepsilon^2 & \varepsilon^2 \\ 0 & \varepsilon^2 & 1 + y_f \end{pmatrix} m_0^2 \qquad y_f \equiv \left(\frac{a_3}{M_f} \right)^2$$

Not universal: flavour violation sources already at M_X (GUT scale)

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Slepton sector in the SCKM basis:

$$(m^2_{\tilde{E}})^{\rm SCKM} = \begin{pmatrix} 1+\bar{\varepsilon}^2\, y_\tau & \frac{1}{3}\bar{\varepsilon}^3 & \frac{1}{3}\bar{\varepsilon}^3 \\ \frac{1}{3}\bar{\varepsilon}^3 & 1+\bar{\varepsilon}^2 & \bar{\varepsilon}^2 \\ \frac{1}{3}\bar{\varepsilon}^3 & \bar{\varepsilon}^2 & 1+y_\tau \end{pmatrix} m_0^2 \qquad (m^2_{\tilde{L}})^{\rm SCKM} = \begin{pmatrix} 1+\varepsilon^2\, y_\nu & \frac{1}{3}\varepsilon^2\bar{\varepsilon} & \bar{\varepsilon}^3\, y_\nu \\ \frac{1}{3}\varepsilon^2\bar{\varepsilon} & 1+\varepsilon^2 & 3\;\bar{\varepsilon}^2\, y_\nu \\ \bar{\varepsilon}^3\, y_\nu & 3\;\bar{\varepsilon}^2\, y_\nu & 1+y_\nu \end{pmatrix} m_0^2$$

matrices at the GUT scale: RGE effect (from RH ν and non-universality)

e.g. $$\left(m^2_{\tilde{E}}\right)_{32}(M_{\rm SUSY}) \simeq \left[\left(m^2_{\tilde{E}}\right)_{32}(M_X) \left(1 - \frac{1}{16\pi^2}\,(2y_\tau^2)\right) - 4\frac{A^e_{33}A^{e\dagger}_{32}}{16\pi^2} \right] \log\left(\frac{M_X}{M_{\rm SUSY}}\right)$$

sizeable in the τ-μ and τ-e sectors

Soft masses:

Common for each triplet in the unbroken SU(3) limit

$$(m^2_{\tilde{f}})_{ij} = m_0^2 \Big(\delta_{ij} + \frac{1}{M_f^2} \left[\theta^\dagger_{3,\,i}\, \theta_{3,\,j} + \overline{\theta}^\dagger_{3,\,i}\, \overline{\theta}_{3,\,j} + \theta^\dagger_{23,\,i}\, \theta_{23,\,j} + \overline{\theta}^\dagger_{23,\,i}\, \overline{\theta}_{23,\,j} \right] + \frac{1}{M_f^4} (\epsilon^{ikl} \overline{\theta}_{3,\,k}\, \overline{\theta}_{23,\,l})^\dagger (\epsilon^{jmn} \overline{\theta}_{3,\,m}\, \overline{\theta}_{23,\,n}) + \quad \ldots \Big)$$

Slepton sector in the SCKM basis:

A-terms: $$(A_e)^{\rm SCKM} = \begin{pmatrix} \frac{\bar{\varepsilon}^4}{3} & \bar{\varepsilon}^3 & \bar{\varepsilon}^3 \\ \bar{\varepsilon}^3 & 3\,\bar{\varepsilon}^2 & 3\,\bar{\varepsilon}^2 \\ \bar{\varepsilon}^3 & 3\,\bar{\varepsilon}^2 & 1 \end{pmatrix} A_0\ y_\tau$$

same structure as Yukawas, but not aligned (different O(1) coeff.)

⇨ *not* diagonal in the SCKM basis

Soft masses:

Common for each triplet in the unbroken SU(3) limit

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Slepton sector in the SCKM basis:

Mass Insertions (MIs): $(\delta^e_{\rm LL})_{ij} \equiv \frac{(m^2_{\tilde{L}})_{ij}}{M^2_{\tilde{e}}}$ $(\delta^e_{\rm RR})_{ij} \equiv \frac{(m^2_{\tilde{E}})_{ji}}{M^2_{\tilde{e}}}$

$$(\delta^e_{\rm LL})_{12} \approx \frac{\epsilon^2\bar{\epsilon}}{3}; \quad (\delta^e_{\rm RR})_{12} \approx \frac{\bar{\epsilon}^3}{3}; \quad (\delta^e_{\rm LR})_{12} \approx A_0 \frac{m_\tau}{M^2_{\tilde{e}}} \bar{\epsilon}^3$$

$$(\delta^e_{\rm LL})_{13} \approx \bar{\epsilon}^3 \; y^\nu_{33}; \quad (\delta^e_{\rm RR})_{13} \approx \frac{\bar{\epsilon}^3}{3}; \quad (\delta^e_{\rm LR})_{13} \approx A_0 \frac{m_\tau}{M^2_{\tilde{e}}} \bar{\epsilon}^3$$

$$(\delta^e_{\rm LL})_{23} \approx \bar{\epsilon}^2 \; y^\nu_{33}; \quad (\delta^e_{\rm RR})_{23} \approx \bar{\epsilon}^2; \quad (\delta^e_{\rm LR})_{23} \approx A_0 \frac{m_\tau}{M^2_{\tilde{e}}} 3\bar{\epsilon}^2$$

