Supersymmetry: Pandora's Box

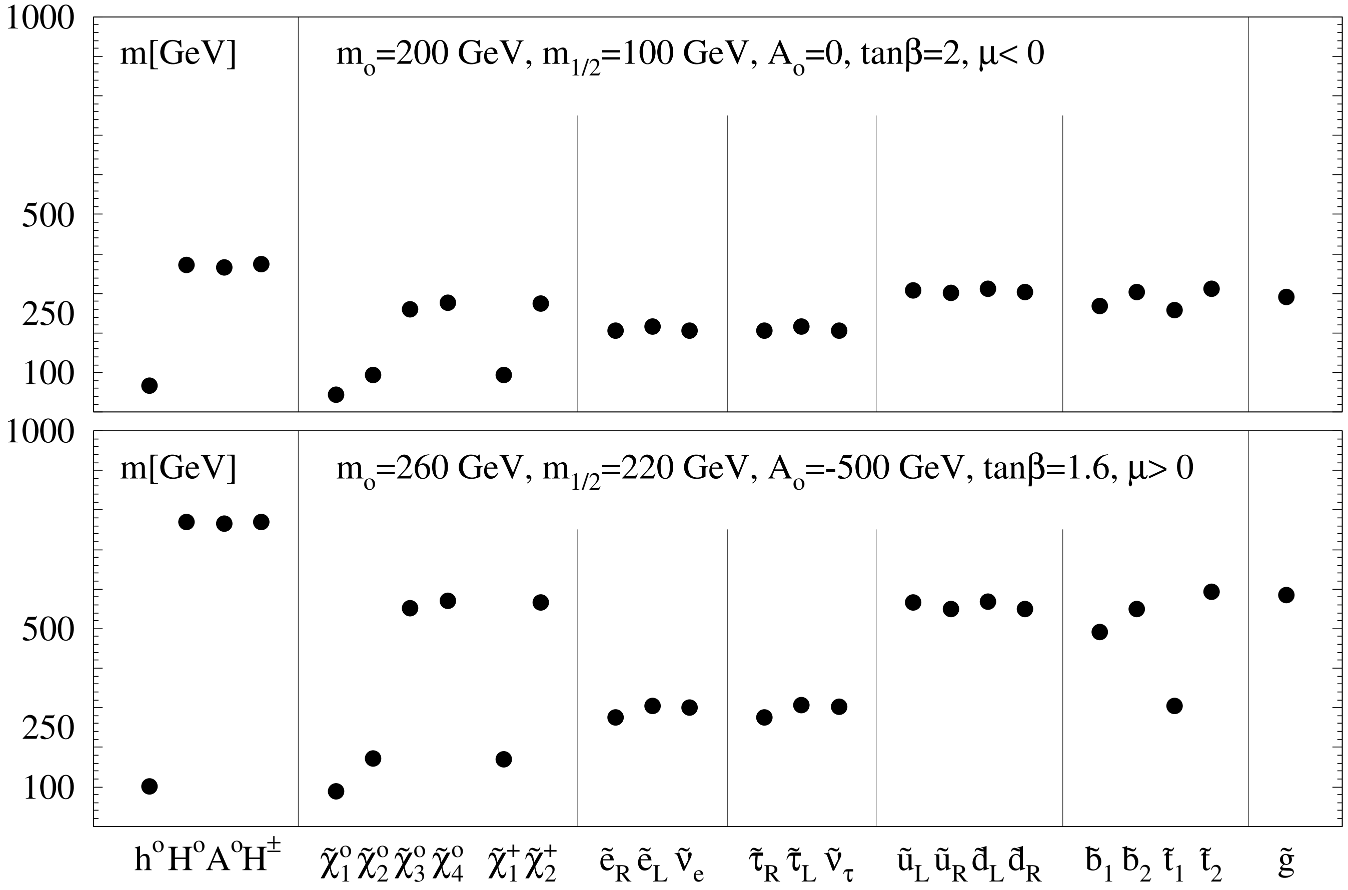
Fermionic forces and bosonic matter:

	Spin 0	Spin $\frac{1}{2}$ Weak ES	Spin $\frac{1}{2}$ Mass ES	Spin 1
Matter	$\tilde{\nu}$ $\tilde{l}$ $\tilde{q}$	ν l q_{CKM}	q	
Forces	$H^{\pm}$ H^0 h^0, A^0	$\tilde{g}$ $\tilde{W}^{\pm}$ $\tilde{H}^{\pm}$ $\tilde{\gamma}$ $\tilde{Z}$ $\tilde{h}, \tilde{A}$	$\tilde{\chi}_i^{\pm}$ Charginos $\tilde{\chi}_i^0$ Neutralinos	g $W^{\pm}$ γ Z

May stabilise radiative corrections, may allow grand unification, may not exist...

