Phenomenology of new neutral gauge bosons in an extended MSSM

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Outline

- Motivation
- Modelling Z' production and decay : extending the MSSM with extra U(1)'
- Reference Point
- Benchmark Models
- Z' production cross sections
- Conclusions

Motivation and state-of-art

- **Standard Model extension + U(1)'gauge symmetry:**

  new neutral gauge boson Z'

- **Experimental searches**: **Z'→ $\ell^+ \ell^-$ (ℓ =e, μ)**
- SM couplings Z'-fermions as Z (**S**equential **S**tandard **M**odel Z')

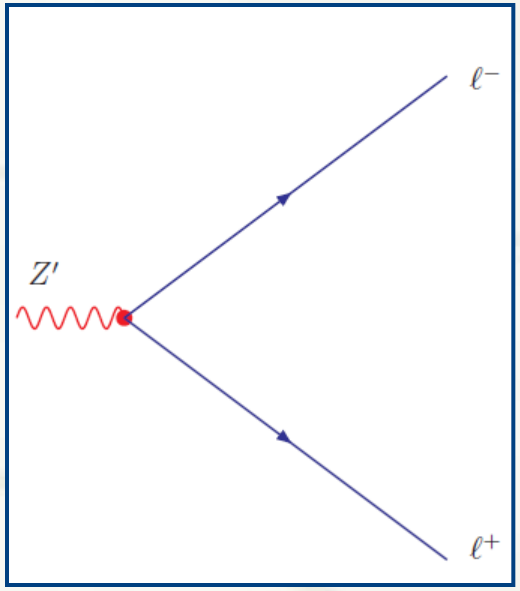
  Tevatron: $m_{Z'} > 1023$ GeV (D0), 963 GeV (CDF)

  LHC: $m_{Z'} > 1140$ GeV CMS and 1048 GeV ATLAS
- String models: $m_{Z'} > 887$ GeV CMS, 738-900 GeV ATLAS

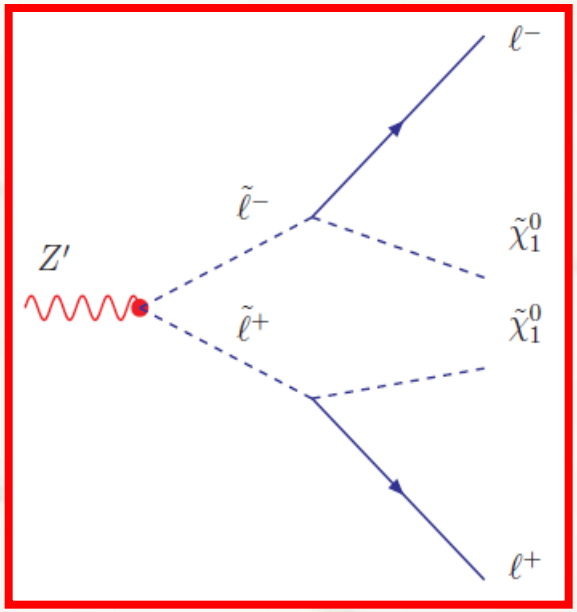
Assumptions:

- No physics beyond SM. **Z' decays only into SM particles**
- Branching ratios depending on masses and couplings
- String models: one parameter, θ, characterizing U(1)' model

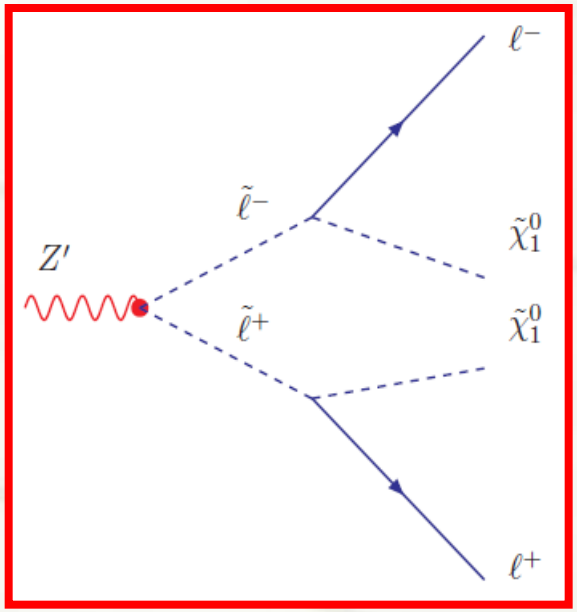
Extended MSSM



Extended MSSM



Extended MSSM



Our assumption:

- **Z' decays in supersymmetric particles are allowed.**
- **Sfermion, Higgs, chargino, neutralino masses and branching ratios are derived taking in account all corrections due to U(1)'[1].**
- The new physics contribution will significantly decrease the Br into SM particles ,then the **mass limits have to be revisited.**
- Sleptons production in Z' decays has an additional constrain $m_{z'}$

1. T.Ghergetta, et al. Phys.Rev. D57(1998) 3178.

Z' modelling: U(1)' models

- All Z' phenomenology can described as:

$$Z'(\theta) = Z'_\psi \cos\theta - Z'_\chi \sin\theta$$

- The charge of a generic field Φ:

$$Q'(\Phi) = Q_\psi(\Phi)\cos\theta - Q_\chi(\Phi)\sin\theta$$

Models

Name	θ	value
Z'_η	$\mathrm{ArcCos}\left[\sqrt{\frac{5}{8}}\right]$	0.66
Z'_ψ	0	0
Z'_N	$\mathrm{ArcTan}\left[\sqrt{15}\right] - \frac{\pi}{2}$	-0.25
Z'_I	$\mathrm{ArcCos}\left[\sqrt{\frac{5}{8}}\right] - \frac{\pi}{2}$	-0.91
Z'_S	$\mathrm{ArcTan}\left[\frac{\sqrt{15}}{9}\right] - \frac{\pi}{2}$	-1.16
Z'_χ	$-\frac{\pi}{2}$	-1.57

Decays into SM particles only

- Coupling g_1, g_2, g' ($U(1)_y$, $SU(2)_L$, $U(1)'$)

$$g_1 = g_2 \tan\theta_W$$

$$g' = \sqrt{\frac{5}{3}} g_1$$

Extended MSSM+U(1)' masses

Higgs masses

- A third boson is required to break U(1)' and give mass to Z'.

$$\Phi_1 = \begin{pmatrix} \phi_1^0 \\ \phi_1^- \end{pmatrix}, \Phi_2 = \begin{pmatrix} \phi_2^+ \\ \phi_2^0 \end{pmatrix}, \Phi_3 = \phi_3^0.$$

$$v = \sqrt{v_1^2 + v_2^2}$$

- Vacuum expectation $\langle \phi_i^0 \rangle = v_i/\sqrt{2}$, trilinear scalar potential for neutral Higgs bosons $V_\lambda = \lambda A \phi_1^0 \phi_2^0 \phi_3^0$ and $\mu = \frac{\lambda v_3}{\sqrt{2}}$
- After symmetry breaking: 6 Higgs ($H^\pm$,A, h, H, **H'**) diagonalising mass matrices:

$$m_{H^\pm}^2 = \frac{\lambda A_\lambda v_3}{\sin 2\beta} + \left(1 - 2\frac{\lambda^2}{g_2^2}\right) m_W^2$$

$$m_A^2 = \frac{\lambda A_\lambda v_3}{\sin 2\beta}\left(1 + \frac{v^2}{4v_3^2}\sin^2 2\beta\right),$$

Extended MSSM+U(1)' masses

✦ Neutralinos masses

✦ Besides $\tilde{\chi}_1^0$ $\tilde{\chi}_2^0$ $\tilde{\chi}_3^0$ $\tilde{\chi}_4^0$ **two extra neutralinos** $\tilde{\chi}_5^0$ $\tilde{\chi}_6^0$ associated with extra Z' and H'.

✦ M_1,M_2,M' are the soft masses of $\tilde{B}$, $\tilde{W}_3$ and $\tilde{B}'$.

$$\mathcal{M}_{\tilde{\chi}^0} = \begin{pmatrix} M_1 & 0 & 0 & -\frac{1}{2}g_1 v_1 & \frac{1}{2}g_1 v_2 & 0 \\ 0 & M_2 & 0 & \frac{1}{2}g_2 v_1 & \frac{1}{2}g_2 v_2 & 0 \\ 0 & 0 & M' & Q'_1 g' v_1 & Q'_2 g' v_2 & Q'_3 g' v_3 \\ -\frac{1}{2}g_1 v_1 & \frac{1}{2}g_2 v_1 & Q'_1 g' v_1 & 0 & \frac{1}{\sqrt{2}}\lambda v_3 & \frac{1}{\sqrt{2}}\lambda v_2 \\ \frac{1}{2}g_1 v_2 & -\frac{1}{2}g_2 v_2 & Q'_2 g' v_2 & \frac{1}{\sqrt{2}}\lambda v_3 & 0 & \frac{1}{\sqrt{2}}\lambda v_1 \\ 0 & 0 & Q'_3 g' v_3 & \frac{1}{\sqrt{2}}\lambda v_2 & \frac{1}{\sqrt{2}}\lambda v_1 & 0 \end{pmatrix}$$

✦ Charginos

Being Z' and H' neutral the MSSM chargino sector is **not affected**.