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$$(m^2_{\tilde{f}})_{ij} = m_0^2\Big(\delta_{ij} + \frac{1}{M_f^2}\left[\theta^\dagger_{3,\,i}\,\theta_{3,\,j} + \overline{\theta}^\dagger_{3,\,i}\,\overline{\theta}_{3,\,j} + \theta^\dagger_{23,\,i}\,\theta_{23,\,j} + \overline{\theta}^\dagger_{23,\,i}\,\overline{\theta}_{23,\,j}\right]$$
$$+ \frac{1}{M_f^4}(\epsilon^{ikl}\overline{\theta}_{3,\,k}\,\overline{\theta}_{23,\,l})^\dagger(\epsilon^{jmn}\overline{\theta}_{3,\,m}\,\overline{\theta}_{23,\,n}) + \quad \ldots \quad \Big)$$

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$(\delta^e_{\rm LL})_{12} \approx 10^{-4}$ $(\delta^e_{\rm RR})_{12} \approx 10^{-3}$ $(\delta^e_{\rm LR})_{12} \approx a_0\, 10^{-5}$

$(\delta^e_{\rm LL})_{13} \approx 10^{-3}$ $(\delta^e_{\rm RR})_{13} \approx 10^{-3}$ $(\delta^e_{\rm LR})_{13} \approx a_0\, 10^{-5}$

$(\delta^e_{\rm LL})_{23} \approx 10^{-2}$ $(\delta^e_{\rm RR})_{23} \approx 10^{-2}$ $(\delta^e_{\rm LR})_{23} \approx a_0\, 10^{-3}$

No ambiguity in the computation of the LFV processes:

$$\frac{BR(l_i \to l_j \gamma)}{BR(l_i \to l_j \nu_i \bar{\nu}_j)} = \frac{48\pi^3 \alpha}{G_F^2}(|A_L^{ij}|^2 + |A_R^{ij}|^2)$$

Hisano et al. '95

$$A_L^{ij} = \frac{\alpha_2}{4\pi}\frac{(\delta^e_{\rm LL})_{ij}}{m^2_{\tilde{l}}}\left[\frac{\mu M_2 \tan\beta}{(M_2^2-\mu^2)}\, F_{2\rm LL}(a_2,b)+\tan^2\theta_W\, \frac{\mu M_1 \tan\beta}{(M_1^2-\mu^2)}\, F_{1\rm LL}(a_1,b)\right] + \frac{\alpha_1}{4\pi}\,\frac{(\delta^e_{\rm RL})_{ij}}{m^2_{\tilde{l}}}\left(\frac{M_1}{m_{l_i}}\right) F_{1\rm LR}(a_1)\,,$$

$$A_R^{ij} = \frac{\alpha_1}{4\pi}\left(\frac{(\delta^e_{\rm RR})_{ij}}{m^2_{\tilde{l}}}\frac{\mu M_1 \tan\beta}{(M_1^2-\mu^2)}\, F_{1\rm RR}(a_1,b)+\frac{(\delta^e_{\rm LR})_{ij}}{m^2_{\tilde{l}}}\left(\frac{M_1}{m_{l_i}}\right) F_{1\rm LR}(a_1)\right),$$

⇨ $\mu \to e\gamma$ LR contr. for $A_0 \neq 0$ $\quad \frac{(\delta^e_{\rm RR})_{12}\; m_{l_i} \tan\beta}{(\delta^e_{\rm LR})_{12}\; M_1} \simeq \frac{(\bar{\varepsilon}^3/3)\; m_\mu \tan\beta}{\bar{\varepsilon}^3 A_0\; (m_\tau/M^2_{\tilde{e}})\; M_1} = \frac{m_\mu \tan\beta}{3\; m_\tau}\frac{M^2_{\tilde{e}}}{A_0 M_1}$

⇨ $A_0 = 0 \quad \frac{BR(\tau \to e\,\gamma)}{BR(\mu \to e\,\gamma)} \approx \left(\frac{m_\tau}{m_\mu}\right)^5 \frac{\Gamma_\mu}{\Gamma_\tau}\frac{(\delta^e_{\rm LL})^2_{13}}{(\delta^e_{\rm LL})^2_{12}} \approx \mathcal{O}(1) \quad \frac{BR(\tau \to \mu\,\gamma)}{BR(\mu \to e\,\gamma)} \approx \left(\frac{m_\tau}{m_\mu}\right)^5 \frac{\Gamma_\mu}{\Gamma_\tau}\frac{(\delta^e_{\rm LL})^2_{23}}{(\delta^e_{\rm LL})^2_{12}} \approx \mathcal{O}(10^3)$