A Supersymmetry Scenario

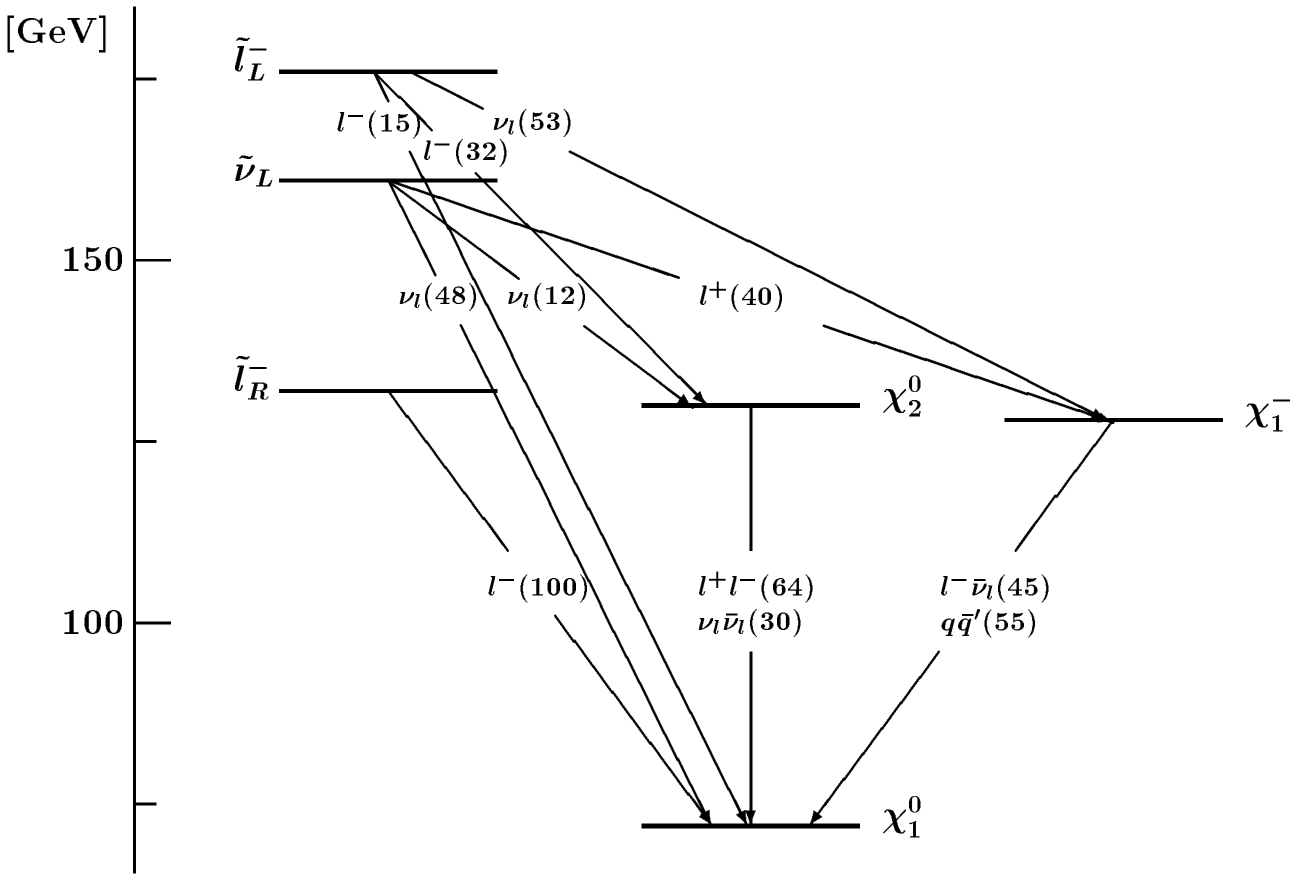
Supersymmetry: not only many new particles but also many more parameters than Standard Model



If Supersymmetry exists, many of its particles may be observable, many of its parameters may be measurable at a Linear Collider.