Extended MSSM+U(1)' masses

D-Term

✦ Sfermion masses

$$m_a^2 = (m_a^0)^2 + \Delta m_a^2 + \Delta m'^2_a$$

$$\Delta \tilde{m}'^2_a = \frac{g'^2}{2}(Q'_1 v_1^2 + Q'_2 v_2^2 + Q'_3 v_3^2)$$

Soft term

MSSM hyperfine splitting

U(1)' extension Higgses to break symmetry

U(1)' charges of Higgses fields

- Mass eigenstates

$$\mathcal{M}^2_{\tilde{f}} = \begin{pmatrix} (M^{\tilde{f}}_{LL})^2 & (M^{\tilde{f}}_{LR})^2 \\ (M^{\tilde{f}}_{LR})^2 & (M^{\tilde{f}}_{RR})^2 \end{pmatrix}$$

Assuming a all squarks common mass and all slepton common mass at Z'mass scale.

Extended MSSM+U(1)' masses

- **For up down squarks the matrix elements** $x_w = \sin^2\theta_W$,

$$(M^{\tilde{u}}_{LL})^2 = (m^0_{\tilde{u}_L})^2 + m_u^2 + \left(\frac{1}{2} - \frac{2}{3}x_w\right) m_Z^2 \cos 2\beta + Q'_{\tilde{u}_L}\Delta\tilde{m}'^2_{\tilde{u}_L}$$

$$(M^{\tilde{u}}_{RR})^2 = (m^0_{\tilde{u}_R})^2 + m_u^2 + \left(\frac{1}{2} - \frac{2}{3}x_w\right) m_Z^2 \cos 2\beta + Q'_{\tilde{u}_R}\Delta\tilde{m}'^2_{\tilde{u}_R}$$

$$(M^{\tilde{u}}_{LR})^2 = m_u (A_u - \mu \cot\beta).$$

← $m_{Z'}$ and θ dependence in D-term

- $m^0_{\tilde{u}_{L,R}}$ mass squark at Z' mass scale A_u is coupling constant Higgs-sfermion
- The mass light quarks and slepton is small $(M^{\tilde{u}}_{LR})^2 \sim\sim 0$ ⟶ $\mathcal{M}^2_{\tilde{f}}$ diagonal. Weak eigenstates ~ mass eigenstates. Except stop .

$\tilde{f}_1 \sim \tilde{f}_L$ $\tilde{f}_2 \sim \tilde{f}_R$

Extended MSSM+U(1)'

- **Sfermions**: $\tilde{\ell}$ $\tilde{\nu}_\ell$ $(\ell = e, \mu, \tau)$ $\tilde{q}$
- Gauginos: $\tilde{g}$ $\tilde{W}^\pm$ $\tilde{Z}$ $\tilde{\gamma}$ $\tilde{Z}'$
- **Higgs** h, A, H, $H^\pm$ **H'**
- Charginos $\tilde{\chi}_1^\pm$ $\tilde{\chi}_2^\pm$
- **Neutralinos** $\tilde{\chi}_1^0$ $\tilde{\chi}_2^0$ $\tilde{\chi}_3^0$ $\tilde{\chi}_4^0$ $\tilde{\chi}_5^0$ $\tilde{\chi}_6^0$
- R-parity conserved, LSP $\tilde{\chi}_1^0$
- **D-term** depending on U(1)' sfermion charges and Higgs vacuum expectation values→**sfermion masses.**
- **Some scenario are discarded due large negative D-term**

Representative Point

- Study Z' decay in a MSSM, U(1)' point with these parameters:

$$m_{Z'} = 3 \text{ TeV} , \ \theta = \theta_{\text{I}} = \arccos \sqrt{\frac{5}{8} - \frac{\text{Pi}}{2}} ,$$
$$\mu = 200 , \ \tan\beta = 20 , \ A_q = A_\ell = 500 \text{ GeV} ,$$
$$m^0_{\tilde{q}_L} = m^0_{\tilde{q}_R} = m^0_{\tilde{\ell}_I} = m^0_{\tilde{\ell}_R} = m^0_{\tilde{\nu}_L} = m_{\tilde{\nu}_R} = m^0 = 2.5 \text{ TeV}$$

$$\text{M}_1 = 100 \text{ GeV} , \ \text{M}_2 = 200 \text{ GeV} , \ \text{M}' = 1 \text{ TeV}$$

R

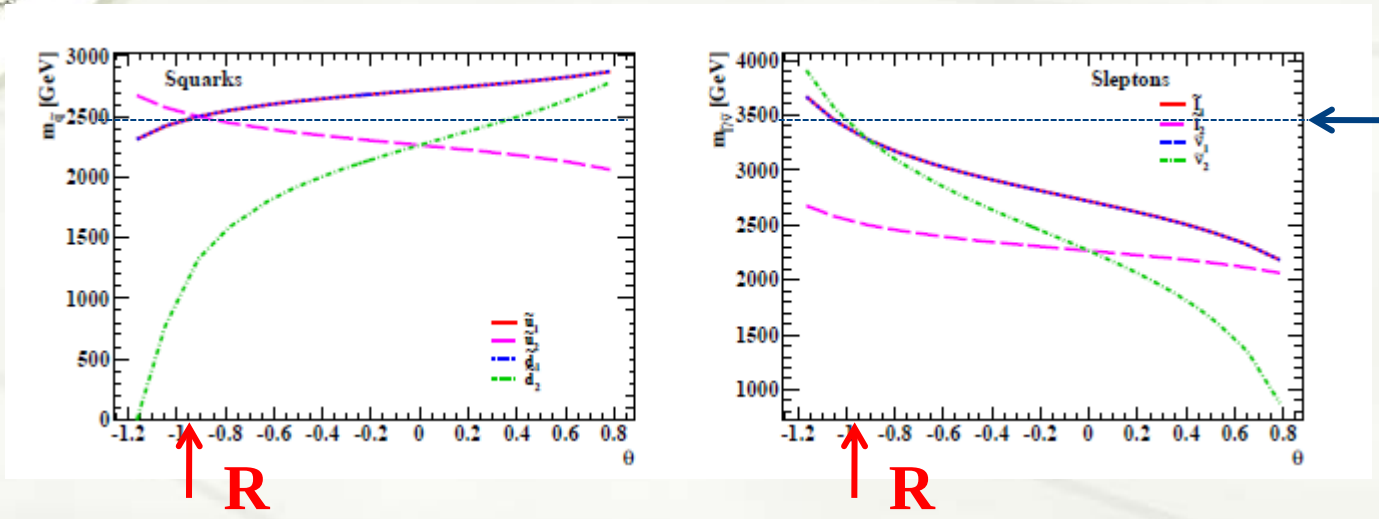
- Gaugino masses M_1 and M_2 have to satisfy, gaugino unification:

$$\frac{M_1}{M_2} = \frac{5}{3} \tan^2 \theta_W .$$

Masses:sfermion

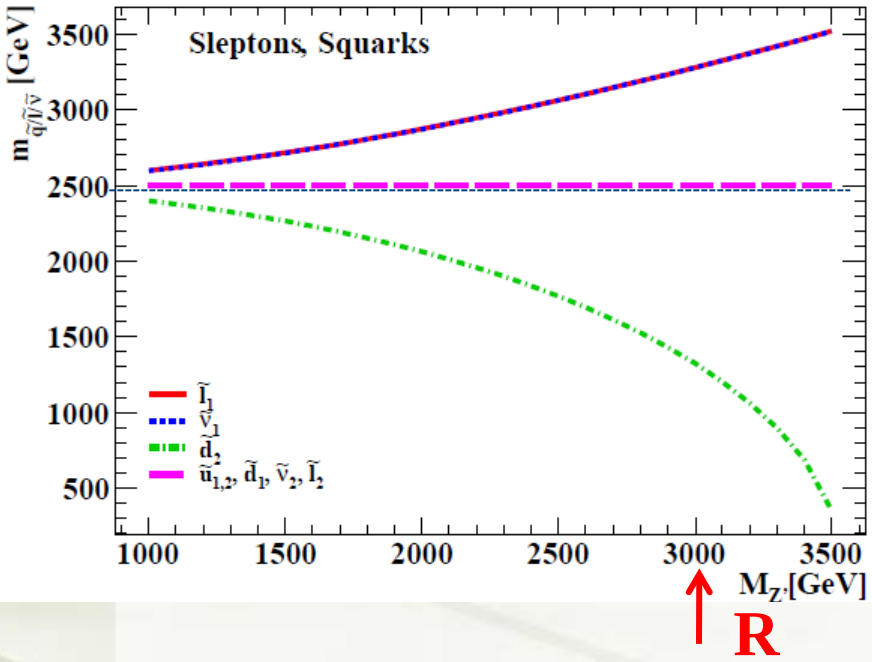
- θ depencence: model choice

m_0 initial value

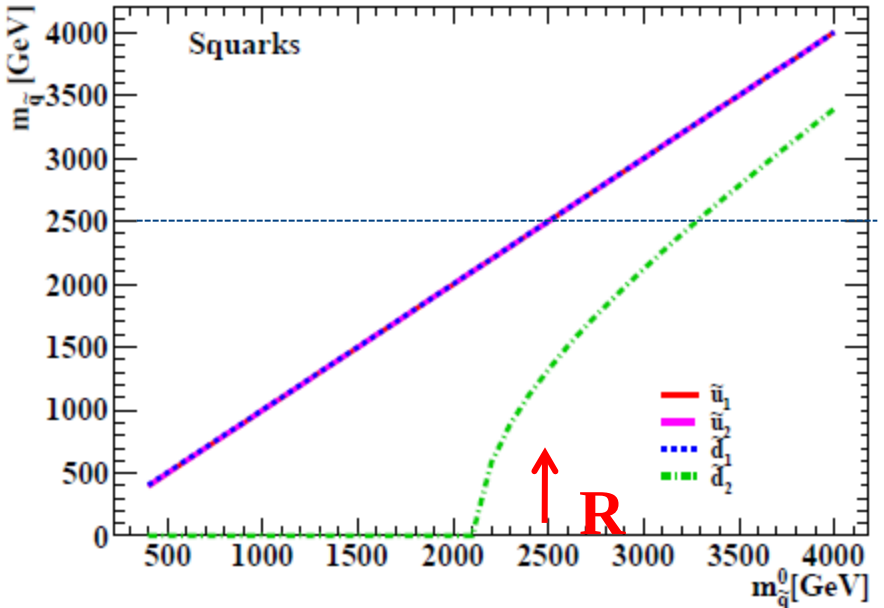


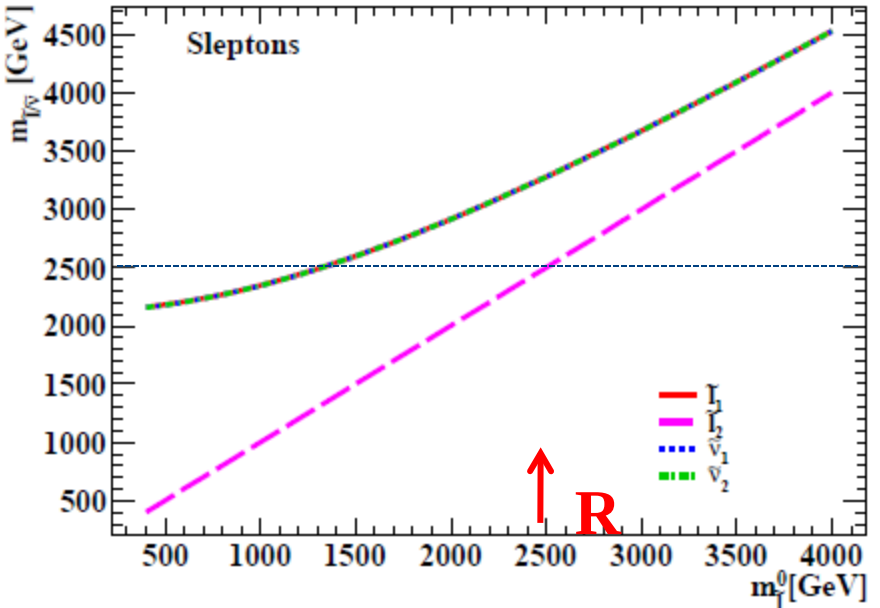
- Remarkable Dependence from D-term ,
  if negative and large→ unphysical masses
- $m_{\tilde{u}_1} \approx m_{\tilde{t}_1}$ $m_{\tilde{u}_2} \approx m_{\tilde{t}_2}$ In this parameter space point.
- θ~-π (Z'_χ) unphysical for $m_{Z'}$ =3TeV → discarded

Masses:sfermions



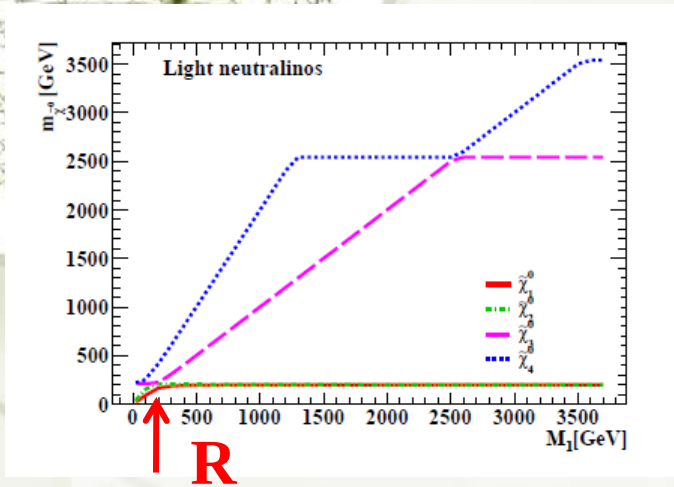
- Z' &squark, slep dependence
  - m_0 initial value
- $m^2_{\tilde{f}}$ dependes on D-term
- Little variation on tan β and trilinear coupling A
- No dependence gaugino masses (M_1,M_2,M')

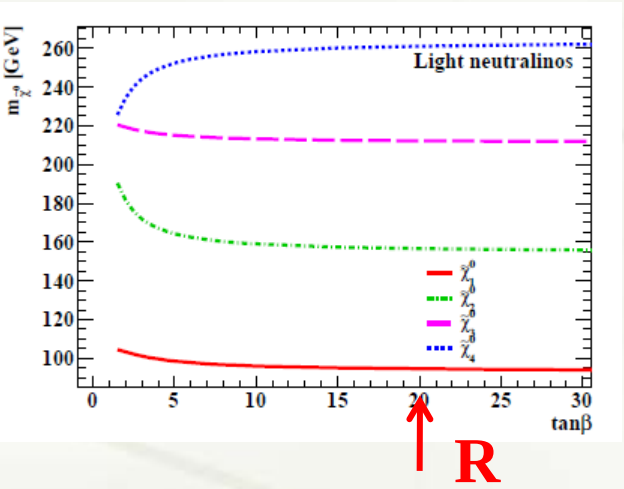




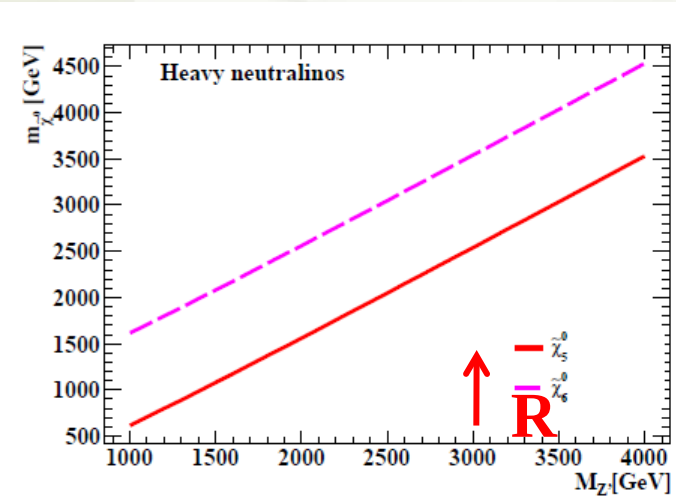
Masses : neutralinos

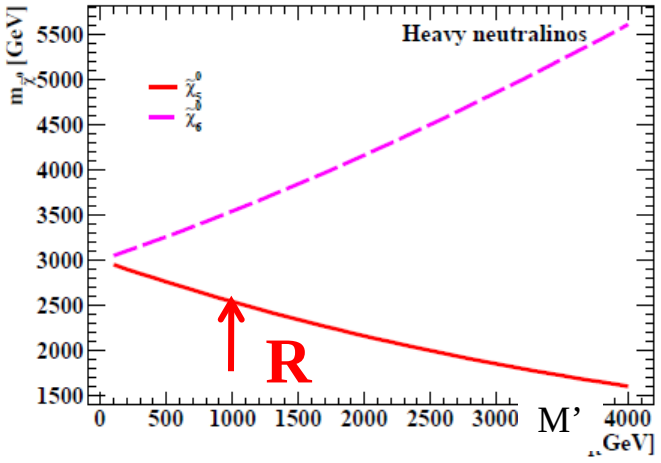
✦Dependences from Gaugino masses : $M_1 M'$