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$\Rightarrow \mu \to e\gamma$ LR contr. for $A_0 \neq 0$

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$\Rightarrow A_0 = 0$

$$\frac{BR(\tau \to e\,\gamma)}{BR(\mu \to e\,\gamma)} \approx \left(\frac{m_\tau}{m_\mu}\right)^5 \frac{\Gamma_\mu}{\Gamma_\tau} \frac{(\delta^e_{\rm LL})^2_{13}}{(\delta^e_{\rm LL})^2_{12}} \approx \mathcal{O}(1) \qquad \frac{BR(\tau \to \mu\,\gamma)}{BR(\mu \to e\,\gamma)} \approx \left(\frac{m_\tau}{m_\mu}\right)^5 \frac{\Gamma_\mu}{\Gamma_\tau} \frac{(\delta^e_{\rm LL})^2_{23}}{(\delta^e_{\rm LL})^2_{12}} \approx \mathcal{O}(10^3)$$

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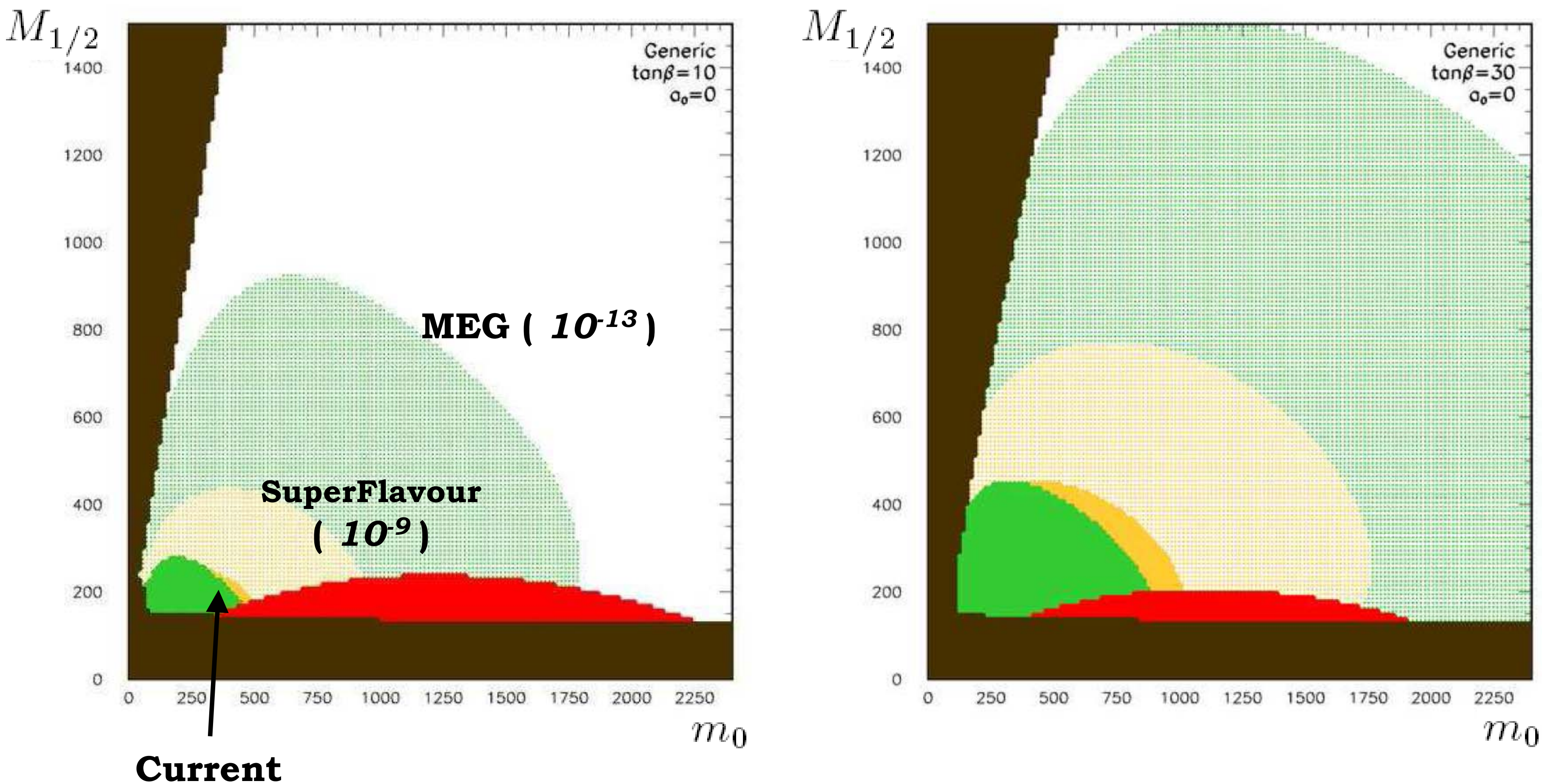
$$\frac{BR(\tau \to e\,\gamma)}{BR(\mu \to e\,\gamma)} \approx \left(\frac{m_\tau}{m_\mu}\right)^5 \frac{\Gamma_\mu}{\Gamma_\tau} \frac{(\delta^e_{\rm LL})^2_{13}}{(\delta^e_{\rm LL})^2_{12}} \approx \mathcal{O}(1) \qquad \frac{BR(\tau \to \mu\,\gamma)}{BR(\mu \to e\,\gamma)} \approx \left(\frac{m_\tau}{m_\mu}\right)^5 \frac{\Gamma_\mu}{\Gamma_\tau} \frac{(\delta^e_{\rm LL})^2_{23}}{(\delta^e_{\rm LL})^2_{12}} \approx \mathcal{O}(10^3)$$

