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Recent Work on Baryon-Triality (R-Parity Violation)

What is the LSP?

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OUTLINE

1. **What is Baryon Triality.....and why?**

2. **Spectrum in Baryon Triality Models: What is the LSP?**

3. **Focus on $\tilde{\nu}_\mu$-LSP**

4. **Briefly: LHC Signatures and Rates**

5. **Conclusions**

SUSY SPECTRUM

Standard Model + SUSY $\Longrightarrow$ Double Spectrum (+2 Higgs Doublets)

e^- (spin $= \frac{1}{2}$)	$\longleftrightarrow$	$\tilde{e}$ ($s = 0$)	scalar electron
top t ($s = \frac{1}{2}$)	$\longleftrightarrow$	$\tilde{t}$ ($s = 0$)	scalar top
$W^\pm$ ($s = 1$)	$\longleftrightarrow$	$\tilde{W}^\pm$ ($s = \frac{1}{2}$)	Wino
$H^\pm$ ($s = 0$)	$\longleftrightarrow$	$\tilde{H}^\pm$ ($s = \frac{1}{2}$)	Higgsino
γ, Z^0 ($s = 1$)	$\longleftrightarrow$	$\tilde{\gamma}$, $\tilde{Z}^0$ ($s = \frac{1}{2}$)	Photino, Zino
H^0, h^0 ($s = 0$)	$\longleftrightarrow$	$\tilde{H}^0$, $\tilde{h}^0$ ($s = \frac{1}{2}$)	Higgsino
$g_{a=1,\ldots,8}$ ($s = 1$)	$\longleftrightarrow$	$\tilde{g}_a$ ($s = \frac{1}{2}$)	Gluino

MIXING: After $SU(2)_L \times U(1)_Y \longrightarrow U(1)_{EM}$

$\tilde{W}^\pm,\ \tilde{H}^\pm$	$\xrightarrow{\text{MIX}}$	$\tilde{\chi}^\pm_{i=1,2}$	Charginos
$\tilde{\gamma},\ \tilde{Z}^0,\ \tilde{h}^0,\ \tilde{H}^0$	$\xrightarrow{\text{MIX}}$	$\tilde{\chi}^0_{i=1,2,3,4}$	Neutralinos

SUPERPOTENTIAL

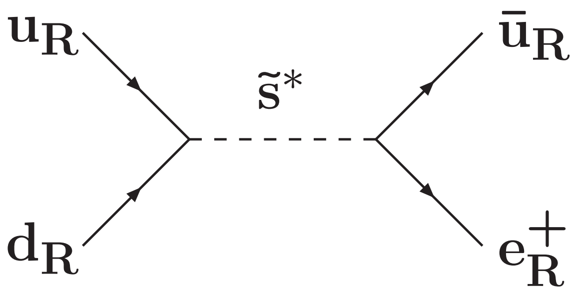
$$W_{P_6} = (h_e)_{ij}\, L_i H_1 E^c_j + (h_d)_{ij}\, Q_i H_1 D^c_j + (h_u)_{ij}\, Q_i H_2 U^c_j + \mu H_1 H_2$$

- These terms give mass to quarks and leptons. This is not all though:

$$W_{\not P_6} = \underbrace{\lambda_{ijk} L_i L_j \overline{E}_k + \lambda'_{ijk} L_i Q_j \overline{D}_k + \kappa_i L_i H_2}_{} + \underbrace{\lambda''_{ijk} \overline{U}_i \overline{D}_j \overline{D}_k}_{}$$

Lepton Number Violating   Baryon Num. Viol.

- Together these lead to rapid proton decay



$$\lambda'_{i1j} \cdot \lambda''_{11j} < 2 \cdot 10^{-27} \left(\frac{M_{\tilde{d}_j}}{100\ \mathrm{GeV}} \right)^2, \quad i = 1, 2,\ j \neq 1,$$

SYMMETRIES

- Need a (discrete) symmetry to protect proton.

- Conventional choice: R-parity, $R_p = (-1)^{2S+3B-L}$ $\Longrightarrow$ MSSM

- Other discrete gauge anomaly-free symmetries: Ibanez, Ross; Luhn, Thormeier, HD

- **Baryon Triality (B$_3$):** Prohibits UDD Terms

$$\Psi_j \to e^{i\alpha_j 2\pi/3}\Psi_j$$

	Q	U^c	D^c	L	E^c	H_d	H_u
α_j	0	2	1	2	2	2	1

- **Proton Hexality P$_6$:** like R-parity, except it prohibits dangerous dimension-5 proton decay operators: $QQQL, \ldots$

LOW-ENERGY BOUNDS ON λ, λ'

$$W_{\mathrm{B}_3} = \lambda_{ijk} L_i L_j \overline{E}_k + \lambda'_{ijk} L_i Q_j \overline{D}_k + \kappa_i L_i H_2$$

- Weakest 2σ bounds in each class

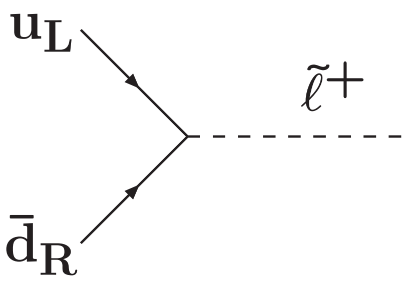
λ_{ijk}	λ'_{1jk}	λ'_{2jk}	λ'_{3jk}
0.07	0.28	0.56	0.52

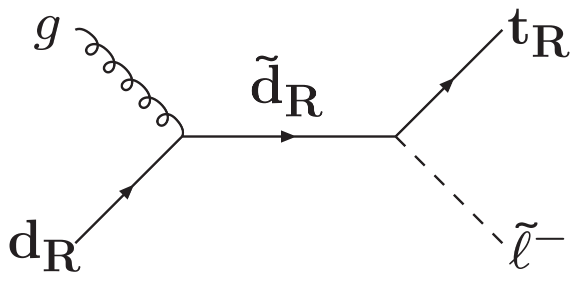
- Bounds scale with $(\tilde{m}/100)$ GeV

- Recall: top Yukawa $h_t \approx 1$, bottom Yukawa $h_b \approx 0.03$

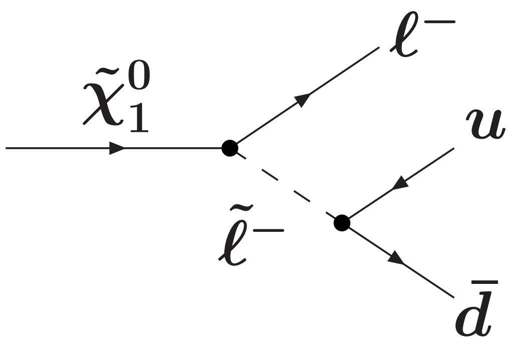
B_3-Phenomenology: Main Changes

1. **Resonant/Associated Single SUSY Production possible**





2. **LSP is no longer stable** $\longrightarrow$ **LSP** $\in \{\chi_1^0, \chi_1^+, \tilde{\nu}_L, \tilde{\ell}^{\pm}_{L,R}, \tilde{\tau}_1^{\pm}, \tilde{q}_{L,R}, \tilde{g}\}$



3. **Extra Mixing**

4. **Neutrinos**

B_3 Spectrum - Mixing

- L_i and H_1 have the same gauge quantum numbers.

$$\mu H_1 H_2 \longrightarrow \boxed{\kappa_i L_i H_2}$$ which leads to mixing

- Higgs mix with sleptons: $h^0_{1,2}, \longleftrightarrow \tilde{\nu}_i$; $h^\pm_{1,2}, \longleftrightarrow \tilde{\ell}^\pm_i$

- Leptons mix with Charginos: $\ell^\pm \longleftrightarrow \tilde{\chi}^\pm$

- Neutrinos mix with Neutralinos ⟶ 7x7 "Neutralino" Mass Matrix

- 1 **massive** neutrino, but κ_i must be small,

$$\boxed{m_\nu < 1 \text{ eV} \quad \text{for} \quad \kappa_i = \mathcal{O}(1\,\text{MeV})}$$

mSUGRA & SUSY BREAKING

- Supersymmetry must be broken; add terms to Lagrangian

1. **Scalar masses:** *e.g.* $m^2_{\tilde{e}L}\phi^*_{\tilde{e}L}\phi_{\tilde{e}L},\ m^2_{\tilde{e}R}\phi^*_{\tilde{e}R}\phi_{\tilde{e}R}$

   Universal parameter at GUT scale: M_0

2. **Gaugino masses:** $m_{\tilde{g}}\bar{\lambda}_{\tilde{g}}\lambda_{\tilde{g}},\ m_{\tilde{W}}\bar{\lambda}_{\tilde{W}}\lambda_{\tilde{W}},\ m_{\tilde{B}}\bar{\lambda}_{\tilde{B}}\lambda_{\tilde{B}},$