•No dependences of light neutralinos From M' ,$M_{Z'}$ and θ

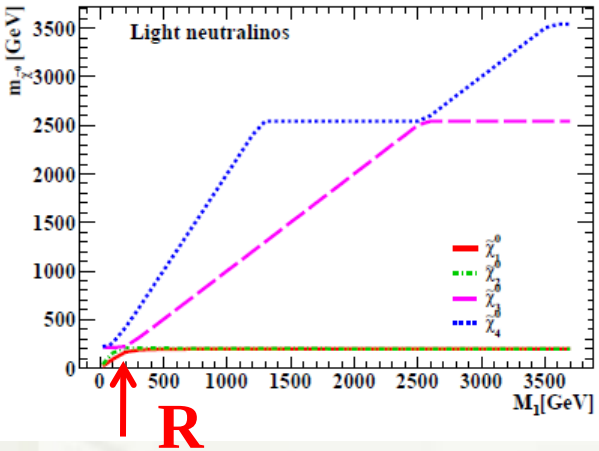


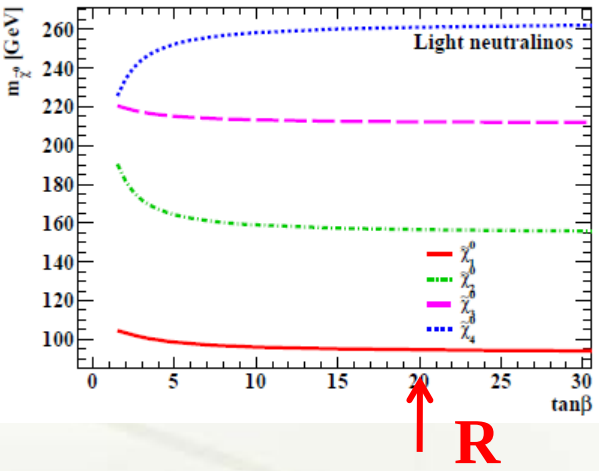


•Dependences of heavy neutralinos From M' and $M_{Z'}$

Masses : neutralinos

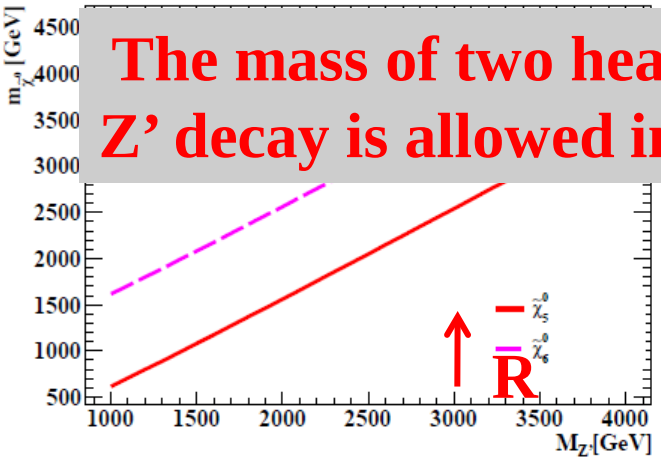
✦Dependences from Gaugino masses : $M_1 M'$

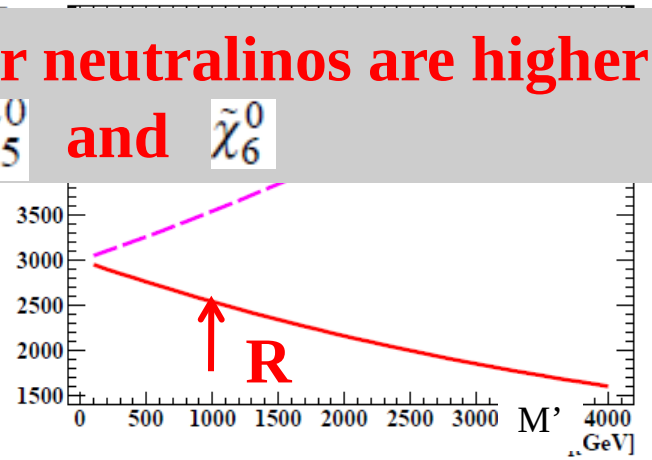




•No dependences of light neutralinos From M' ,$M_{Z'}$ and θ

The mass of two heavier neutralinos are higher than Z' mass No Z' decay is allowed in $\tilde{\chi}_5^0$ and $\tilde{\chi}_6^0$





From M' and $M_{Z'}$

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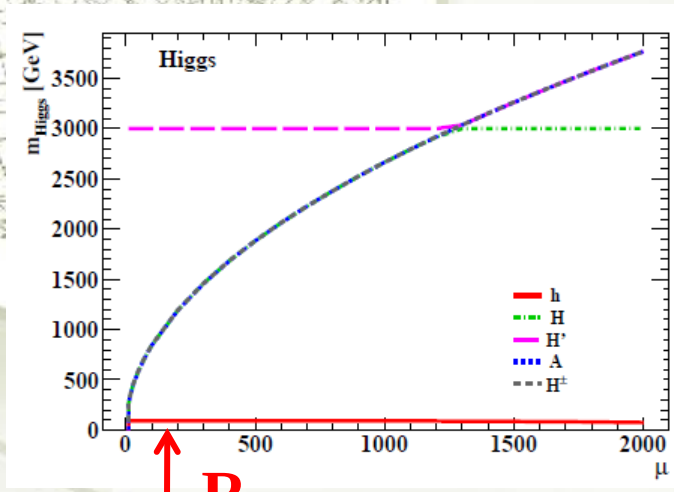
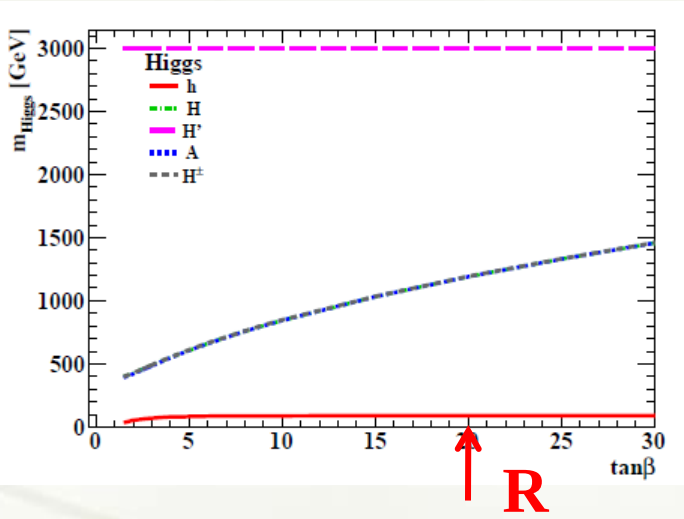
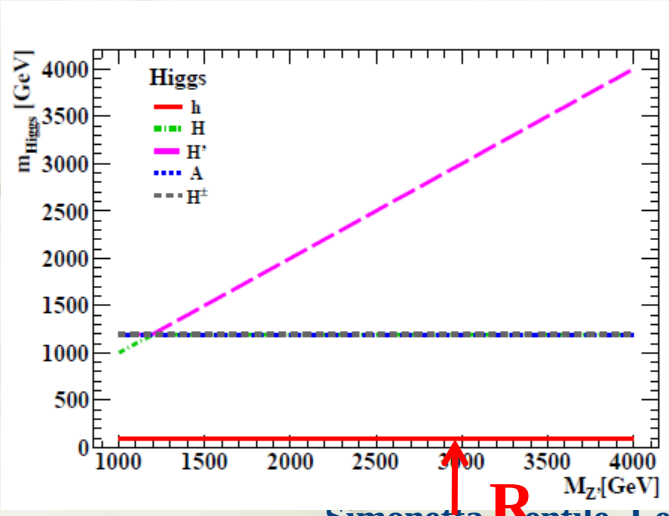
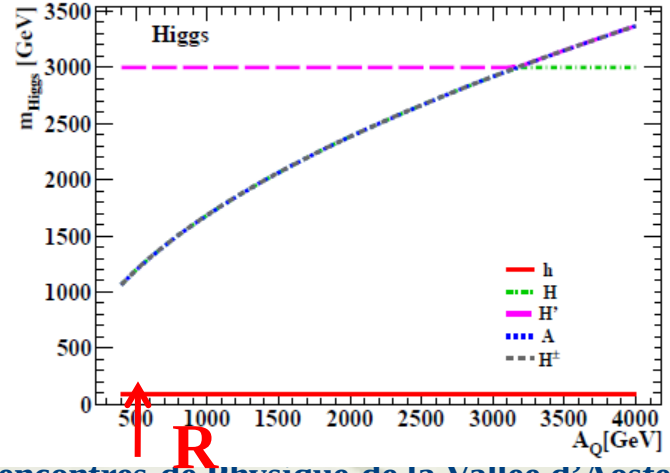
Masses: Higgs

✦Dependences from μ, tanβ,$M_{Z'}$,A_Q









✦U(1)' Higgs H' mass is approx Z' mass

✦Z' decays into H' are not allowed

Branching ratios

- **Representative**

$m_{\tilde{u}_1}$	$m_{\tilde{u}_2}$	$m_{\tilde{d}_1}$	$m_{\tilde{d}_2}$
2499.4	2499.7	2500.7	1323.1
$m_{\tilde{\chi}_1^0}$	$m_{\tilde{\chi}_2^0}$	$m_{\tilde{\chi}_3^0}$	$m_{\tilde{\chi}_4^0}$
94.6	156.5	212.2	260.9
m_h	m_A	m_H	$m_{H'}$
90.7	1190.7	1190.7	3000.0

$m_{\tilde{\ell}_1}$	$m_{\tilde{\ell}_2}$	$m_{\tilde{\nu}_1}$	$m_{\tilde{\nu}_2}$
3279.0	2500.4	3278.1	3279.1
$m_{\tilde{\chi}_5^0}$	$m_{\tilde{\chi}_6^0}$	$m_{\tilde{\chi}_1^\pm}$	$m_{\tilde{\chi}_2^\pm}$
2541.4	3541.4	154.8	262.1
$m_{H^\pm}$			
1193.4			