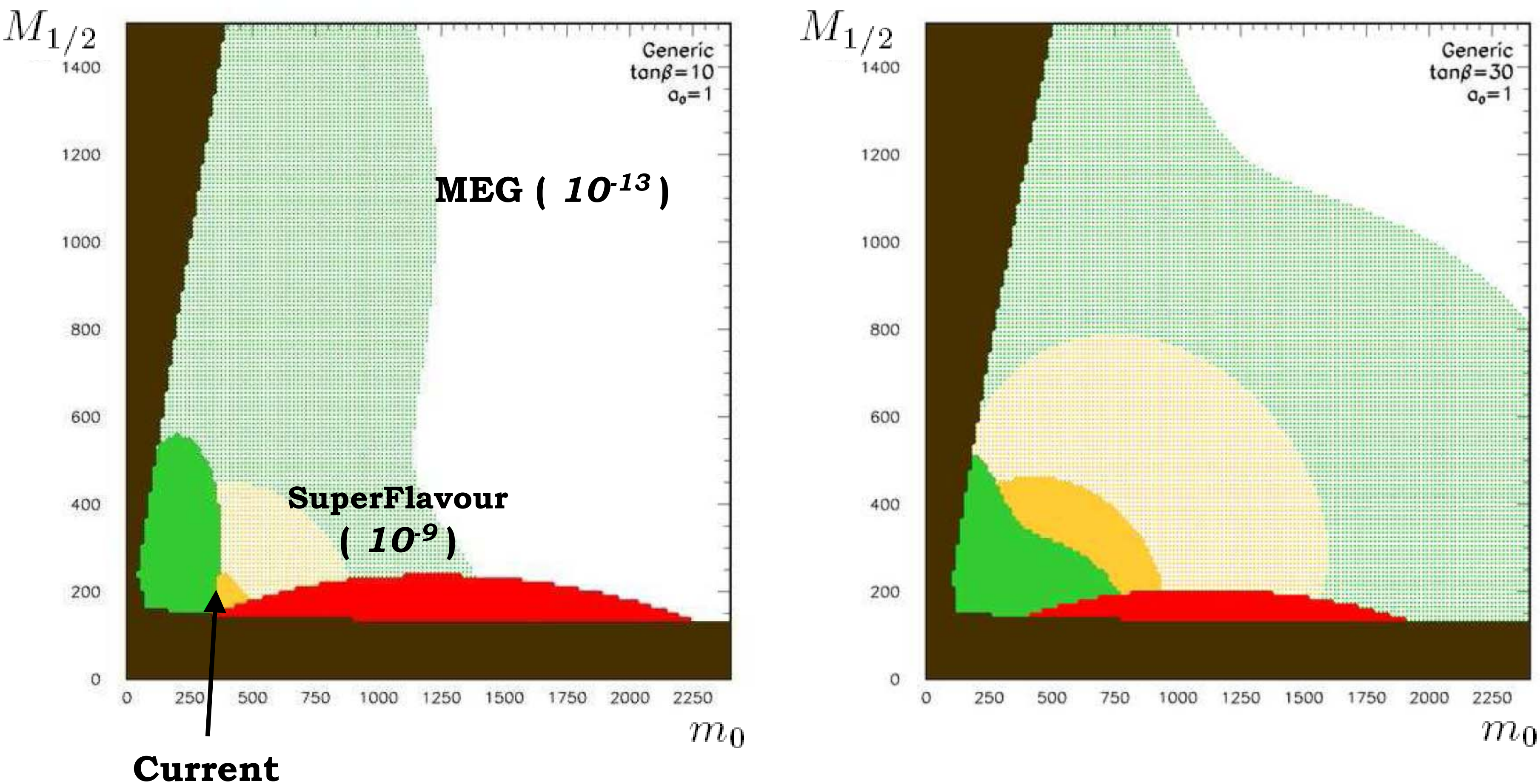
Lepton Flavour Violation

$\tan\beta = 10$ $\quad$ $A_0 = 0$ $\quad$ $\tan\beta = 30$



MEG could test the parameter space even beyond the LHC sensitivity reach

$\tan\beta = 10$ $A_0 = m_0$ $\tan\beta = 30$



MEG could test the parameter space even beyond the LHC sensitivity reach

Spontaneous CP breaking and eEDM

CP spontaneously broken by complex flavon vevs:

$$\langle\theta_3\rangle = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \otimes \begin{pmatrix} a_3^u & 0 \\ 0 & a_3^d\ e^{i\chi} \end{pmatrix} \qquad \langle\bar\theta_3\rangle = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \otimes \begin{pmatrix} a_3^u\ e^{i\alpha_u} & 0 \\ 0 & a_3^d\ e^{i\alpha_d} \end{pmatrix}$$

$$\langle\theta_{23}\rangle = \begin{pmatrix} 0 \\ b_{23} \\ b_{23}\ e^{i\beta_3} \end{pmatrix} \qquad \langle\bar\theta_{23}\rangle = \begin{pmatrix} 0 \\ b_{23}\ e^{i\beta_2'} \\ b_{23}\ e^{i(\beta_2'-\beta_3)} \end{pmatrix}$$

Ross, Vives, Velasco-Sevilla ‘04

Two cases in the eEDM analysis:

- “Generic” SU(3) with O(1) phases
- Explicit example from RVV ‘04

$$\frac{m^2_{\tilde L}}{m_0^2} = \begin{pmatrix} 1+\varepsilon^2\ y_{33}^\nu & \frac{1}{3}\varepsilon^2\bar\varepsilon & L_1^*\ \bar\varepsilon^3\ y_{33}^\nu\ e^{-i(\beta_3-\chi)} \\ \frac{1}{3}\varepsilon^2\bar\varepsilon & 1+\varepsilon^2 & 3L_2^*\ \bar\varepsilon^2\ y_{33}^\nu\ e^{-i(\beta_3-\chi)} \\ L_1\ \bar\varepsilon^3\ y_{33}^\nu\ e^{i(\beta_3-\chi)} & 3L_2\ \bar\varepsilon^2\ y_{33}^\nu\ e^{i(\beta_3-\chi)} & 1+y_{33}^\nu \end{pmatrix}$$

CP spontaneously broken by complex flavon vevs:

$$\langle\theta_3\rangle = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \otimes \begin{pmatrix} a_3^u & 0 \\ 0 & a_3^d \; e^{i\chi} \end{pmatrix} \qquad \langle\bar\theta_3\rangle = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \otimes \begin{pmatrix} a_3^u \; e^{i\alpha_u} & 0 \\ 0 & a_3^d \; e^{i\alpha_d} \end{pmatrix}$$

$$\langle\theta_{23}\rangle = \begin{pmatrix} 0 \\ b_{23} \\ b_{23} \; e^{i\beta_3} \end{pmatrix} \qquad \langle\bar\theta_{23}\rangle = \begin{pmatrix} 0 \\ b_{23} \; e^{i\beta_2'} \\ b_{23} \; e^{i(\beta_2'-\beta_3)} \end{pmatrix}$$

Ross, Vives, Velasco-Sevilla ‘04

Two cases in the eEDM analysis:

- “Generic” SU(3) with O(1) phases
- Explicit example from RVV ‘04

$$\frac{(m^2_{\tilde e_R})^T}{m_0^2} = \begin{pmatrix} 1+\bar\varepsilon^2 \; y^e_{33} & \frac{1}{3}\bar\varepsilon^3 & \frac{1}{3}\bar\varepsilon^3 \; e^{-i(\beta_3-\chi)} \\ \frac{1}{3}\bar\varepsilon^3 & 1+\bar\varepsilon^2 & E^* \; \bar\varepsilon^2 \; e^{-i(\beta_3-\chi)} \\ \frac{1}{3}\bar\varepsilon^3 \; e^{i(\beta_3-\chi)} & E \; \bar\varepsilon^2 \; e^{i(\beta_3-\chi)} & 1+y^e_{33} \end{pmatrix}$$

Spontaneous CP breaking and eEDM

• CP exact symmetry of the high energy theory: soft (scalar and gaugino) masses real and μ term (from Giudice-Masiero mech.) real.

• After SU(3)/CP breaking, Yukawa matrices and off-diagonal elements in soft masses contain *O(1)* CP violating phases (e.g. $\delta_{\rm CKM}$).

• Trilinear couplings A_f have the same (leading order) structure as Yukawas: diagonal elements in A_f are real at leading order in SCKM basis.