SUSY Spectroscopy

Martyn & Blair, hep-ph/9910416



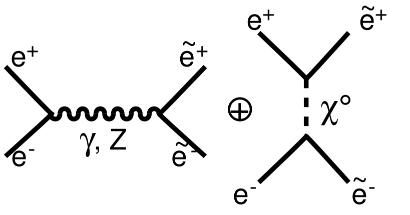
Simple pattern if R-parity of conserved

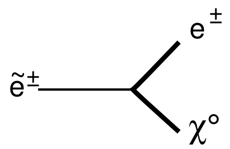
Signatures for Supersymmetry

SUSY PARTICLE **PRODUCTION** **DECAY** **BR** **SIGNATURE**

Scalar Electron

$e^+ e^- \to \tilde{e}^+ \tilde{e}^-$





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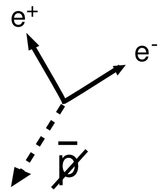
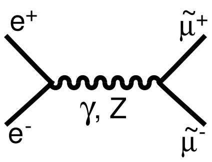
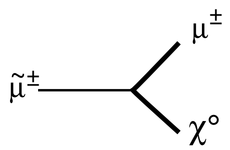


Scalar Muon

$e^+ e^- \to \tilde{\mu}^+ \tilde{\mu}^-$





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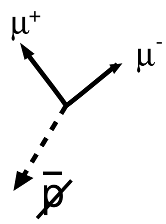
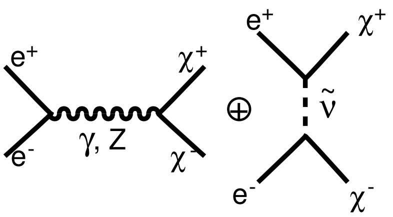
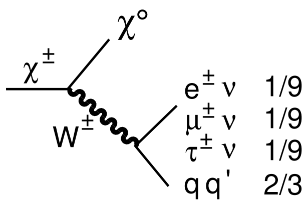
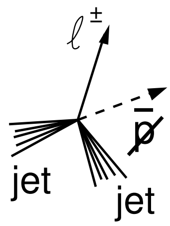