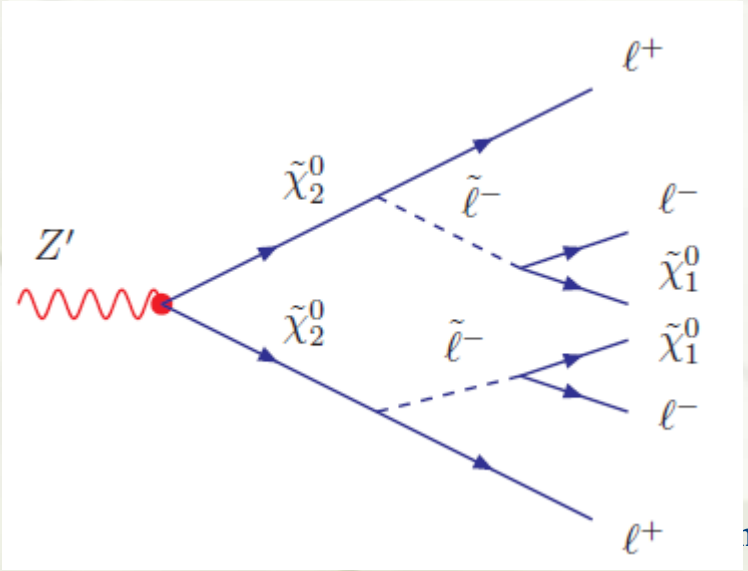
Br SM ~ 77%

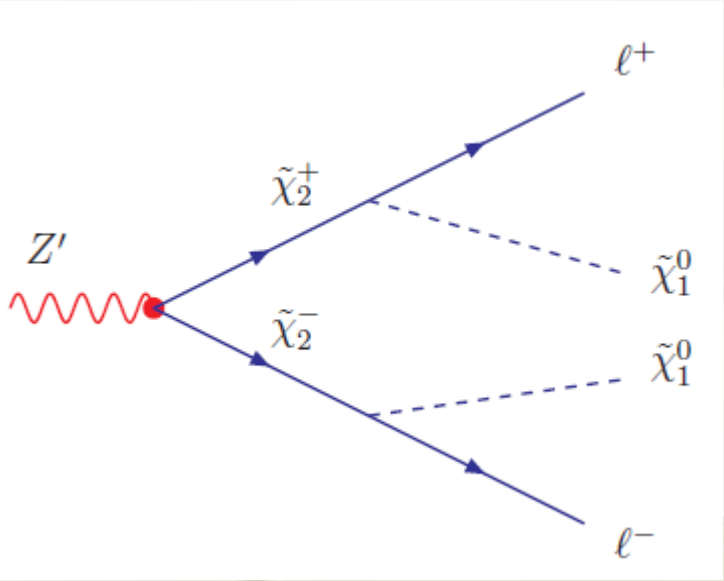
Br MSSM ~23%

Final state	BR (%)	Final State	BR (%)
$\sum_i u_i \bar{u}_i$	0.00	$\tilde{\chi}_1^0 \tilde{\chi}_1^0$	0.07
$\sum_i d_i \bar{d}_i$	40.67	$\tilde{\chi}_1^0 \tilde{\chi}_2^0$	0.43
$\sum_i \ell_i^+ \ell_i^-$	13.56	$\tilde{\chi}_1^0 \tilde{\chi}_3^0$	0.71
$\sum_i \nu_i \bar{\nu}_i$	27.11	$\tilde{\chi}_1^0 \tilde{\chi}_4^0$	0.27
$\sum_{i,j} \tilde{u}_i \tilde{u}_j^*$	0.00	$\tilde{\chi}_1^0 \tilde{\chi}_5^0$	1×10^{-6}
$\sum_{i,j} \tilde{d}_i \tilde{d}_j^*$	9.58	$\tilde{\chi}_2^0 \tilde{\chi}_2^0$	0.65
$\sum_{i,j} \tilde{\ell}_i \tilde{\ell}_j^*$	0.00	$\tilde{\chi}_2^0 \tilde{\chi}_3^0$	2.13
$\sum_{i,j} \tilde{\nu}_i \tilde{\nu}_j^*$	0.00	$\tilde{\chi}_2^0 \tilde{\chi}_4^0$	0.80
W^+W^-	1×10^{-5}	$\tilde{\chi}_2^0 \tilde{\chi}_5^0$	3×10^{-6}
H^+H^-	0.50	$\tilde{\chi}_3^0 \tilde{\chi}_3^0$	1.75
hA	3×10^{-3}	$\tilde{\chi}_3^0 \tilde{\chi}_4^0$	1.31
HA	0.51	$\tilde{\chi}_3^0 \tilde{\chi}_5^0$	4×10^{-6}
ZH	3×10^{-3}	$\tilde{\chi}_4^0 \tilde{\chi}_4^0$	0.25
Zh	1×10^{-5}	$\tilde{\chi}_4^0 \tilde{\chi}_5^0$	9×10^{-7}
ZH'	0.00	$\tilde{\chi}_5^0 \tilde{\chi}_5^0$	0.00
$H'A$	0.00	$\sum_i \tilde{\chi}_i^0 \tilde{\chi}_6^0$	0.00
$W^\pm H^\mp$	7×10^{-3}	$\tilde{\chi}_1^\pm \tilde{\chi}_1^\mp$	1.76
		$\tilde{\chi}_1^\pm \tilde{\chi}_2^\mp$	1.95
		$\tilde{\chi}_2^\pm \tilde{\chi}_2^\mp$	0.54

Branching ratios

- Many decays into supersymmetric particles kinematically **forbidden**(up squarks, **sleptons**, H',heavy neutralinos)
- Final state **leptons from cascade decays**





Z' final state leptons

- Study of Z' decays as function of $\tilde{\nu}$, $\tilde{\ell}$ mass, in **different Z' production models**, θ :
- Parameters in Z' Models :

$$m_{Z'} = 3 \text{ TeV } \mu = 200 \text{ , } \tan\beta = 20 \text{ , } A_q = A_\ell = 500 \text{ GeV ,}$$
$$m_{\tilde{q}}^0 = 5 \text{ TeV , } M_1 = 150 \text{ GeV , } M_2 = 300 \text{ GeV , } M' = 1 \text{ TeV}$$

- Z' decays into squarks, H' $\tilde{\chi}_5^0$, $\tilde{\chi}_6^0$ not kinematically allowed, as for Representative Point
- Determine MSSM scenario where $\tilde{\nu}$, $\tilde{\ell}$ (and all SUSY-particles) have physical masses after adding D-term.

Z'_η, model, $\theta_\eta = \sqrt{5/8}$

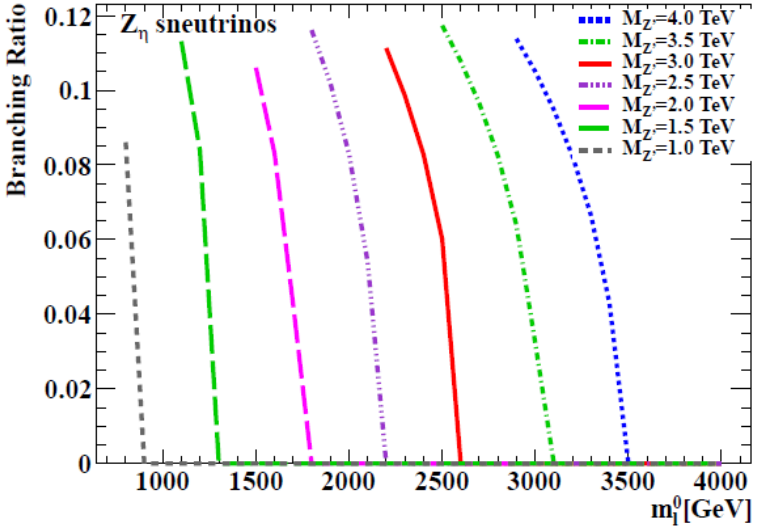
- The minimal physical lepton mass

$m_{\tilde{\ell}} = 1.6$ GeV. $m^0_{\tilde{\ell}} > 2.12$ TeV.

- $Z' \to \tilde{\ell}^+\tilde{\ell}^-$ **NO**
- $Z' \to \tilde{\nu}_2\tilde{\nu}_2^*$ ~11% **YES**

$2.13 \text{ TeV} < m^0_{\tilde{\ell}} < 2.59 \text{ TeV}$

- $Z' \to \tilde{\chi}^0\tilde{\chi}^0$ ~11% **YES**
- $\tilde{\chi}^+\tilde{\chi}^-$ ~ 5% **YES**



$m_{Z'}$ [GeV]	$m^0_{\tilde{\ell}}$ [GeV]	$m_{\tilde{\ell}_1}$ [GeV]	$m_{\tilde{\ell}_2}$ [GeV]	$m_{\tilde{\nu}_1}$ [GeV]	$m_{\tilde{\nu}_2}$ [GeV]
3000	2200	1986	1745	1984	586.40

$m_{\tilde{\chi}^\pm_1}$=184 GeV $m_{\tilde{\chi}^\pm_2}$=330 GeV
$m_A = m_H = m_{H^\pm}$= 1190 GeV.