   Universal parameter at GUT scale: $M_{1/2}$

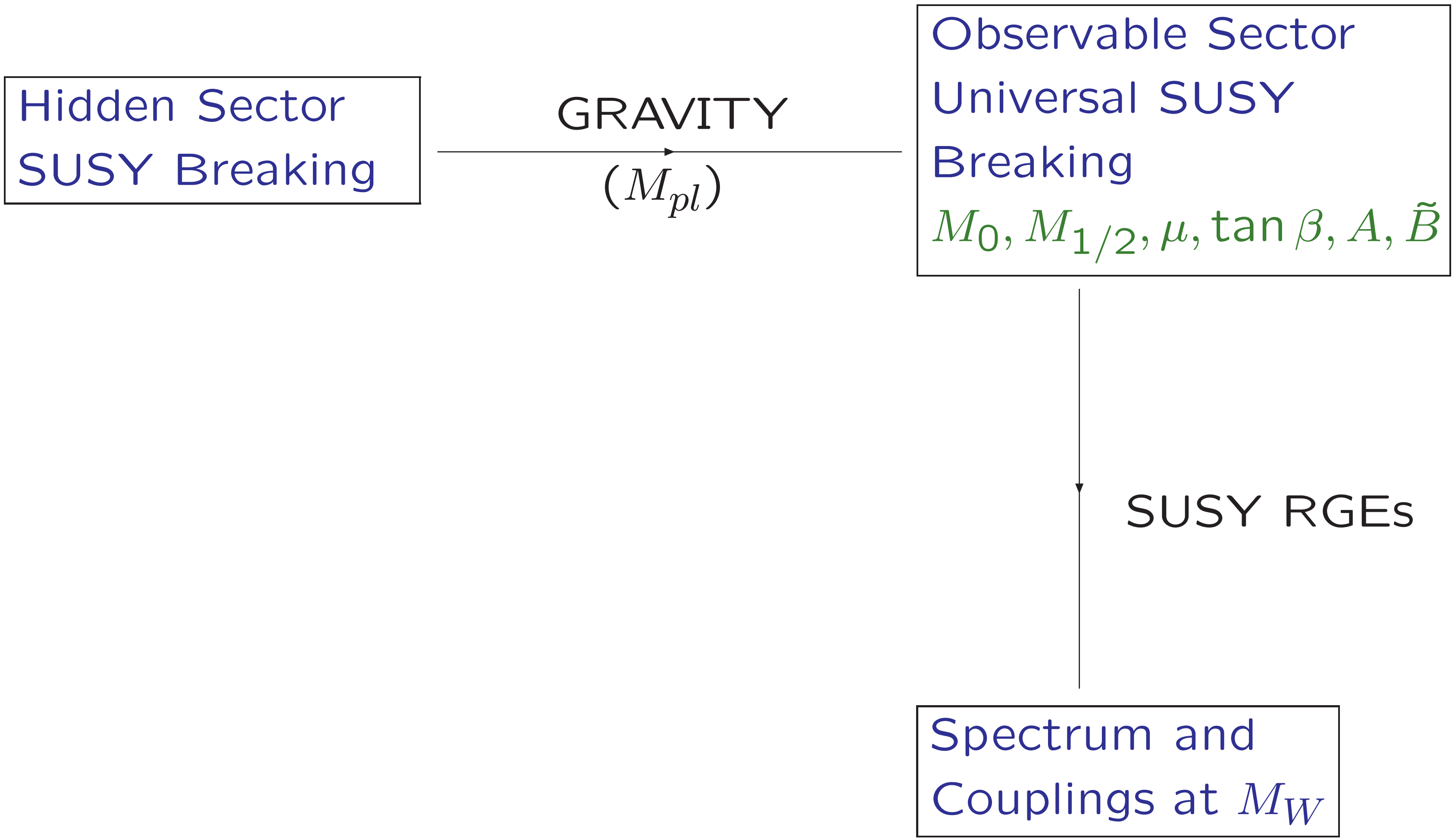
3. **Trilinear Couplings:** *e.g.* $\mathbf{A}\cdot(h_e)_{ij}\phi_{L_i}\phi_{H_1}\phi_{E^c_j}$

   Universal parameter at GUT scale: A

4. **Bilinear Couplings:** $B\cdot\mu\,\phi_{H_1}\phi_{H_2},\ \ \tilde{B}=B\cdot\mu$

   Universal parameter at GUT scale: B

P_6-mSUGRA

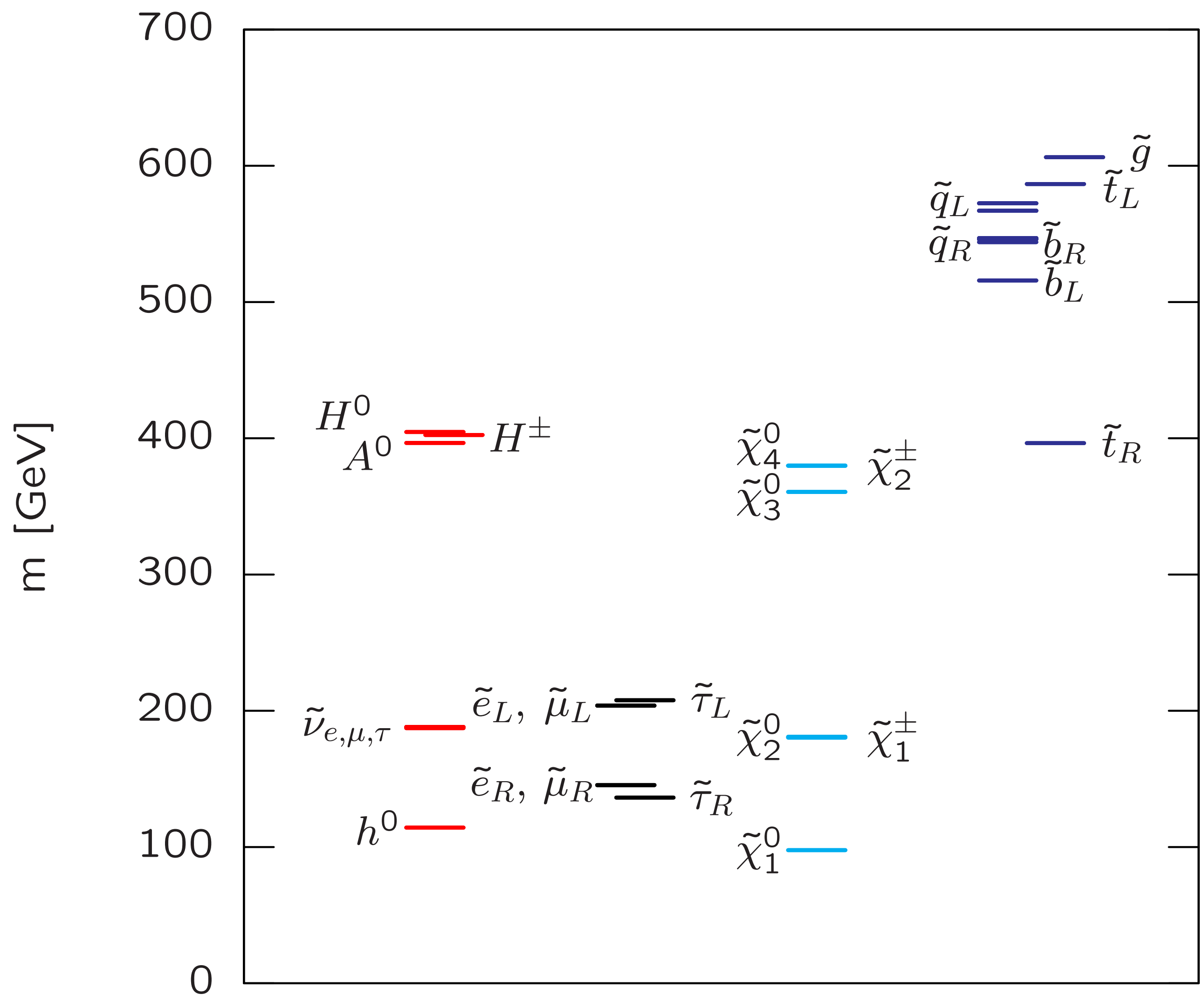


Include Radiative Electroweak Symmetry Breaking:

Replace: $\tilde{B},\ \mu \longrightarrow sgn(\mu)$

SPS1a Spectrum (P_6)

$M_0 = 100$ GeV, $M_{1/2} = 250$ GeV, $A_0 = -100$ GeV, $\tan\beta = 10$, sgn(μ)=+1