Chargino

$e^+ e^- \to \chi^+ \chi^-$

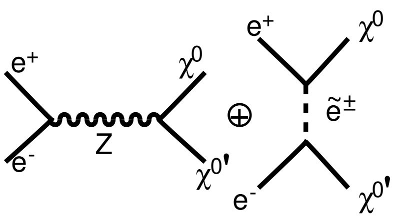


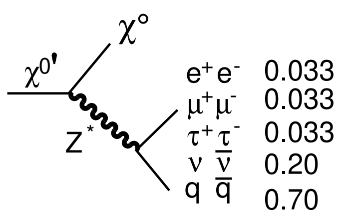


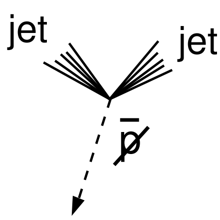


Neutralino

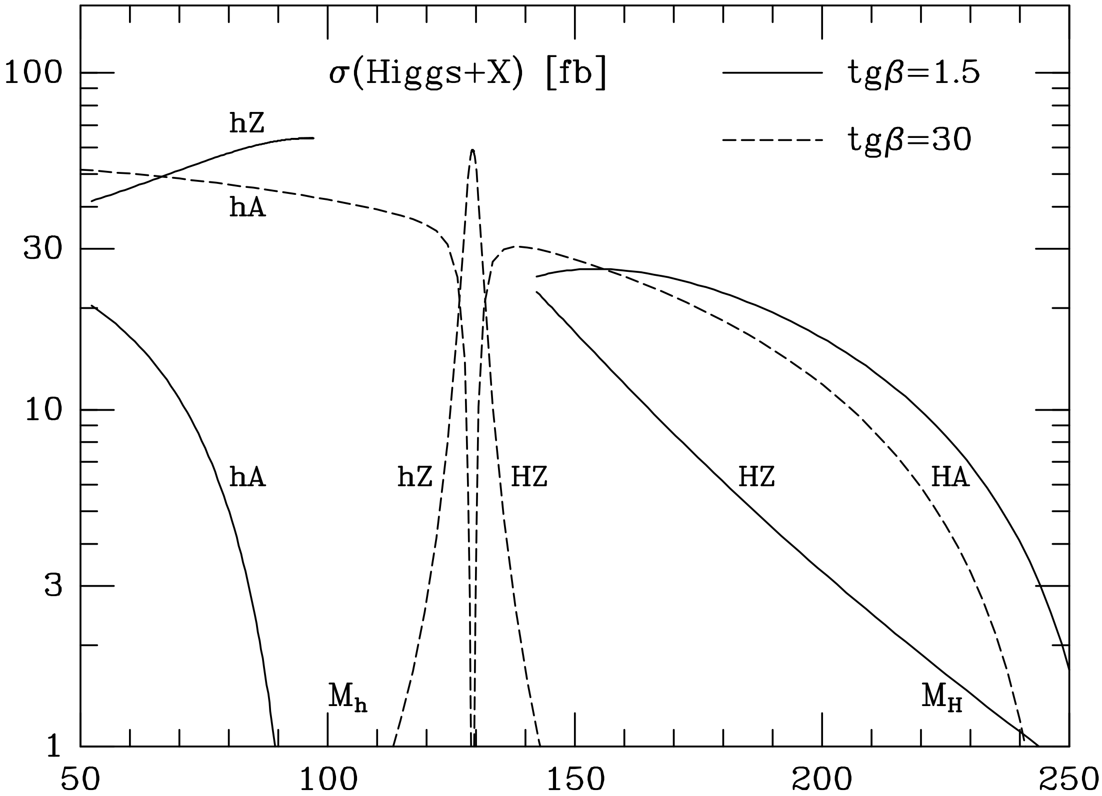
$e^+ e^- \to \chi^0 \chi^{0\prime}$

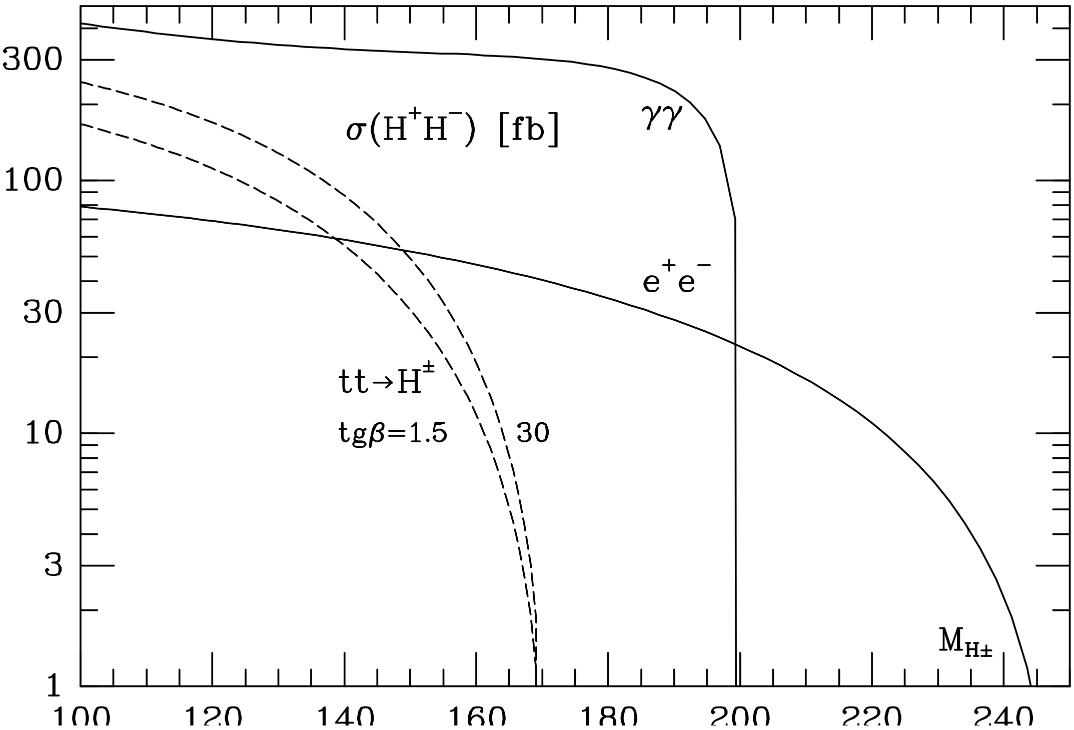




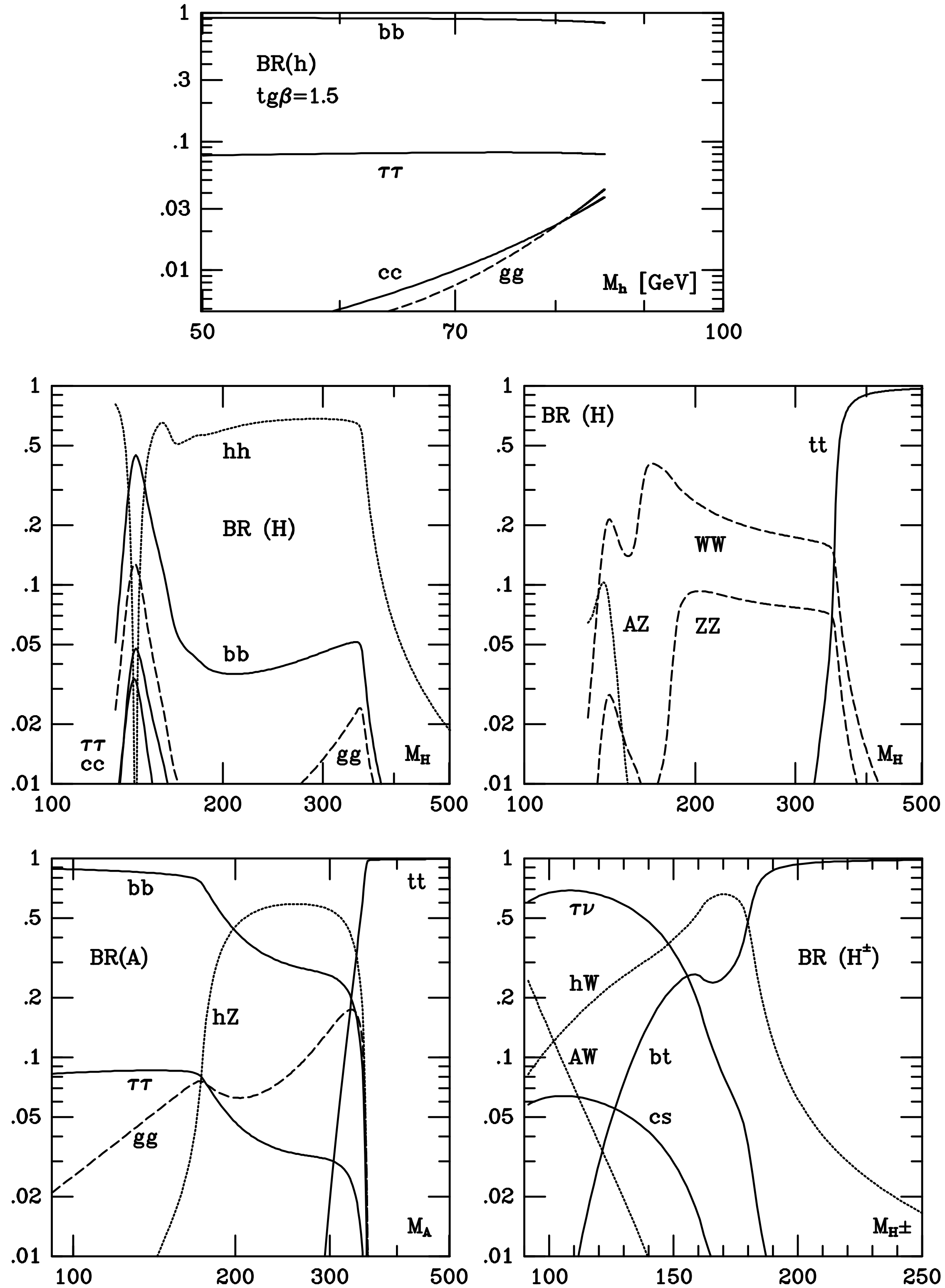


MSSM Higgs Production