All θ

$m_{Z'}$	$m_{\tilde{\chi}^0_1}$	$m_{\tilde{\chi}^0_2}$	$m_{\tilde{\chi}^0_3}$	$m_{\tilde{\chi}^0_4}$	$m_{\tilde{\chi}^0_5}$	$m_{\tilde{\chi}^0_6}$	m_h	m_{H_3}
[GeV]	[GeV]	[GeV]	[GeV]	[GeV]	[GeV]	[GeV]	[GeV]	[GeV]
3000	136.70	193.20	210.10	330.20	2541.00	3541.00	91.10	3000.00

Z'_η, model, $\theta_\eta = \sqrt{5/8}$

- The minimal physical lepton mass

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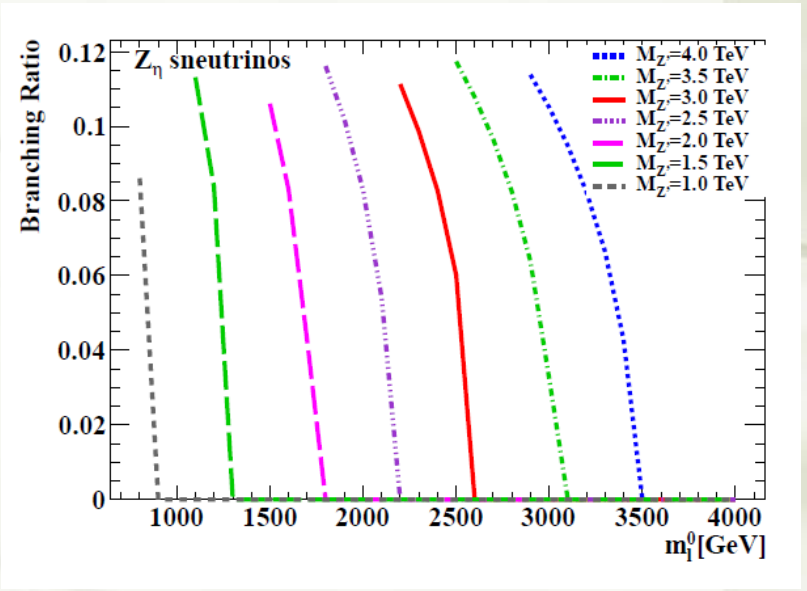
- $Z' \to \tilde{\chi}^0\tilde{\chi}^0$ ~11% **YES**
- $\tilde{\chi}^+\tilde{\chi}^-$ ~ 5% **YES**



$m_{Z'}$	$m^0_{\tilde{\ell}}$	$m_{\tilde{\ell}_1}$	$m_{\tilde{\ell}_2}$	$m_{\tilde{\nu}_1}$	$m_{\tilde{\nu}_2}$	$m_{\tilde{\chi}^\pm}$=184 GeV $m_{\tilde{\chi}^\pm}$=330 GeV	
3000	136.70	193.20	210.10	330.20	2541.00	3541.00	91.10	3000.00

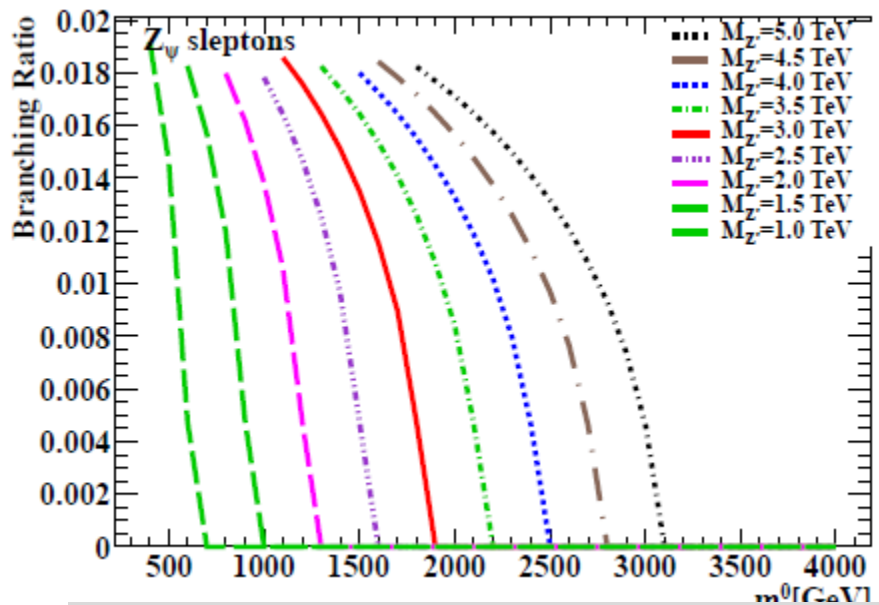
All

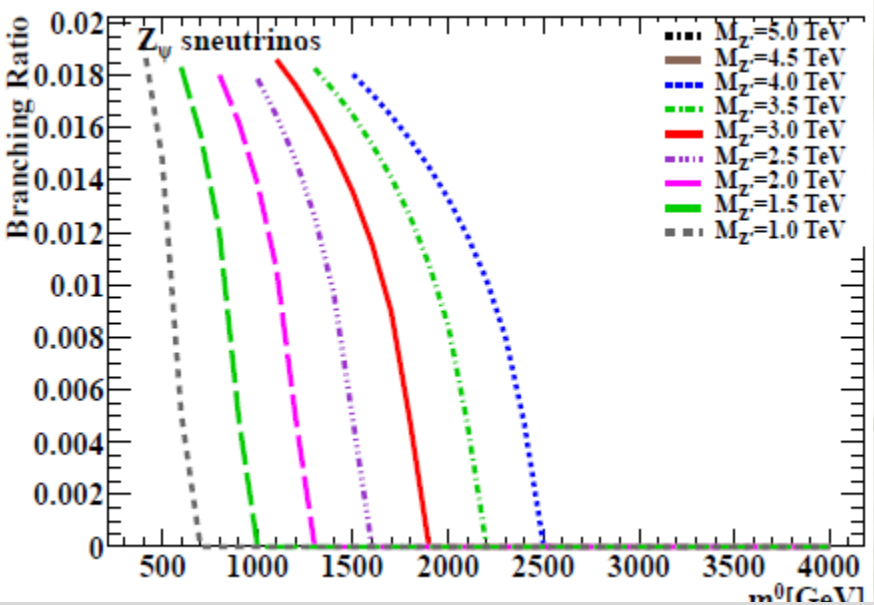
NOT favourable to reconstruct charged slepton masses

Z'_{ψ}, model, $\theta_{\psi} = 0$

- $Z' \to \tilde{\ell}^{+}\tilde{\ell}^{-}$ ~ 2% **YES**
- $Z' \to \tilde{\nu}_2\tilde{\nu}_2^{*}$ ~ 2% **YES**
- $Z' \to \tilde{\chi}^0\tilde{\chi}^0$ ~20% **YES**
- $Z' \to \tilde{\chi}^{+}\tilde{\chi}^{-}$ ~10% **YES**

$m_{Z'}$ [GeV]	$m^0_{\tilde{\ell}}$ [GeV]	$m_{\tilde{\ell}_1}$ [GeV]	$m_{\tilde{\ell}_2}$ [GeV]	$m_{\tilde{\nu}_1}$ [GeV]	$m_{\tilde{\nu}_2}$ [GeV]
3000	1100	1529	296.20	1526	292.90

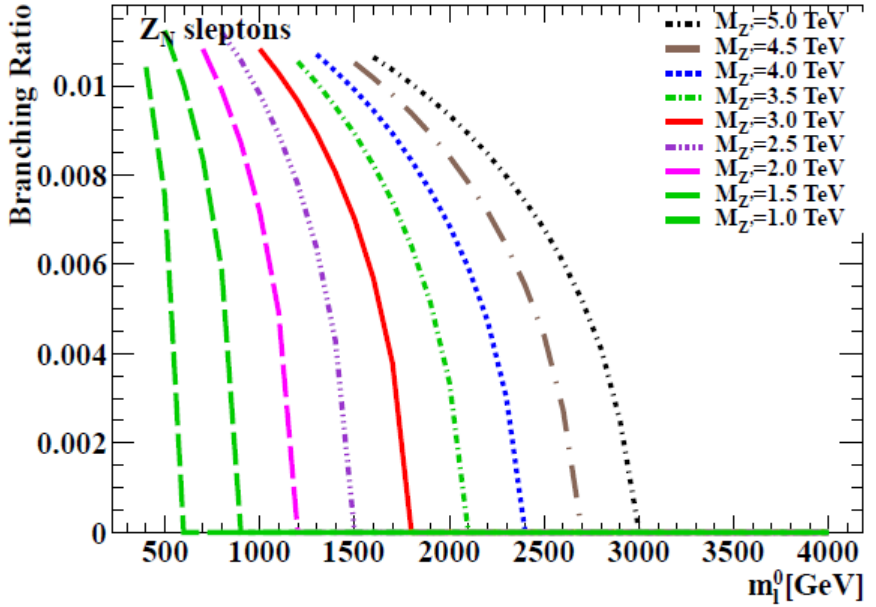




Possible to study Z' decay into charged sleptons

Z'_N, model, $\theta_N = \sqrt{15}\text{-}\pi/2$

- $Z' \to \tilde{\ell}^+\tilde{\ell}^-$ ~1% **YES**
- $Z' \to \tilde{\nu}_2\tilde{\nu}_2^*$ **coupling suppressed**
- $Z' \to \tilde{\chi}^0\tilde{\chi}^0$ ~19% **YES**
- $Z' \to \tilde{\chi}^+\tilde{\chi}^-$ ~ 10% **YES**