B_3 -mSUGRA

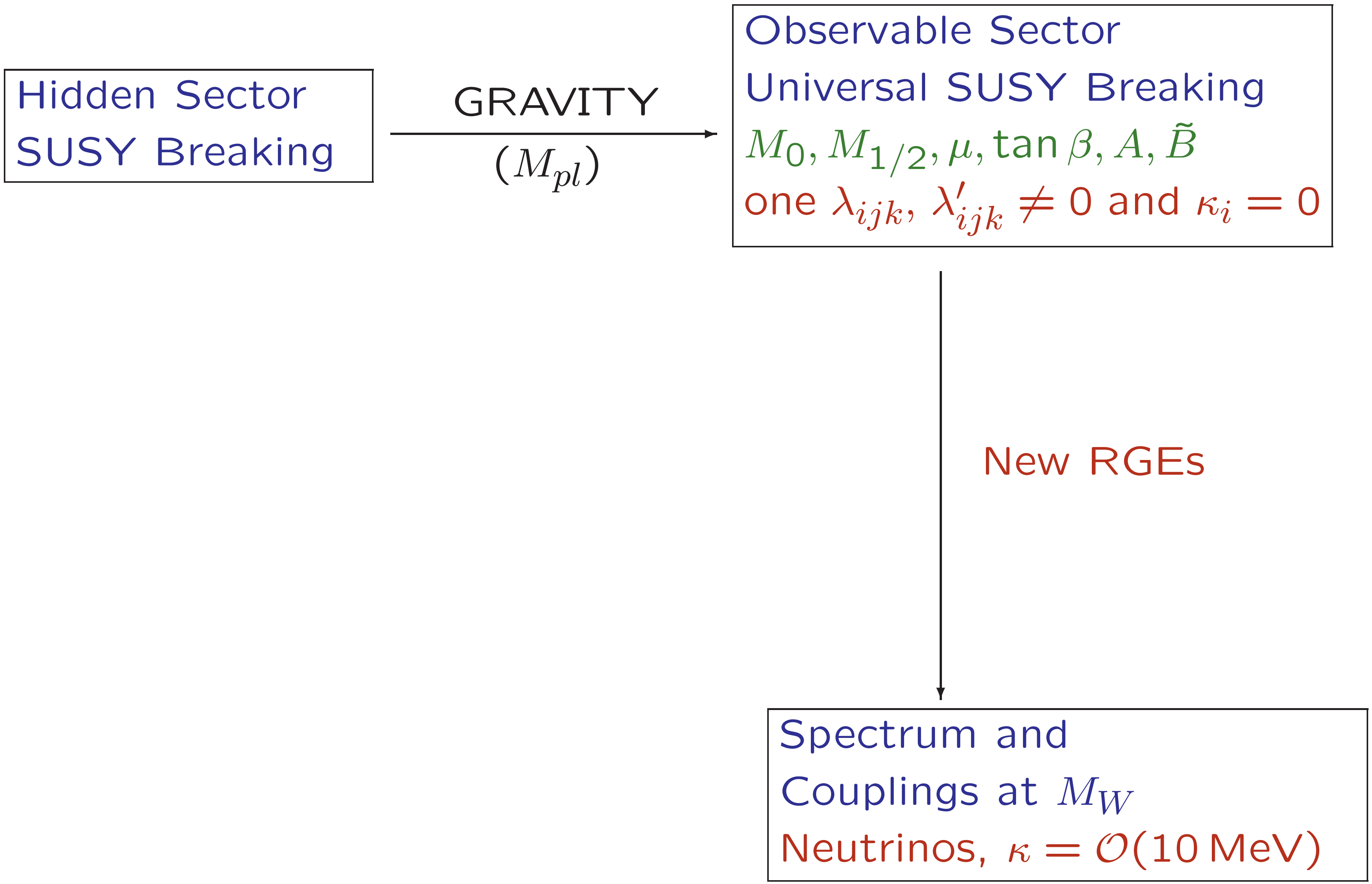
- No new universal soft breaking parameters

- New RGE's, 1-Loop: `de Carlos & White`
  `Steffen & Besmer`
  `Allanach, Dedes & HD:` complete set of soft terms

- 2-loop RGE's for dimensionless parameters: `Allanach, Dedes, HD`

- Modification of unification picture: α_s, $b-\tau$-unif., fix-point structure

B_3-mSUGRA


Hidden Sector
SUSY Breaking
GRAVITY
(M_{pl})
Observable Sector
Universal SUSY Breaking
$M_0, M_{1/2}, \mu, \tan\beta, A, \tilde{B}$
one $\lambda_{ijk}, \lambda'_{ijk} \neq 0$ and $\kappa_i = 0$
New RGEs
Spectrum and
Couplings at M_W
Neutrinos, $\kappa = \mathcal{O}(10\,\text{MeV})$

Example Spectra

	SPS1a	$\lambda_{123} = 0.08$	$\lambda'_{331} = 0.122$	$\lambda''_{212} = 0.5$
$\tilde{\nu}_e$	189	187	189	189
$\tilde{\nu}_\mu$	189	187	189	189
$\tilde{\nu}_\tau$	188	188	**93**	188
$\tilde{e}^\pm_{R,L}$	146; 206	146; 205	146; 206	146; 206
$\tilde{\mu}^\pm_{R,L}$	146; 206	146; 205	146; 206	146; 206
$\tilde{\tau}^\pm_{1,2}$	137; 210	134; 210	**104**; **159**	137; 210
$\tilde{u}_1$	552	552	552	552
$\tilde{u}_2$	567	567	567	568
$\tilde{c}_1$	552	552	552	**394**
$\tilde{c}_2$	567	567	567	**562**
$\tilde{d}_1$	552	552	**536**	**393**
$\tilde{d}_2$	575	575	574	**570**
$\tilde{s}_1$	552	552	552	**393**
$\tilde{s}_2$	575	575	575	**570**
$\tilde{b}_{1,2}$	518; 550	518; 550	**511**; 549	519; 551
$\tilde{t}_{1,2}$	400; 591	400; 591	399; **586**	401; 592
$\tilde{\chi}^0_1$	97	97	97	97
$\tilde{\chi}^0_2$	181	181	181	181
$\tilde{\chi}^0_3$	362	362	360	362
$\tilde{\chi}^0_4$	380	380	379	380
$\tilde{\chi}^\pm_1$	182	182	181	182
$\tilde{\chi}^\pm_2$	378	378	377	378
$\tilde{g}$	610	610	610	**604**
h^0	110	110	110	110

Brief Summary: mSUGRA $\leftrightarrow$ B_3 mSUGRA

mSUGRA	B_3-mSUGRA
discrete gauge anomaly-free	discrete gauge anomaly-free
proton stable	proton stable
add neutrino sector/scale by hand	naturally light massive neutrinos
natural dark matter candidate	axino as dark matter candidate

- Both must solve strong CP problem: Peccei-Quinn $\longrightarrow$ axion/axino

What is the LSP?

- LSP-Decays $\Longrightarrow$ LSP $\neq \chi_1^0$ is allowed

$$\boxed{\text{LSP} \in \{\tilde{\nu}_L,\, \tilde{\ell}^{\pm}_{L,R},\, \tilde{q}_{L,R},\, \tilde{\chi}^0_1,\, \tilde{\chi}^{\pm}_1,\, \tilde{g}\}}$$

- We here consider simple mSUGRA models at $\mathbf{M_X}$

$\Longrightarrow$ LSP is determined dynamically as a function of

$$[M_0,\, M_{1/2},\, A,\, \tan\beta,\, \mathrm{sgn}(\mu),\, \Lambda]$$

- Searching SUSY parameter space we have found following LSPs:

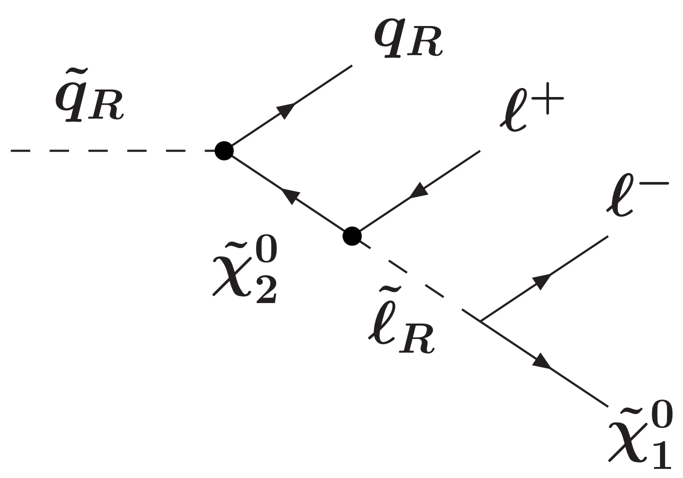
$$\boxed{\text{LSP} \in \{\, \tilde{\chi}^0_1,\, \tilde{\tau}_1,\, \tilde{\nu}_i,\, \tilde{e}_R,\, \tilde{\mu}_R,\, \tilde{d}_R,\, \tilde{s}_R,\, \tilde{b}_1,\, \tilde{t}_1 \,\}}$$

Why is nature of LSP Important?

- At the LHC dominant supersymmetric production are

$$pp \longrightarrow \tilde{q}\tilde{q},\ \tilde{g}\tilde{g},\ \tilde{q}\tilde{g}$$

- Squarks and gluinos typically cascade decay to the LSP (not always true in B_3 models)