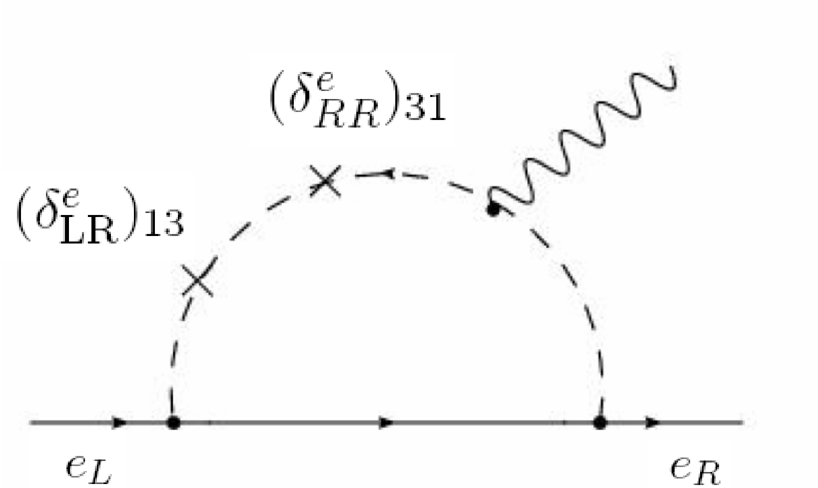
Ross, Vives, Velasco-Sevilla '04

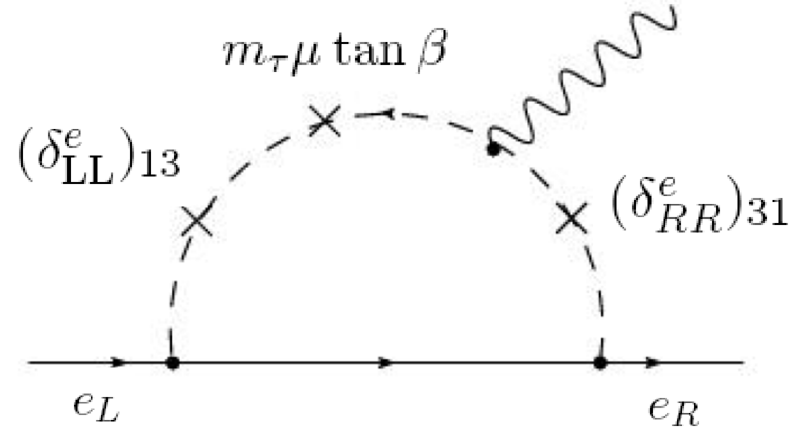
Contributions to eEDM from off-diagonal terms in sfermion mass matrices:

$$\frac{d_e}{e} = \frac{\alpha M_1}{8\pi \cos^2\theta_W M_{\tilde e}^2} \Im m\left[(\delta^e_{\rm LL})_{1i}(\delta^e_{\rm LR})_{i1}\, f_1 + (\delta^e_{\rm LR})_{1i}(\delta^e_{\rm RR})_{i1}\, f_2 + (\delta^e_{\rm LL})_{1i}(\delta^e_{\rm LR})_{ij}(\delta^e_{\rm RR})_{j1} f_3\right]$$

$$(\delta^e_{\rm LR})_{1i}(\delta^e_{\rm RR})_{i1} \;\approx\; A_0 \bar\epsilon^6 \frac{m_\tau}{M_{\tilde e}^2}$$

$$(\delta^e_{\rm LL})_{13}(\delta^e_{\rm LR})_{33}(\delta^e_{\rm RR})_{31} \;\approx\; \bar\epsilon^6 y^\nu_{33} \frac{m_\tau}{M_{\tilde e}^2}\; \mu \tan\beta$$





Contributions to eEDM from off-diagonal terms in sfermion mass matrices:

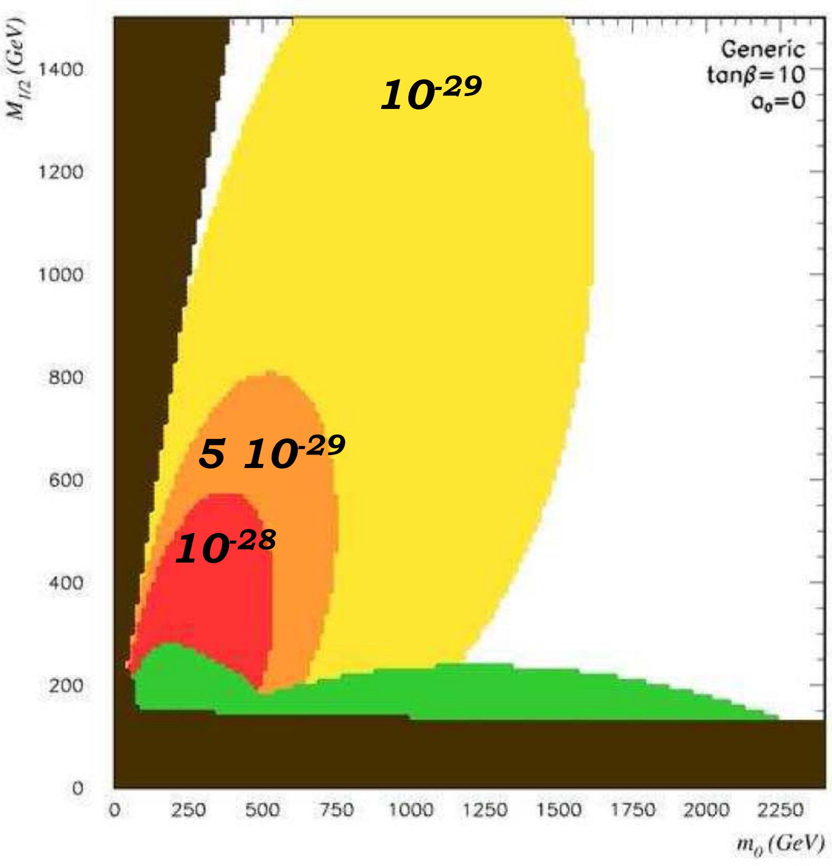
$$\frac{d_e}{e} = \frac{\alpha M_1}{8\pi \cos^2\theta_W M^2_{\tilde{e}}} \Im m \left[(\delta^e_{\rm LL})_{1i} (\delta^e_{\rm LR})_{i1} \, f_1 + (\delta^e_{\rm LR})_{1i} (\delta^e_{\rm RR})_{i1} \, f_2 + (\delta^e_{\rm LL})_{1i} (\delta^e_{\rm LR})_{ij} (\delta^e_{\rm RR})_{j1} f_3 \right]$$

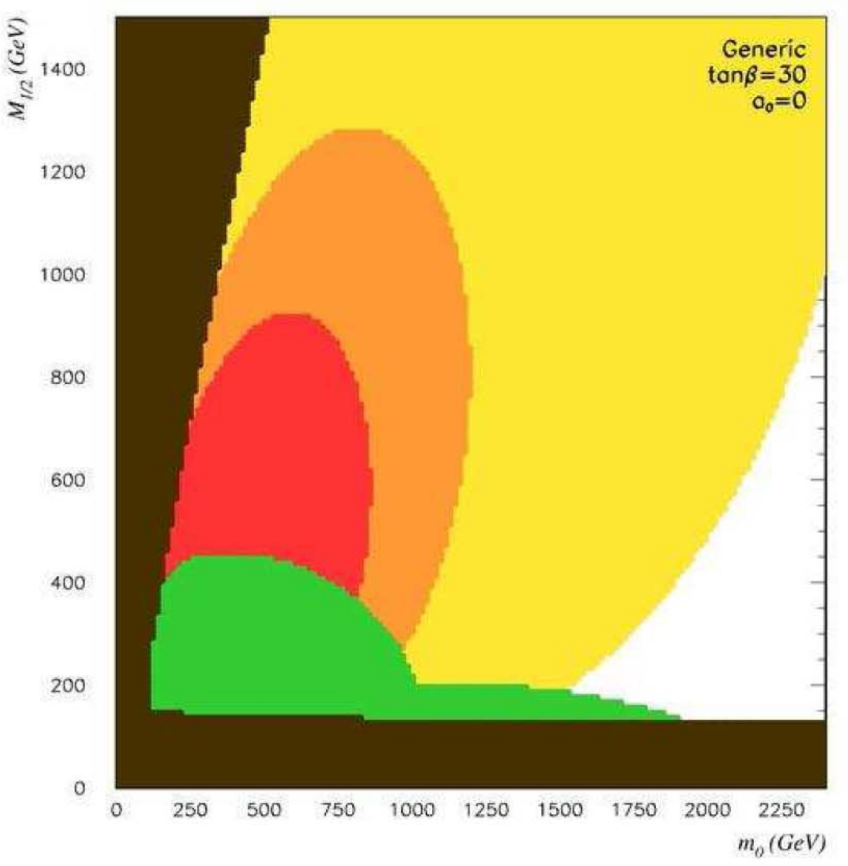
$$(\delta^e_{\rm LR})_{1i} (\delta^e_{\rm RR})_{i1} \;\approx\; A_0 \bar{\epsilon}^6 \frac{m_\tau}{M^2_{\tilde{e}}}$$

$$(\delta^e_{\rm LL})_{13} (\delta^e_{\rm LR})_{33} (\delta^e_{\rm RR})_{31} \;\approx\; \bar{\epsilon}^6 y^\nu_{33} \frac{m_\tau}{M^2_{\tilde{e}}} \; \mu \tan\beta$$