$m_{Z'}$ [GeV]	$m^0_{\tilde{\ell}}$ [GeV]	$m_{\tilde{\ell}_1}$ [GeV]	$m_{\tilde{\ell}_2}$ [GeV]	$m_{\tilde{\nu}_1}$ [GeV]	$m_{\tilde{\nu}_2}$ [GeV]
3000	1000	1674	319.90	1672	1000

Possible to study Z' decay into charged sleptons

Z'_I, model, $\theta_I = \sqrt{5/8}\text{-}\pi/2$

- No minimal physical lepton mass
- $Z' \to \tilde{\ell}^+\tilde{\ell}^-$ **suppressed**
- $Z' \to \tilde{\nu}_2\tilde{\nu}_2^*$ **NO**
- $Z' \to \tilde{\chi}^0\tilde{\chi}^0$ ~ 10%
- $Z' \to \tilde{\chi}^+\tilde{\chi}^-$ ~ 5%

$m_{Z'}$ [GeV]	$m^0_{\tilde{\ell}}$ [GeV]	$m_{\tilde{\ell}_1}$ [GeV]	$m_{\tilde{\ell}_2}$ [GeV]	$m_{\tilde{\nu}_1}$ [GeV]	$m_{\tilde{\nu}_2}$ [GeV]
3000	200	2131	204.70	2130	2131
3000	1000	2346	1001	2344	2345

NOT favourable to reconstruct charged slepton masses

Z'_S , model, $\theta_S = \sqrt{15/9}\,\pi/2$

- No minimal physical lepton mass
- $Z' \to \tilde{\ell}^+\tilde{\ell}^-$ ~ 0.08
- $Z' \to \tilde{\nu}_2\tilde{\nu}_2^*$ **NO**
- $Z' \to \tilde{\chi}^0\tilde{\chi}^0$ ~ 7%
- $Z' \to \tilde{\chi}^+\tilde{\chi}^-$ ~ 4%

$m_{Z'}$ [GeV]	$m^0_{\tilde{\ell}}$ [GeV]	$m_{\tilde{\ell}_1}$ [GeV]	$m_{\tilde{\ell}_2}$ [GeV]	$m_{\tilde{\nu}_1}$ [GeV]	$m_{\tilde{\nu}_2}$ [GeV]
3000	200	2691	970.50	2690	3007

NOT favourable to reconstruct charged slepton masses

Z_{SSM}', model

- The **Sequential Standard Model** is one of most used model for Z' production and decay.
- All Z' couplings to fermions/sfermions are the same as Z in SM
- Detection SUSY particles depends only on $m_{Z'}$ and SUSY parameters
- No D-term
- Important issue: NO parameter θ
- Benchmark scenario

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Two minimal physical lepton mass Z_{SSM}', model,

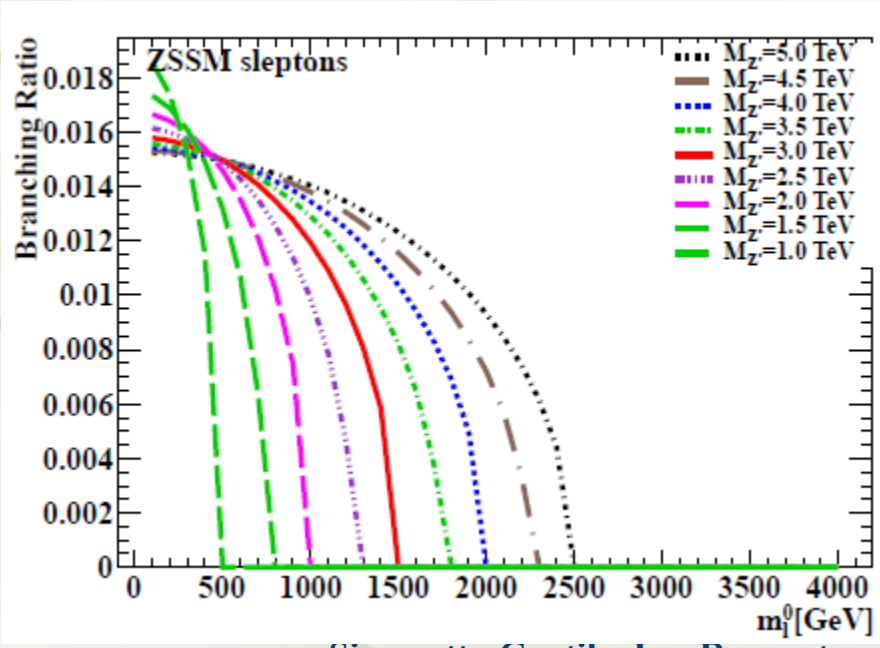
- $Z' \to \tilde{\ell}^+\tilde{\ell}^-$ ~ 2%
- $Z' \to \tilde{\nu}_2\tilde{\nu}_2^*$ ~3%
- $Z' \to \tilde{\chi}^0\tilde{\chi}^0$ ~ 32%
- $Z' \to \tilde{\chi}^+\tilde{\chi}^-$ ~ 16%

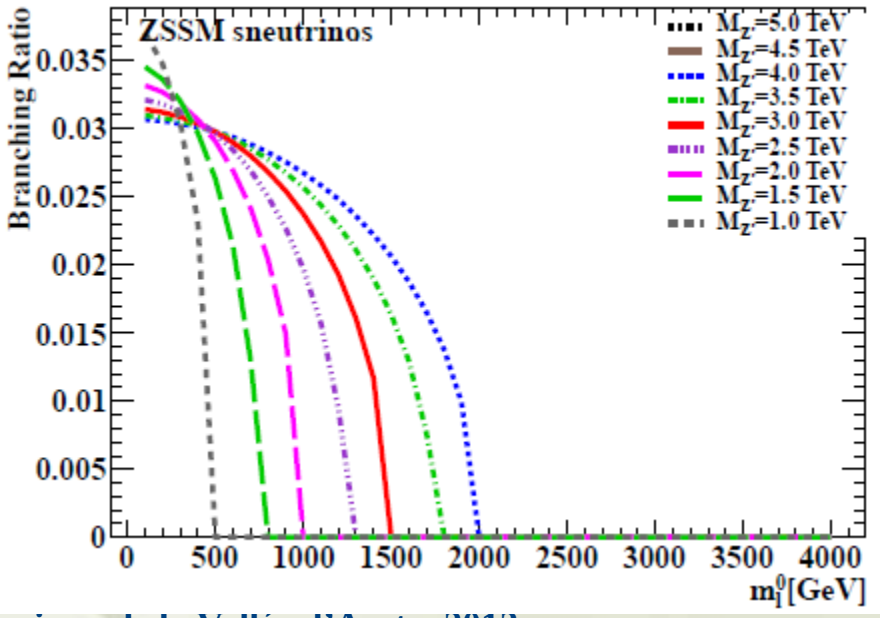
$m_{\tilde{\chi}_1^\pm}$=184.00 GeV, $m_{\tilde{\chi}_2^\pm}$= 330.0 GeV.

m_h=90.70 m_A=m_H= $m_{H^\pm}$=1 TeV

$m_{\tilde{\ell}}$ =200GeV, $m_{z'}$=3TeV

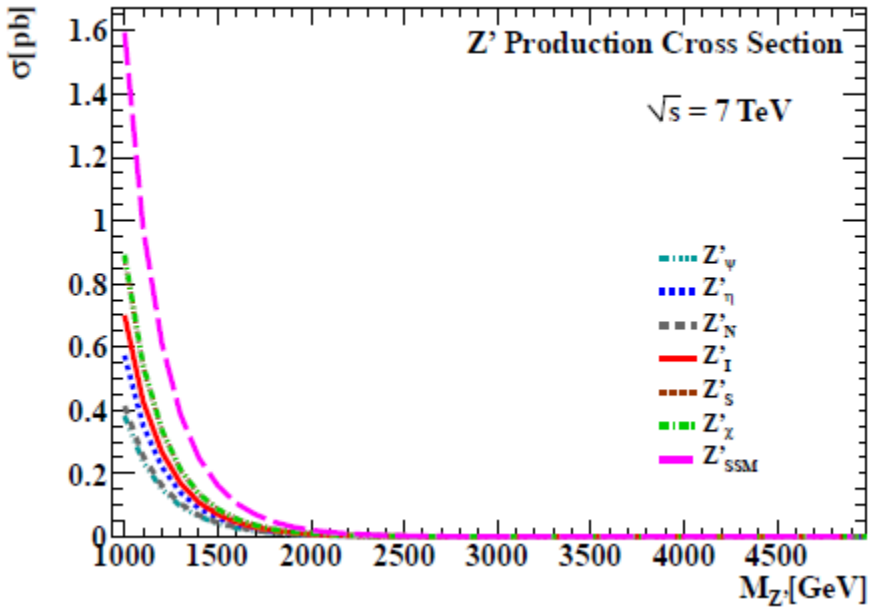
$m_{\tilde{\chi}_1^0}$= 129.20 GeV, $m_{\tilde{\chi}_2^0}$=178.5 GeV, $m_{\tilde{\chi}_3^0}$= 232.30 GeV, $m_{\tilde{\chi}_4^0}$= 333.30GeV.