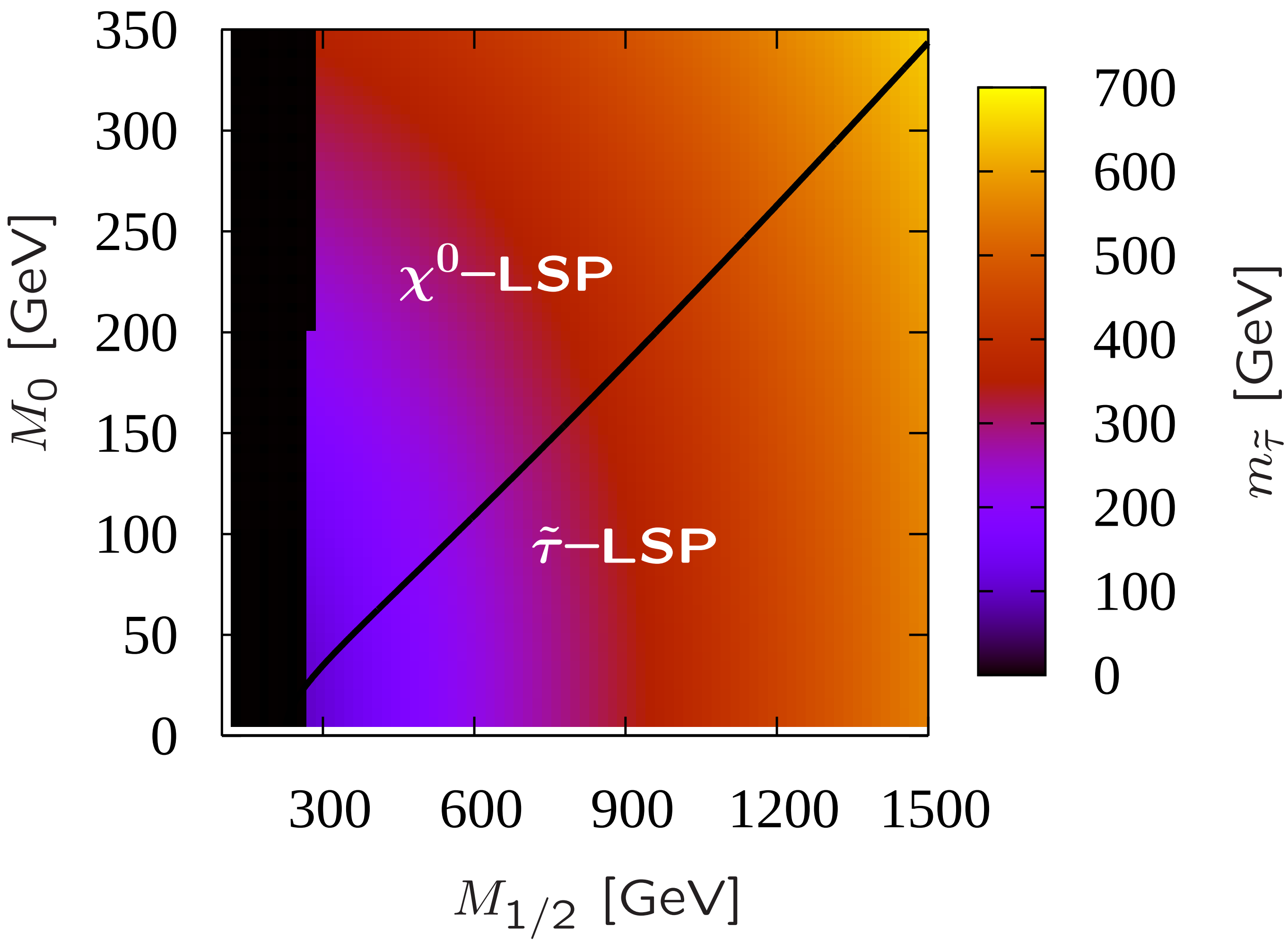
- LSP central part of most signatures

- So how do we get various LSPs?

$\tilde{\tau}$-LSP with $\Lambda = 0$

Allanach,Bernhardt,C.Kom,HD

- Possibility of a $\tilde{\tau}$–LSP $\rightarrow$ changes phenomenology

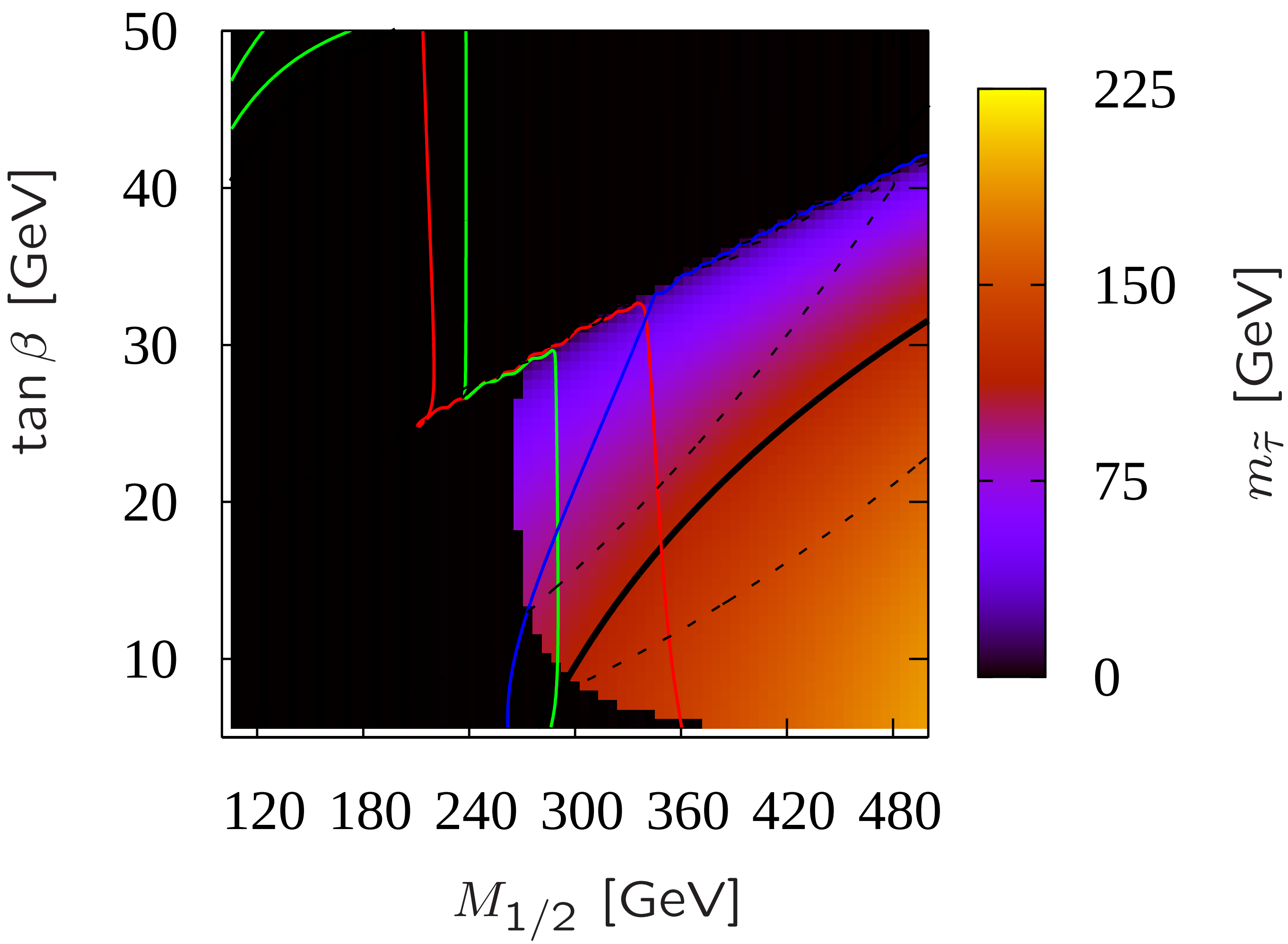


- SPS1a($M_0 = 100$ GeV, $M_{1/2} = 250$ GeV, $A = -100$ GeV, $\tan\beta = 10$) chosen so χ_1^0 is LSP

$\tilde{\tau}$-LSP region largely unexplored

- Consider $M_0 = A_0 = 0$ (at M_{GUT})
- Possibility: Neutralino not even NLSP or NNLSP, but NNNLSP.

black contour: $m_h = m_{\tilde{\tau}_1}$. red: $m_{\chi_1^0} = m_{\tilde{e}_1}$. green: $m_h = m_{\chi_1^0}$. blue: $m_{\chi_2^0} = m_{\tilde{\tau}_2}$



How about other LSPs?

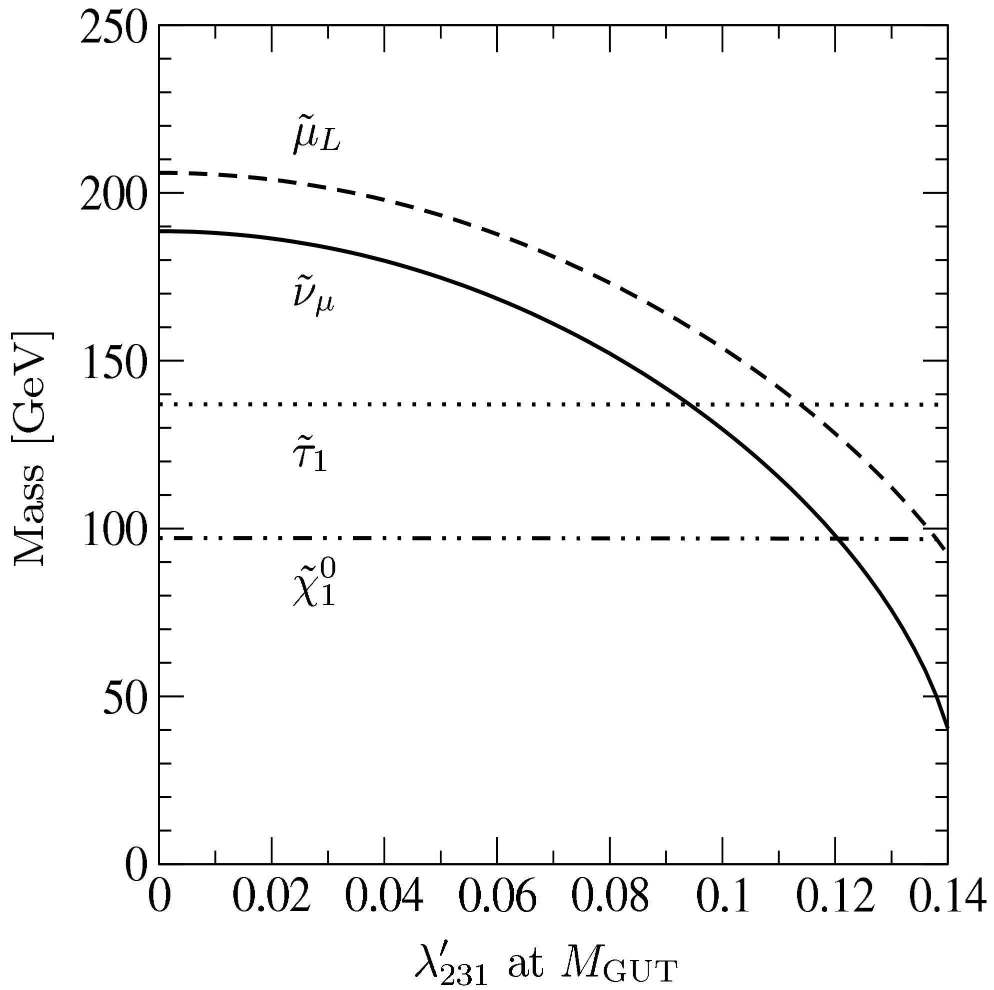
- Consider sneutrino as the possible LSP Bernhardt, Das, Grab,HD

$$
\begin{aligned}
16\pi^2 \frac{d(m^2_{\tilde{\nu}_i})}{dt} &= -\left(\frac{6}{5} g_1^2 |M_1|^2 + 6 g_2^2 |M_2|^2 - \frac{3}{5} g_1^2 S\right) \\
&\quad + 6\lambda'^2_{ijk} \left[m^2_{\tilde{\nu}_i} + (\mathbf{m}^2_{\tilde{\mathbf{Q}}})_{jj} + (\mathbf{m}^2_{\tilde{\mathbf{D}}})_{kk} \right] + 6(\mathbf{h}_{\mathbf{D}^k})^2_{ij}
\end{aligned}
$$

