Indirect detection of Dark Matter in non minimal Supergravity scenarii

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SLAC, Stanford, march 18th 2005

Outline

I) Introduction

Supergravity Landscape

II) Indirect detection of dark matter

Principle

Profiles

Results : EGRET ; CANGAROO/HESS ; GLAST

III) Complementarity with collider physics

Bs -> mu+ mu- versus detection

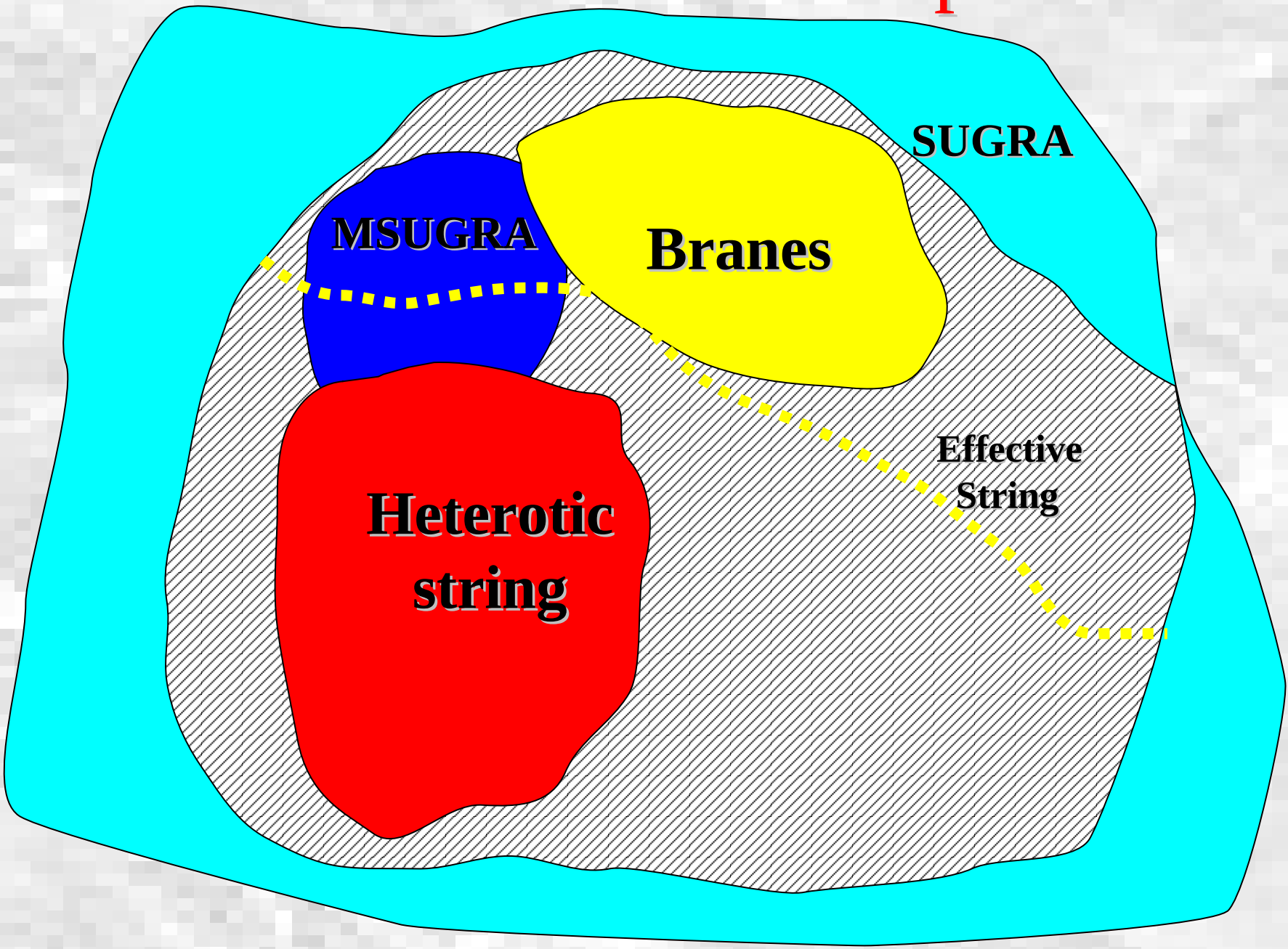
Linear Collider constraints

IV) Application to string inspired SUGRA models

V) Conclusion and Outlooks

Effective Models Landscape

M3/2
Tanβ
b+
<t>
δGS
<V>=0



Effective Models Landscape

Tan β

M

m

A

Sgn(μ)

mSUGRA

Tan β
M3/2 (b1 + dGS)
M3/2 (b2 + dGS)
M3/2 (b3 + dGS)
.
.
M3/2 (1 + n1)
M3/2 (1 + n2)
.
.