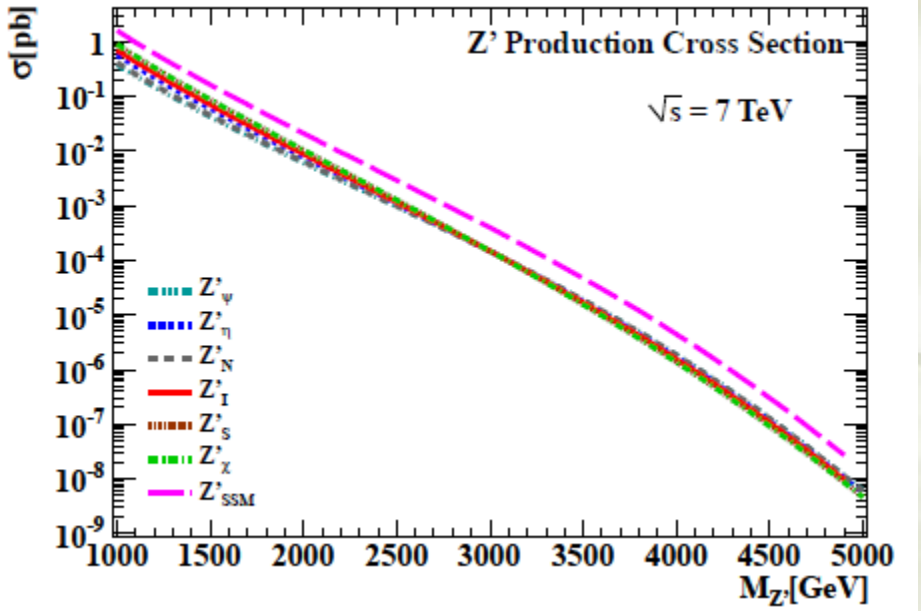




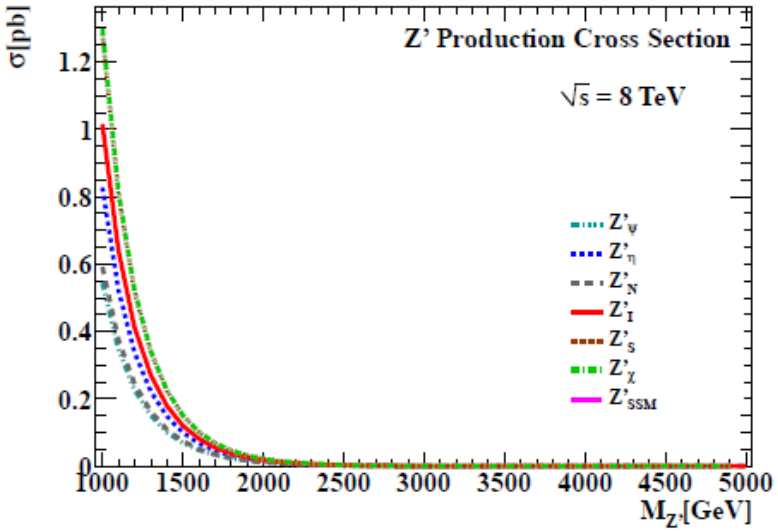
Cross Sections

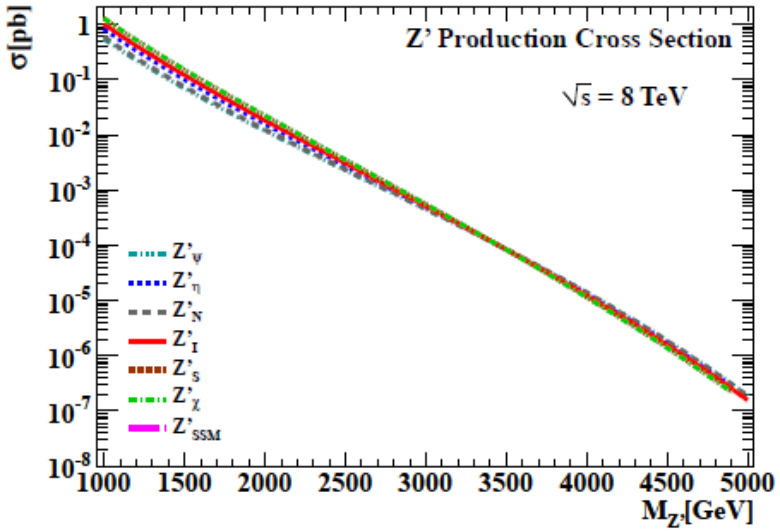
- σ Leading-Order, Parton Distribution Function LO CTEQ6L,changing PDF neglegible impact on σ.
- Parton-level process analogous Z : $q\bar{q} \rightarrow Z'$
- Production **depending** on U(1)' mixing:**θ, Z'mass** not on **SUSY scenario**



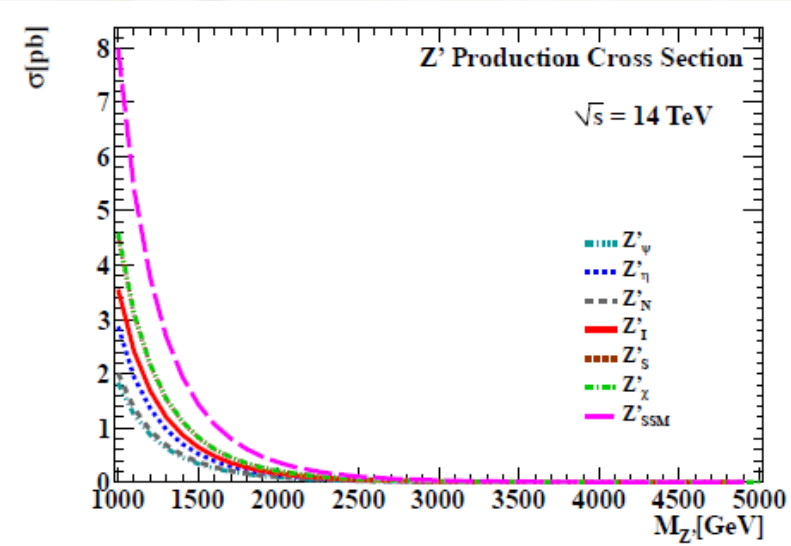


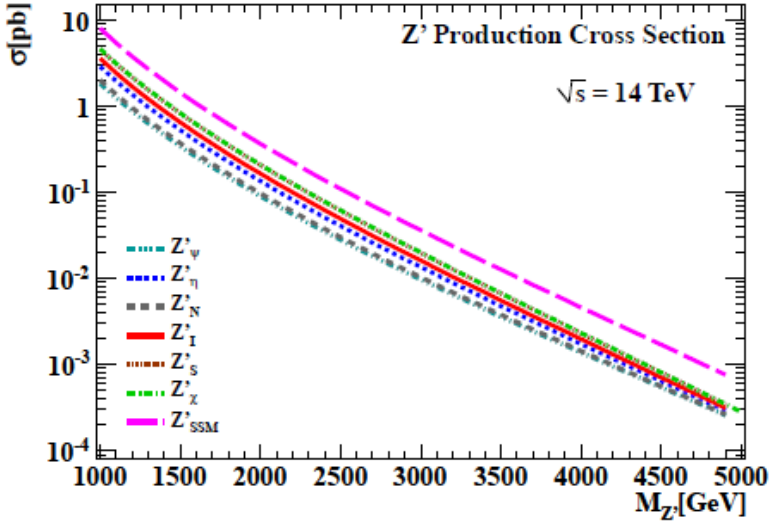
Cross sections





- Z_{SSM} highest
- Z_{ψ} lowest





What do we expect?

$\sqrt{s}$=14TeV
L_{int} =100 fb^{-1}

$\sqrt{s}$=8 TeV
L_{int} =20 fb^{-1}
(run 2012)

$M_{Z'\,TeV}$	Chan	Zη	Zψ	ZN	ZI	ZS	ZSSM
1.5	N_{casc}	13650	10241	9979	8507	8242	775715
1.5	N_{slep}	____	622	414	____	65	24774
2.0	N_{casc}	2344	2784	2705	2230	2146	19570
2.0	N_{slep}	____	162	104	____	16	606
1.5	N_{casc}	523	599	400	317	30	2968
1.5	N_{slep}	____	36	17	____	0	95
2.0	N_{casc}	55	73	70	50	46	462
2.0	N_{slep}	____	4	3	____	0	14

N_{casc}= sneutrinos+neutralinos+charginos, N_{slep}=charged leptons decays

NO acceptance neither reconstruction cuts

Conclusions

- Studied **Z'production and decays** with U(1') gauge symmetry (and SSM) and Supersimmetry (MSSM)
- U(1')+ MSSM:1 extra Higgs boson + 2 neutralinos
- Taken in account **D-term**, assuming all squarks common mass and all slepton common mass at Z'mass scale. D-term may be large and negative.
- Mass and br dependence : θ, μ, tanβ ..... Studied in a point.
- σ at $\sqrt{s_{LHC}}$= 7, 8, 14 TeV
- Perspectives: analysis with hadronization, acceptance and detector simulation is planned. Then, the implementation in HERWIG (or PYTHIA) is necessary.