- $(\mathbf{h}_{\mathbf{D}^k}) \equiv \lambda'_{ijk} A_0$ at M_{GUT}
- $m^2_{\tilde{\nu}_L}(M_W) \approx M_0^2 + 0.52 M^2_{1/2} + 0.5 M_z^2 \cos 2\beta - \mathrm{B}_3$
- The B_3 contribution is negative and thus pulls the sneutrino mass down, as we go from $\mathrm{M}_{\mathrm{GUT}}$ to M_W

$\tilde{\nu}_\mu$-LSP in B_3-mSUGRA

Bernhardt, Das, Grab, HD

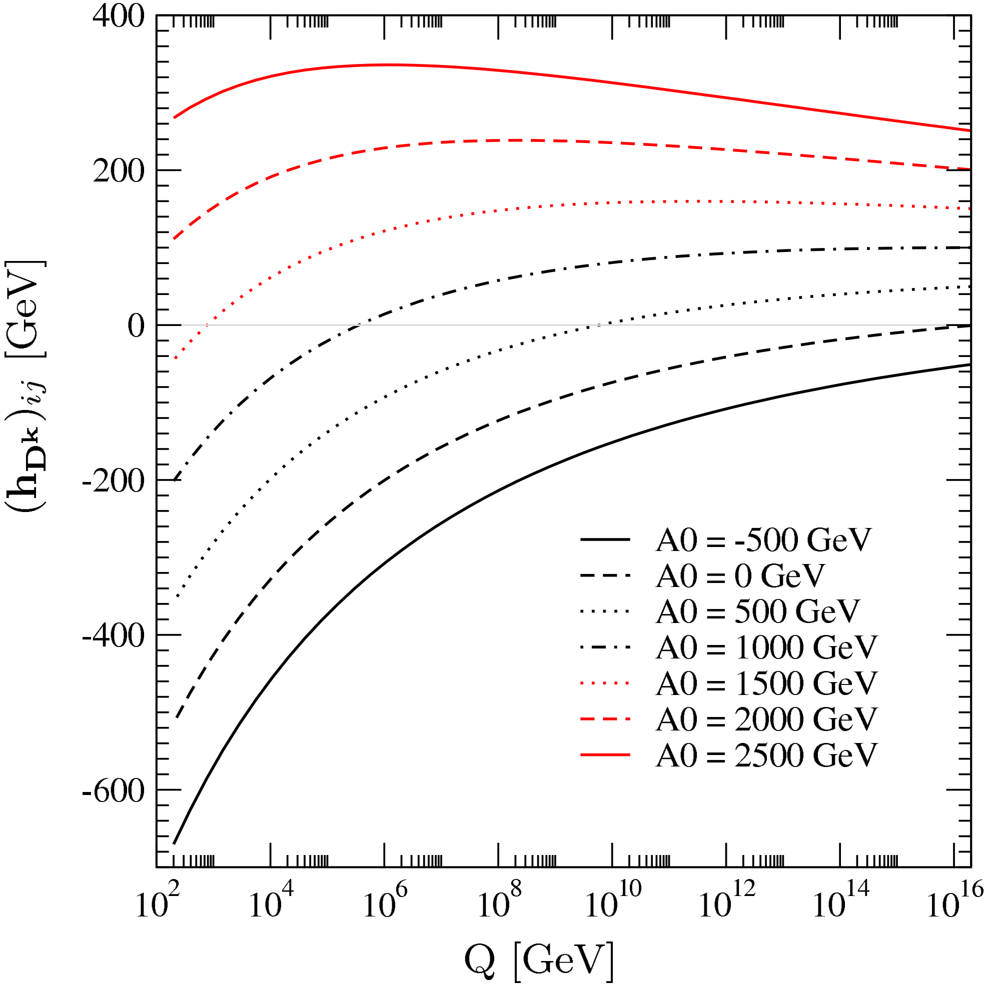


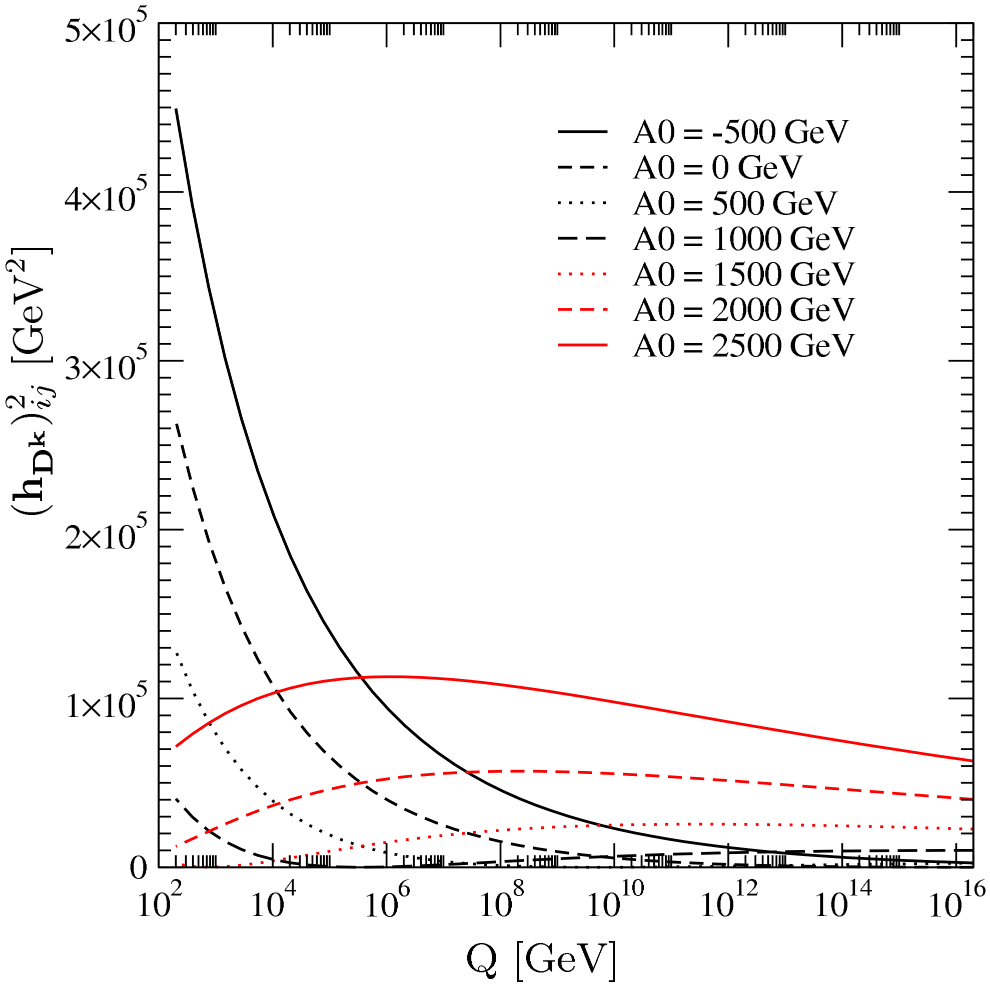
- Other parameters are those of SPS1a, *i.e.* very specific point
- How generic is this scenario?