Spontaneous CP breaking and eEDM

$\tan\beta = 10$ Generic model $\tan\beta = 30$

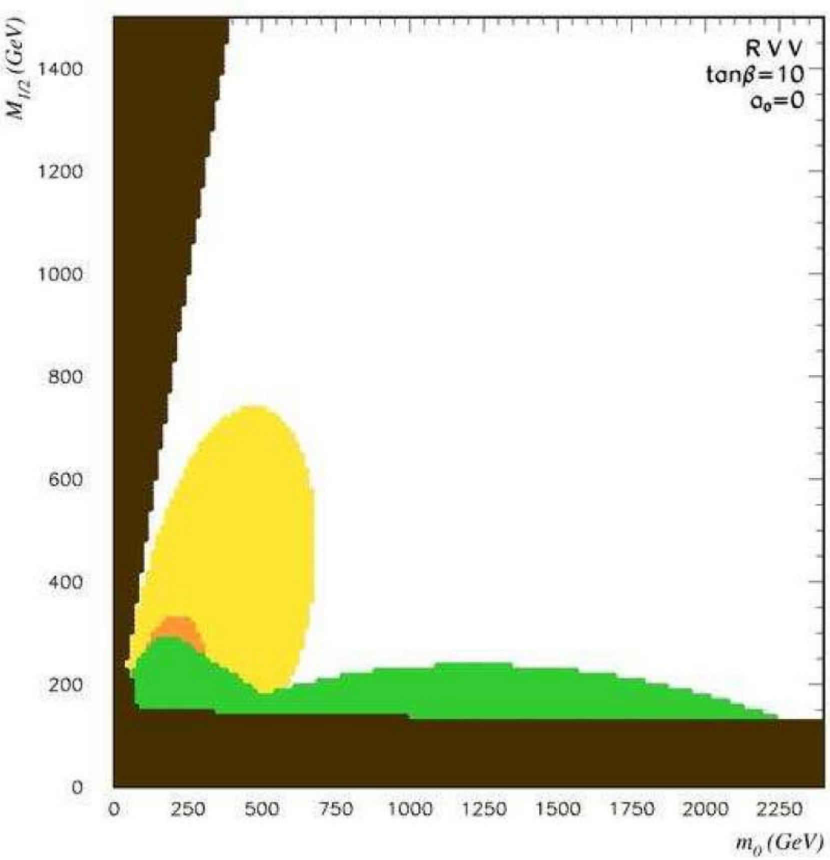


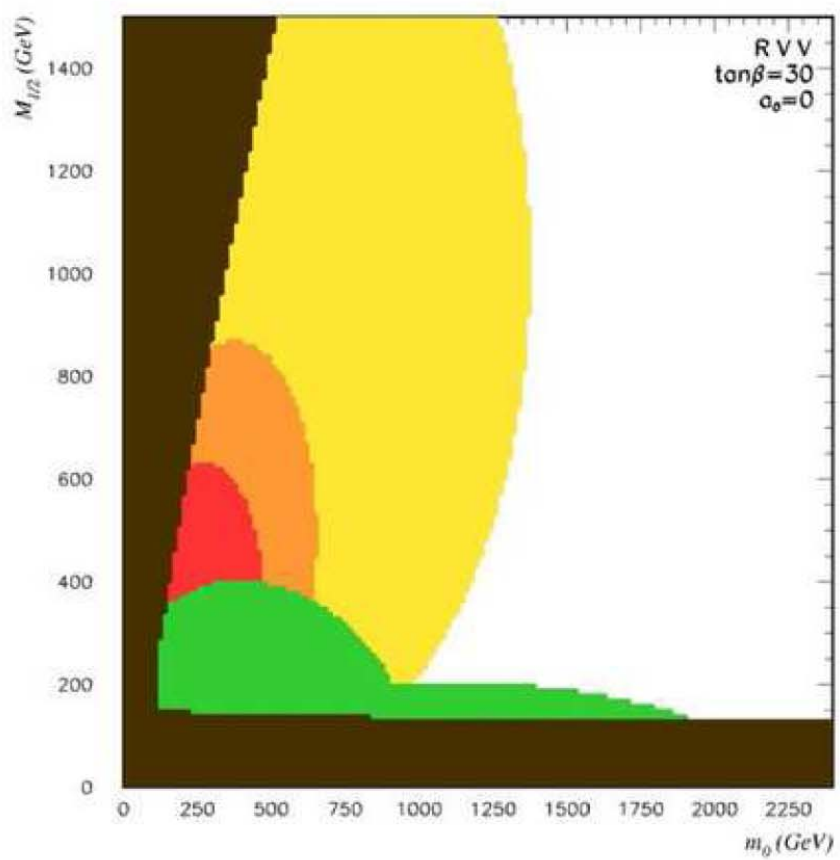


currently unconstrained even with O(1) phases

Spontaneous CP breaking and eEDM

$\tan\beta = 10$ RVV model $\tan\beta = 30$





eEDM about one order of magnitude smaller than in the generic model

Conclusions

In the considered model, LFV and eEDM (with O(1) phases) are in the reach of the upcoming experimental sensitivities, at least for SUSY masses in the LHC range

$\Longrightarrow$ the model will be tested soon

감사합니다