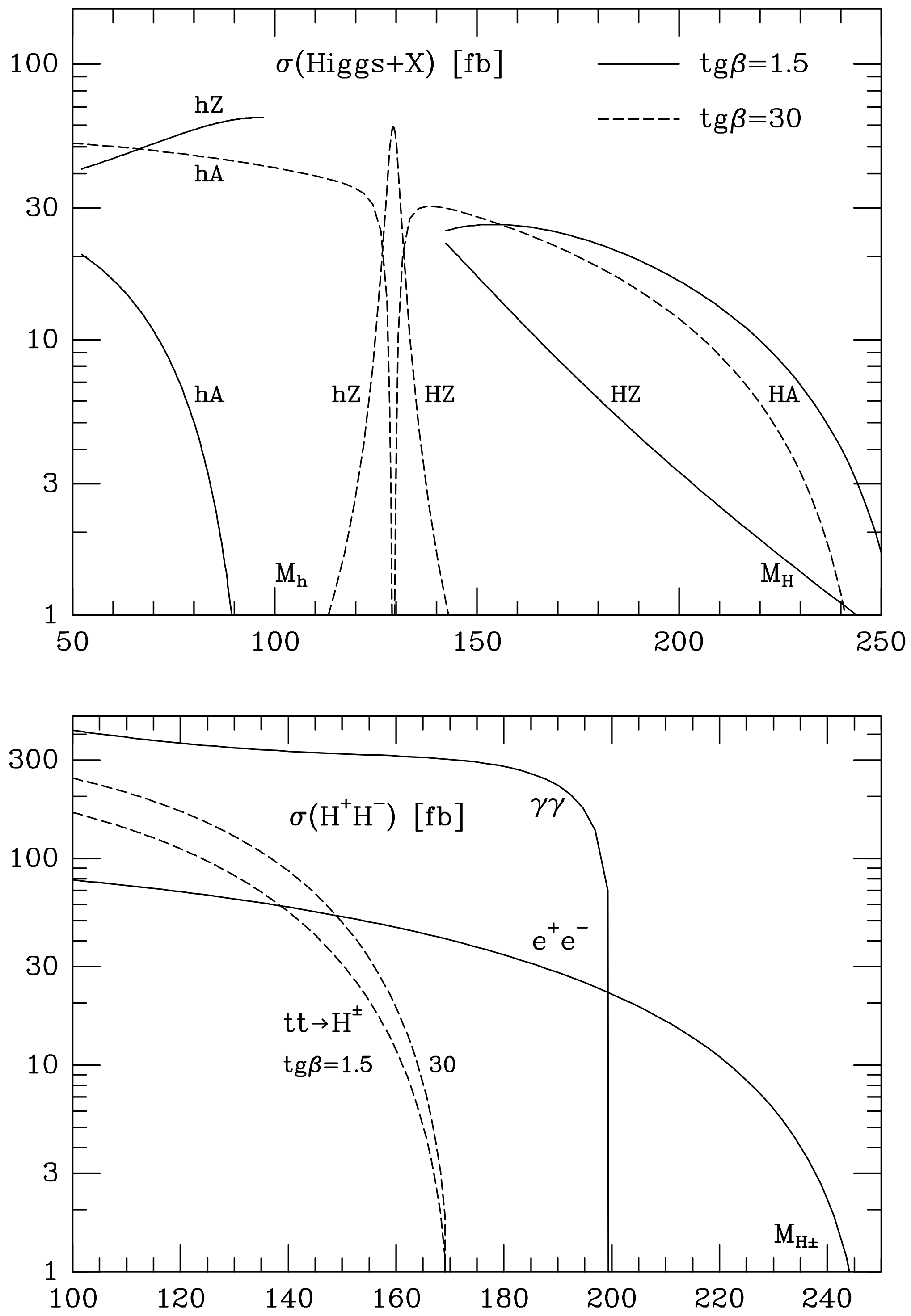




MSSM Higgs Decays

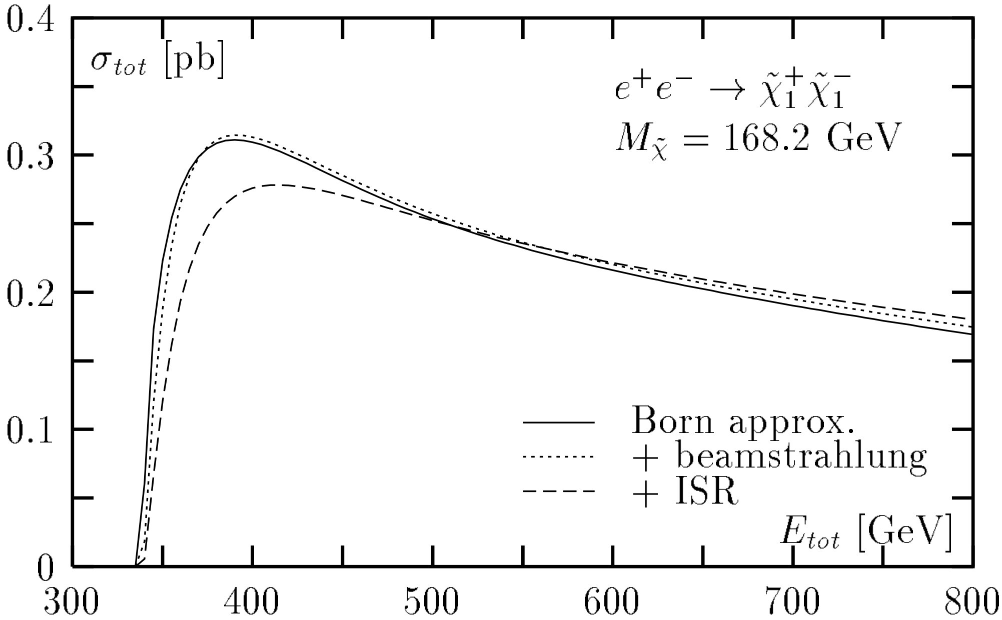


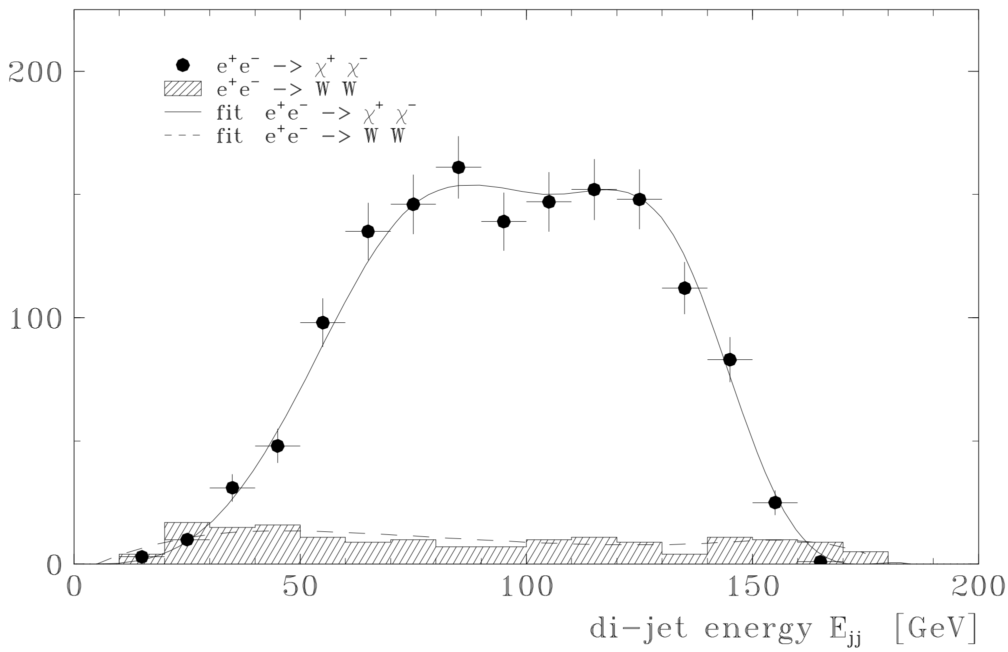
Supersymmetric Higgs Bosons



Chargino/Neutralino Properties

$\sqrt{s} = 500$ GeV



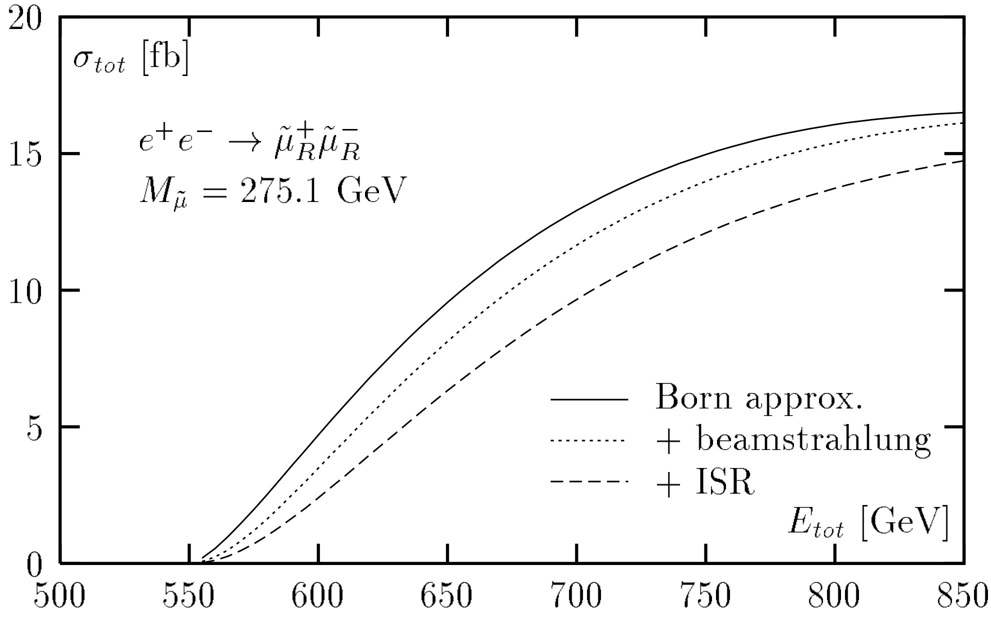


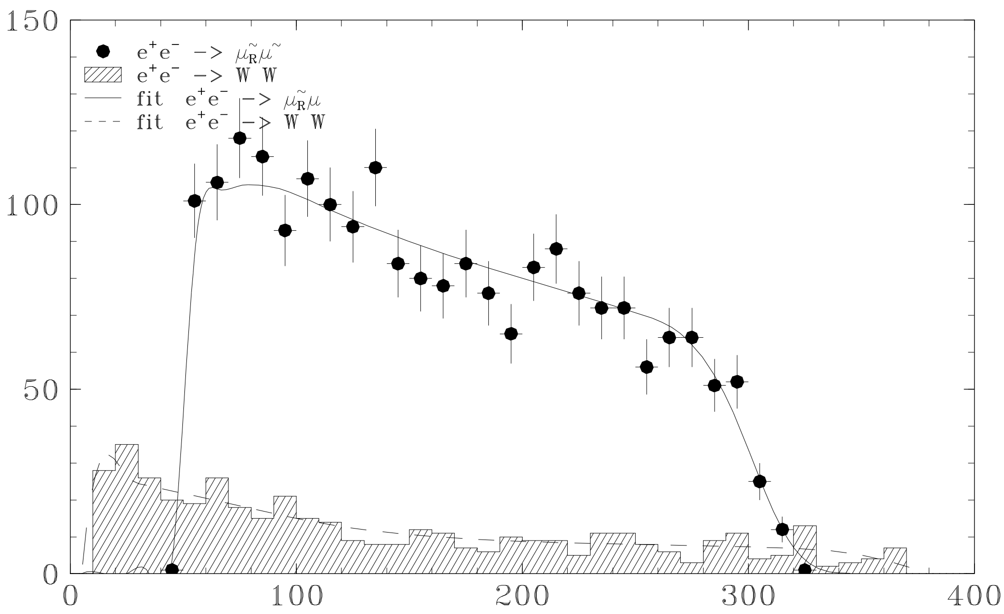
Measure masses of charginos with 100 MeV accuracy