$\tilde{\nu}_\mu$-LSP in B_3-mSUGRA

Bernhardt, Das, Grab, HD

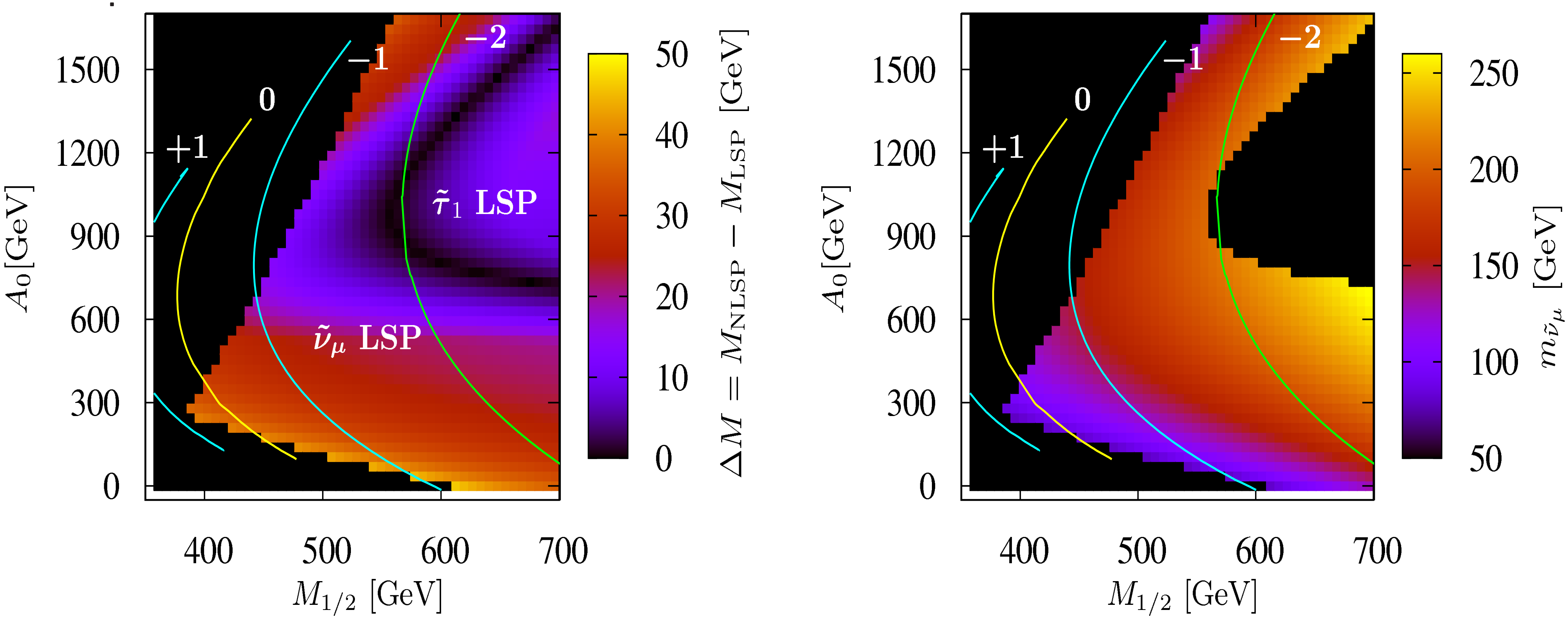
$$16\pi^2 \frac{d(\mathbf{h}_{\mathrm{D^k}})_{ij}}{dt} = -(\mathbf{h}_{\mathrm{D^k}})_{ij}\left(\frac{7}{15}g_1^2 + 3g_2^2 + \frac{16}{3}g_3^2\right) + \lambda'_{ijk}\left(\frac{14}{15}M_1^2 + 6M_2^2 + \frac{32}{3}M_3^2\right) .$$





- $M_{1/2} = 500$ GeV, $\lambda'_{ijk} = 0.1$

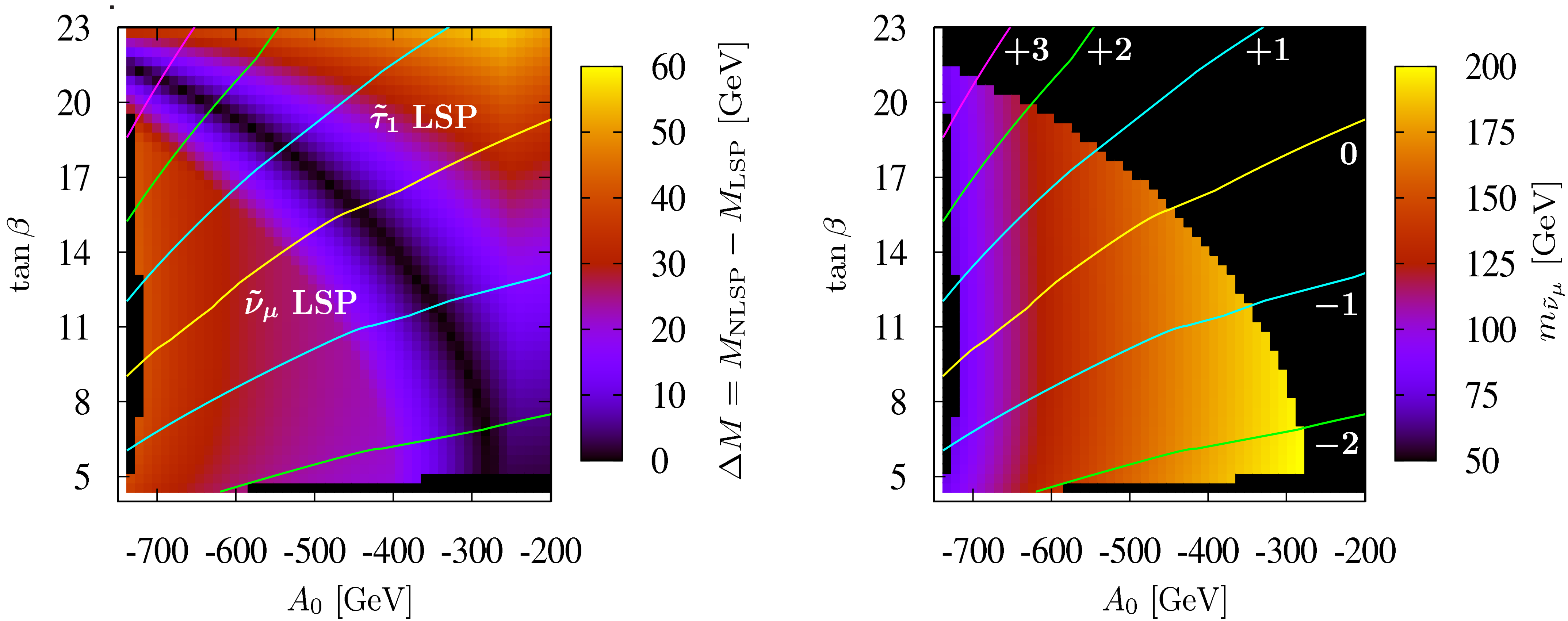
A_0–$M_{1/2}$ Dependance



- $M_0 = 0$, $\tan\beta = 10$, $\text{sgn}(\mu) = +1$; $\lambda'_{231} = 0.16|_{GUT}$

Bernhardt, Das, Grab, HD

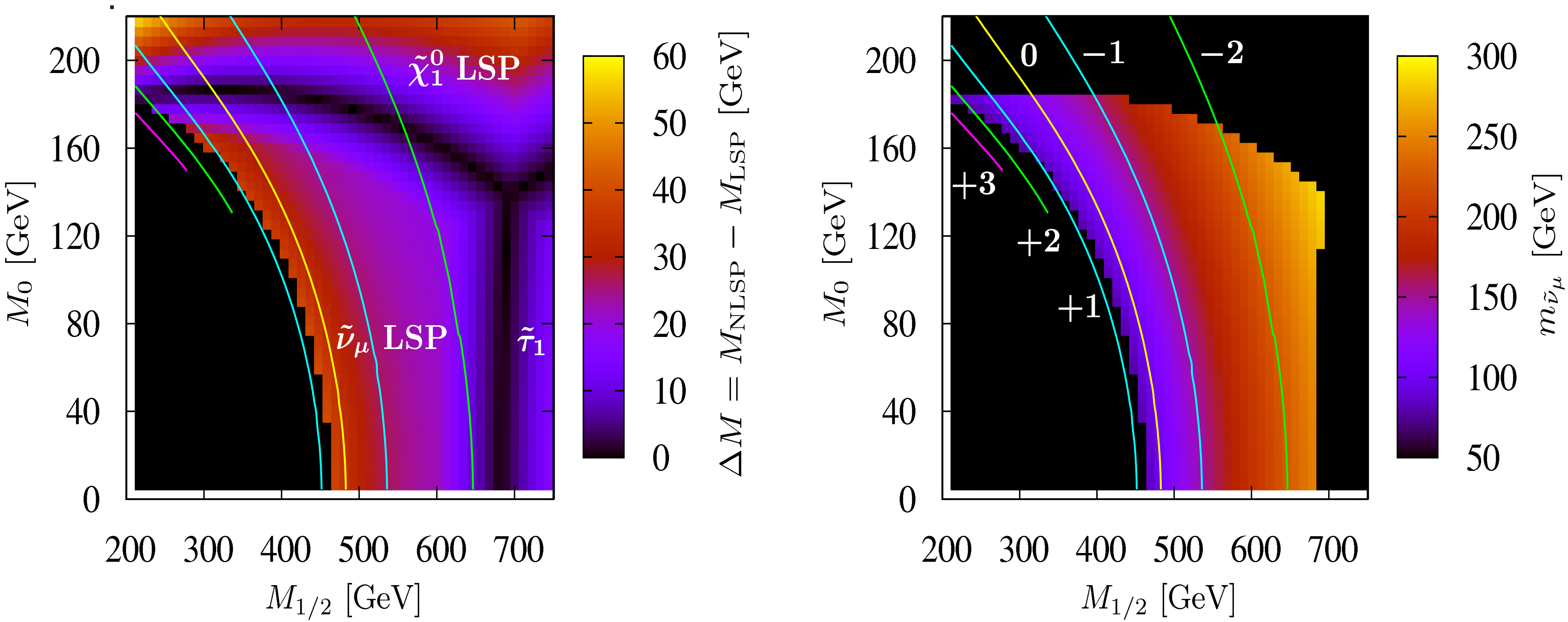
A_0–$\tan\beta$ Dependance



- $M_0 = 50$ GeV, $M_{1/2} = 500$ GeV, $\mathrm{sgn}(\mu) = +1$; $\lambda'_{231} = 0.11|_{\rm GUT}$

Bernhardt, Das, Grab, HD

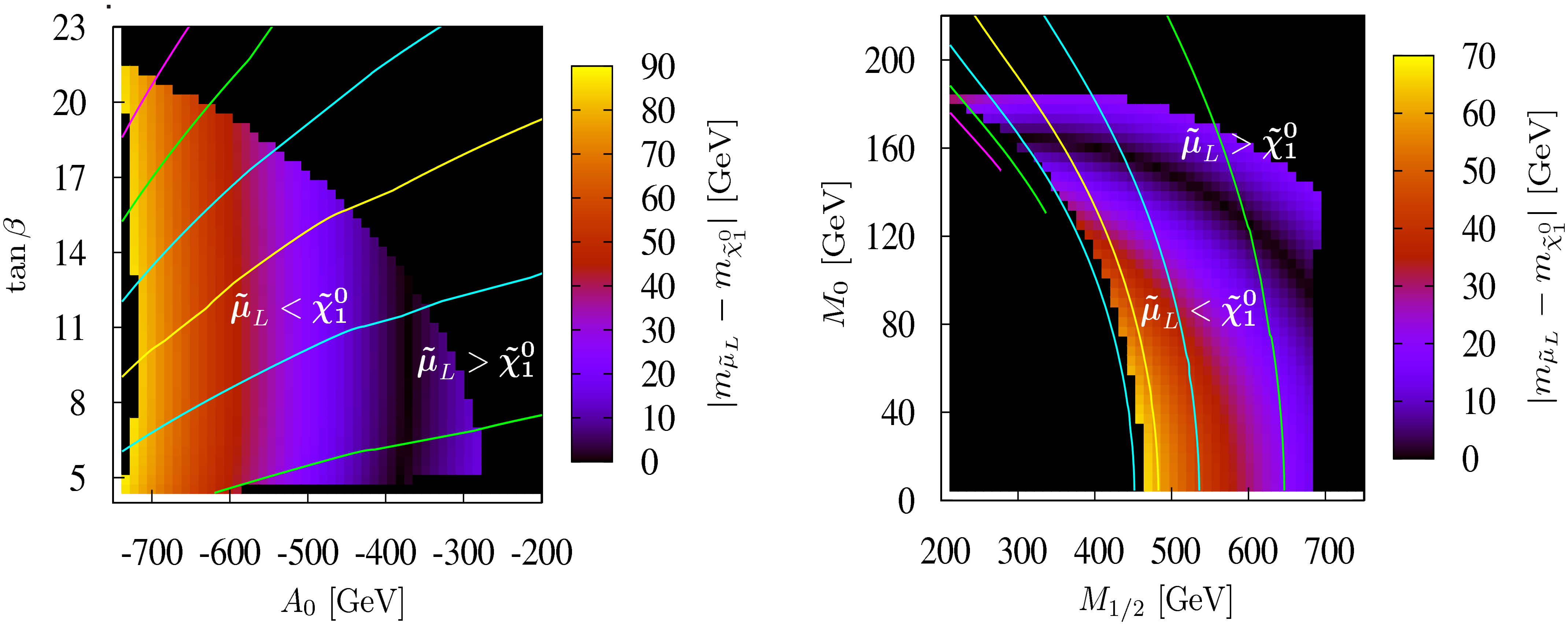
M_0–$M_{1/2}$ Dependance



- $A_0 = -600\,\mathrm{GeV}$, $\tan\beta = 10$, $\mathrm{sgn}(\mu) = +1$; $\lambda'_{231} = 0.11|_{\mathrm{GUT}}$

Bernhardt, Das, Grab, HD

The Mass Difference $|m_{\tilde{\mu}_L} - m_{\tilde{\chi}_1^0}|$



Bernhardt, Das, Grab, HD

$\tilde{\nu}_\mu$-LSP Phenomenology

- Consider the folllowing example Scenario, which yields a $\tilde{\nu}_\mu$-LSP:

$$\begin{aligned} \textbf{Point I:}\quad & M_0 = 100\,\text{GeV}, \qquad M_{1/2} = 450\,\text{GeV}, \\ & A_0 = -600\,\text{GeV}, \qquad \tan\beta = 10, \\ & \text{sgn}(\mu) = +1, \qquad \lambda'_{231} = 0.11|_{\text{GUT}}, \end{aligned}$$

- LSP–Mass: $m_{\tilde{\nu}_\mu} = 124\,\text{GeV}$
- Resonant X-section is large, since coupling is necessarily large,
- But only decay: $\tilde{\nu}_\mu \longrightarrow \bar{b}d$
- No constraint from Tevatron
- Get the following branching ratios $\longrightarrow$

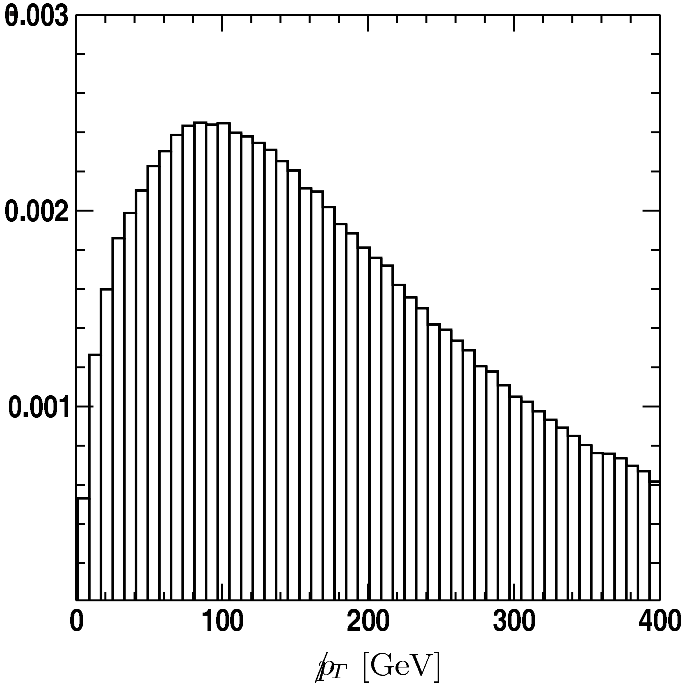
	mass [GeV]	channel	BR	channel	BR
$\tilde{\nu}_\mu$	**124**	$\bar{b}d$	**100%**		
$\tilde{\mu}_L^-$	**147**	$W^-\bar{b}d$	**75.1%**	$\bar{c}d$	**24.9%**
$\tilde{\chi}_1^0$	184	$\tilde{\nu}_\mu^*\nu_\mu$	36.0%	$\tilde{\nu}_\mu\bar{\nu}_\mu$	36.0%
		$\tilde{\mu}_L^+\mu^-$	14.0%	$\tilde{\mu}_L^-\mu^+$	14.0%
$\tilde{\tau}_1^-$	188	$\tilde{\chi}_1^0\tau^-$	100%		
$\tilde{e}_R^-(\tilde{\mu}_R^-)$	206	$\tilde{\chi}_1^0 e^-(\mu^-)$	100%		
$\tilde{\nu}_\tau$	316	$\tilde{\chi}_1^0\nu_\tau$	67.3%	$W^+\tilde{\tau}_1$	32.7%
$\tilde{\nu}_e$	319	$\tilde{\chi}_1^0\nu_e$	100%		
$\tilde{e}_L^-$	329	$\tilde{\chi}_1^0 e^-$	100%		
$\tilde{\tau}_2$	329	$\tilde{\chi}_1^0\tau^-$	65.1%	$h^0\tilde{\tau}_1^-$	18.2%
		$Z^0\tilde{\tau}_1^-$	16.7%		
$\tilde{\chi}_2^0$	350	$\tilde{\nu}_\mu\bar{\nu}_\mu$	23.7%	$\tilde{\nu}_\mu^*\nu_\mu$	23.7%
		$\tilde{\mu}_L^-\mu^+$	22.4%	$\tilde{\mu}_L^+\mu^-$	22.4%
$\tilde{\chi}_1^-$	350	$\tilde{\nu}_\mu^*\mu^-$	49.7%	$\tilde{\mu}_L^-\bar{\nu}_\mu$	42.6%
		$\tilde{\nu}_\tau\tau^-$	2.3%	$\tilde{\nu}_e^* e^-$	1.8%
$\tilde{t}_1$	**650**	$\tilde{\chi}_1^+ b$	42.1%	$\tilde{\chi}_1^0 t$	33.5%
		$\tilde{\chi}_1^0 t$	13.8%	$\mu^+ d$	**10.6%**
$\tilde{\chi}_3^0$	691	$\tilde{\chi}_1^- W^+$	29.7%	$\tilde{\chi}_1^+ W^-$	29.7%
		$\tilde{\chi}_2^0 Z^0$	26.1%	$\tilde{\chi}_1^0 Z^0$	8.3%
$\tilde{\chi}_2^-$	702	$\tilde{\chi}_2^0 W^-$	28.0%	$\tilde{\chi}_1^- Z^0$	26.6%
		$\tilde{\chi}_1^- h^0$	23.8%	$\tilde{\chi}_1^0 W^-$	7.9%
$\tilde{\chi}_4^0$	702	$\tilde{\chi}_1^- W^+$	28.3%	$\tilde{\chi}_1^+ W^-$	28.3%
		$\tilde{\chi}_2^0 h^0$	22.3%	$\tilde{\chi}_1^0 h^0$	7.0%