Measure masses of neutralinos with 600 MeV accuracy

Slepton Properties

$\sqrt{s} = 800$ GeV





Measure masses of sleptons with 2 GeV accuracy

SUSY Masses and Parameters

Martyn & Blair, hep-ph/9910416

particle	mass [GeV]	δm_{cont} [GeV]	δm_{scan} [GeV]	SUSY parameters
$\tilde{\mu}_R$	132.0	0.3	0.09	$\Rightarrow m_0,\ m_{1/2},\quad \tan\beta$
$\tilde{\mu}_L$	176.0	0.3	0.4	
$\tilde{\nu}_\mu$	160.6	0.2	0.8	
$\tilde{e}_R$	132.0	0.2	0.05	
$\tilde{e}_L$	176.0	0.2	0.18	
$\tilde{\nu}_e$	160.6	0.1	0.07	
$\tilde{\tau}_1$	131.0		0.6	$\Rightarrow m_0,\ m_{1/2},\ \mu,\ \tan\beta$
$\tilde{\tau}_2$	177.0		0.6	
$\tilde{\nu}_\tau$	160.6		0.6	
$\chi_1^\pm$	127.7	0.2	0.04	$\Rightarrow \quad M_2,\ \mu,\ \tan\beta$
$\chi_2^\pm$	345.8		0.25	
χ_1^0	71.9	0.1	0.05	$\Rightarrow M_1,\ M_2,\ \mu,\ \tan\beta$
χ_2^0	130.3	0.3	0.07	
χ_3^0	319.8		0.30	
χ_4^0	348.2		0.52	

parameter	true value	error
m_0	100 GeV	0.09 GeV
$m_{1/2}$	200 GeV	0.10 GeV
A_0	0 GeV	6.3 GeV
$\tan\beta$	3	0.02
sgn(μ)	+	not fit

parameter	true value	error
m_0	100 GeV	0.09 GeV
M_1	200 GeV	0.20 GeV
M_2	200 GeV	0.20 GeV
A_0	0 GeV	10.3 GeV
$\tan\beta$	3	0.04
sgn(μ)	+	not fit