	mass [GeV]	channel	BR	channel	BR
$\tilde{b}_1$	**842**	$W^-\tilde{t}_1$	35.8%	$\tilde{\chi}_1^- t$	31.3%
		$\tilde{\chi}_2^0 b$	18.8%	$\bar{\tilde{\nu}}_\mu d$	**12.4%**
$\tilde{d}_R$	**897**	$\nu_\mu b$	**45.0%**	$\mu^- t$	**42.1%**
		$\tilde{\chi}_1^0 d$	12.6%		
$\tilde{t}_2$	**906**	$Z^0\tilde{t}_1$	28.2%	$\tilde{\chi}_1^+ b$	23.7%
		$h^0\tilde{t}_1$	11.7%	$\tilde{\chi}_2^0 t$	10.2%
		$\mu^+ d$	**9.0%**	$\tilde{\chi}_4^0 t$	7.5%
		$\tilde{\chi}_2^+ b$	5.4%	$\tilde{\chi}_1^0 t$	2.6%
$\tilde{b}_2$	**919**	$\tilde{\chi}_1^0 b$	41.3%	$W^-\tilde{t}_1$	25.3%
		$\tilde{\chi}_2^- t$	14.4%	$\tilde{\chi}_4^0 b$	5.3%
		$\tilde{\chi}_3^0 b$	5.0%	$\bar{\nu}_\mu d$	**3.4%**
$\tilde{s}_R$	928	$\tilde{\chi}_1^0 s$	99.8%		
$\tilde{u}_R$ ($\tilde{c}_R$)	932	$\tilde{\chi}_1^0 u(c)$	99.8%		
$\tilde{u}_L(\tilde{c}_L)$	963	$\tilde{\chi}_1^+ d(s)$	65.6%	$\tilde{\chi}_2^0 u(c)$	32.6%
		$\tilde{\chi}_1^0 u(c)$	1.2%		
$\tilde{d}_L$ ($\tilde{s}_L$)	966	$\tilde{\chi}_1^- u(c)$	64.5%	$\tilde{\chi}_2^0 d(s)$	32.5%
		$\tilde{\chi}_1^0 d(s)$	1.6%	$\tilde{\chi}_2^- u(c)$	1.0%
$\tilde{g}$	1046	$\tilde{t}_1\bar{t}$	15.0%	$\tilde{t}_1^* t$	15.0%
		$\tilde{b}_1\bar{b}$	9.2%	$\tilde{b}_1^* b$	9.2%
		$\tilde{d}_R\bar{d}$	5.2%	$\tilde{d}_R^* d$	5.2%

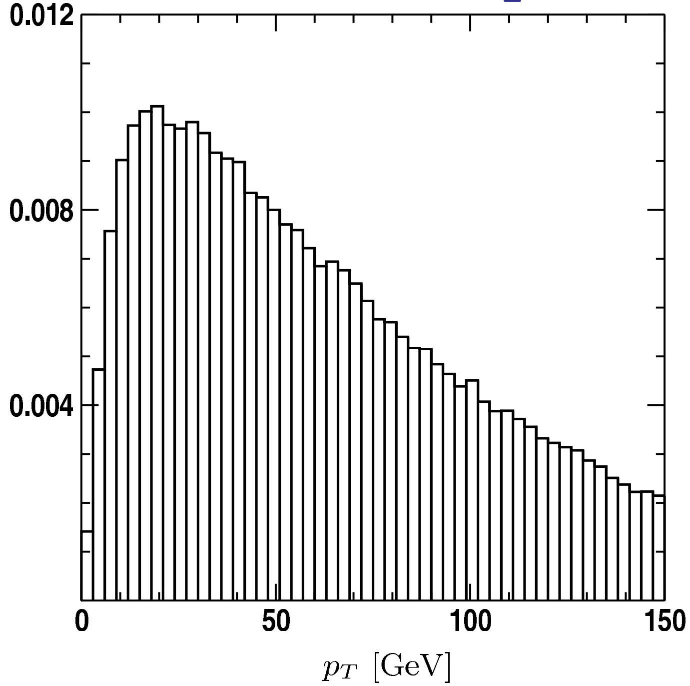
SUSY Pair production

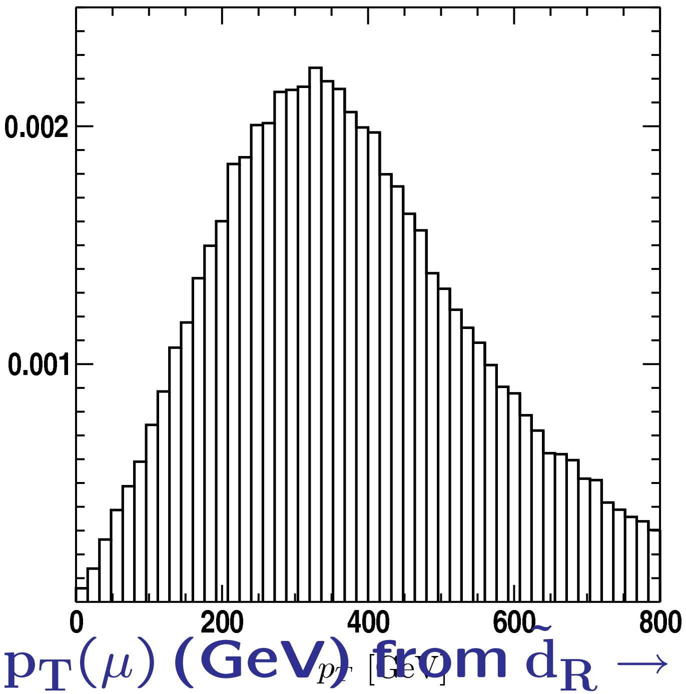
- Total pair production Xsection: $\sigma_{\text{total}} = 3.0\,\text{pb}$
- Following decay chains: often get neutrinos $\longrightarrow$ Plot
- large amounts of $\not{p}_T$ arise for example from the decay $\tilde{d}_R \to \nu_\mu b$
- High p_T muons arise from the direct decays: $\tilde{d}_R \to \mu^- t$; $\tilde{t}_1 \to \mu^+ d$.
  $\longrightarrow$ Plot
- this also results in very high p_T jets/top quarks $\longrightarrow$ Plot
- Note also $\tilde{\chi}_1^0 \to \tilde{\mu}_L^\pm \mu^\mp$

Neutrino $\not{p}_T$ (GeV)

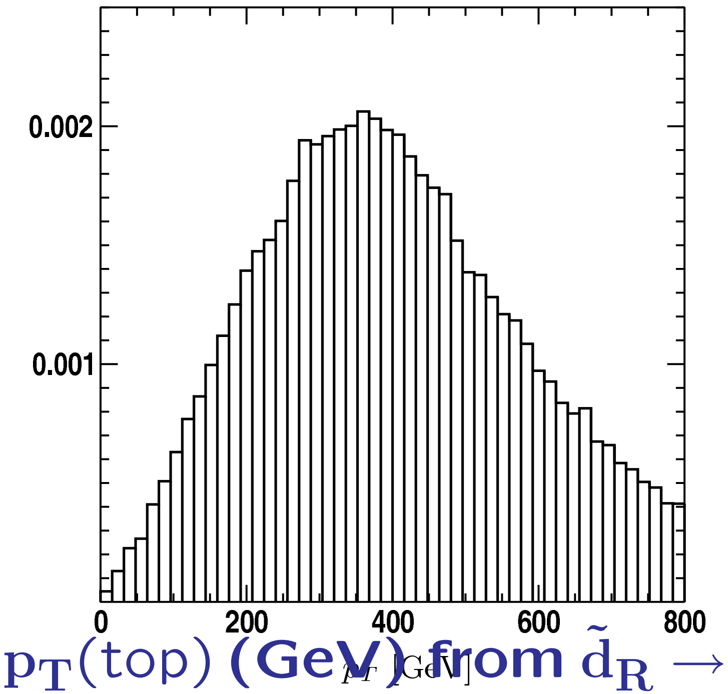


$p_T(\mu)$ (GeV) from $\tilde{\chi}_1^0 \to \tilde{\mu}\mu$





$p_T(\mu)$ (GeV) from $\tilde{d}_R \to \mu t$,



p_T(top) (GeV) from $\tilde{d}_R \to \mu t$

process	cross section
$PP \to \tilde{\nu}_\mu + X$	2.2×10^6 fb
$PP \to \tilde{\chi}_1^0 \nu_\mu + X$	4.2×10^1 fb
$PP \to \tilde{\chi}_2^0 \nu_\mu + X$	6.2×10^0 fb
$PP \to \tilde{\chi}_1^- \mu^+ + X$	1.3×10^1 fb
$PP \to \tilde{\mu}_L^- t + X$	1.6×10^4 fb

What is the LSP?

- Searching B_3-mSUGRA parameter space following LSPs: (Grab, HD)

$$\text{LSP} \in \{\, \tilde{\chi}_1^0,\ \tilde{\tau}_1,\ \tilde{\nu}_i,\ \tilde{e}_R,\ \tilde{\mu}_R,\ \tilde{d}_R,\ \tilde{s}_R,\ \tilde{b}_1,\ \tilde{t}_1 \,\}$$

- Extensive and detailed studies exist for $\tilde{\chi}_1^0$–LSP
- We have performed studies now for $\tilde{\tau}$–LSP and $\tilde{\nu}_\mu$–LSP

Conclusions

- I have given a theoretical motivation for R-parity Violation
- I have focused on the Baryon-Triality (B_3) case
- Analysed in some detail the possible spectra in the B_3 mSUGRA scenario
- Discussed briefly $\tilde{\tau}$–LSP
- Discussed in detail how to get a $\tilde{\nu}_\mu$–LSP
- Presented some novel LHC signatures in $\tilde{\nu}$–LSP scenario