String Motivated

Tan β
M(1 + d'1)
M(1 + d'2)
M(1 + d'3)
.
.
m(1 + d1)
m(1 + d2)
.
.

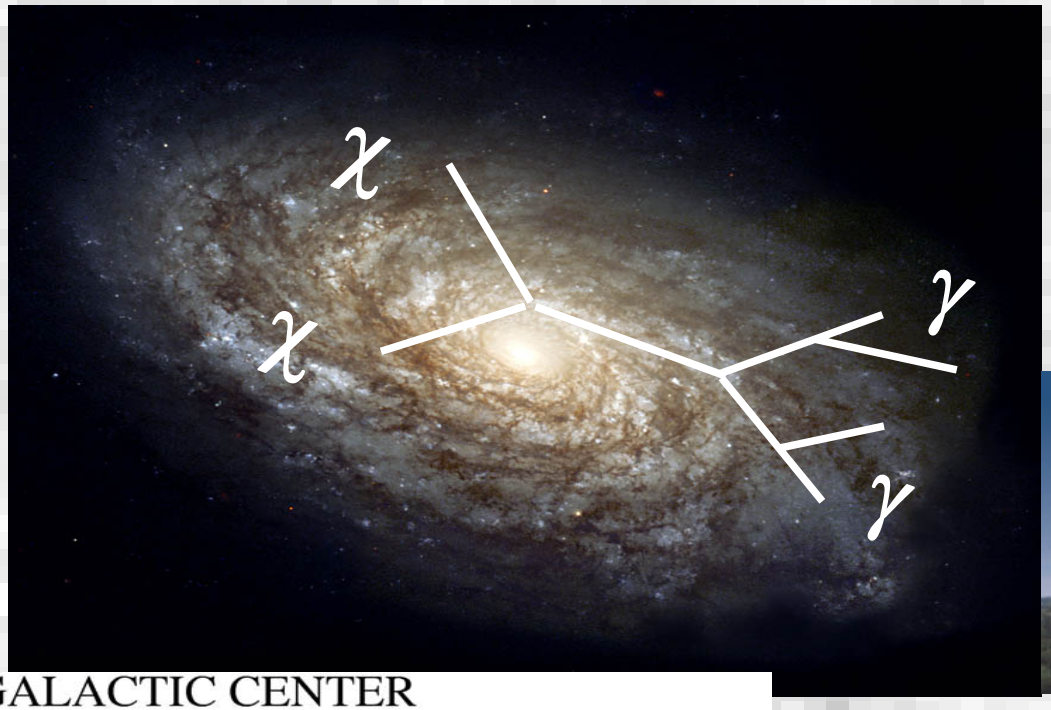
Parametrized SUGRA

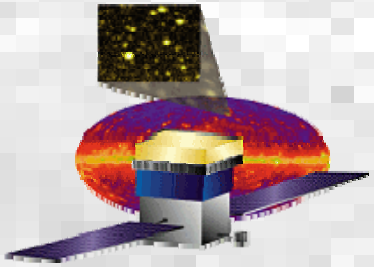
Tan β
M1
M2
M3
.
.
mH1
mH2
.
.
Ab
At

General SUGRA

.

Indirect detection from GC

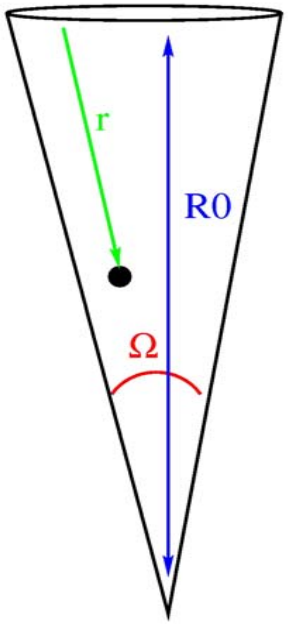




GLAST (2006)

HESS (Namibie, 2004)

GALACTIC CENTER



EARTH

$\Omega \left| \begin{matrix} 10^{-3} \ (\theta = 1^{o}) \\ 10^{-5} \ (\theta = 0.1^{o}) \end{matrix} \right.$

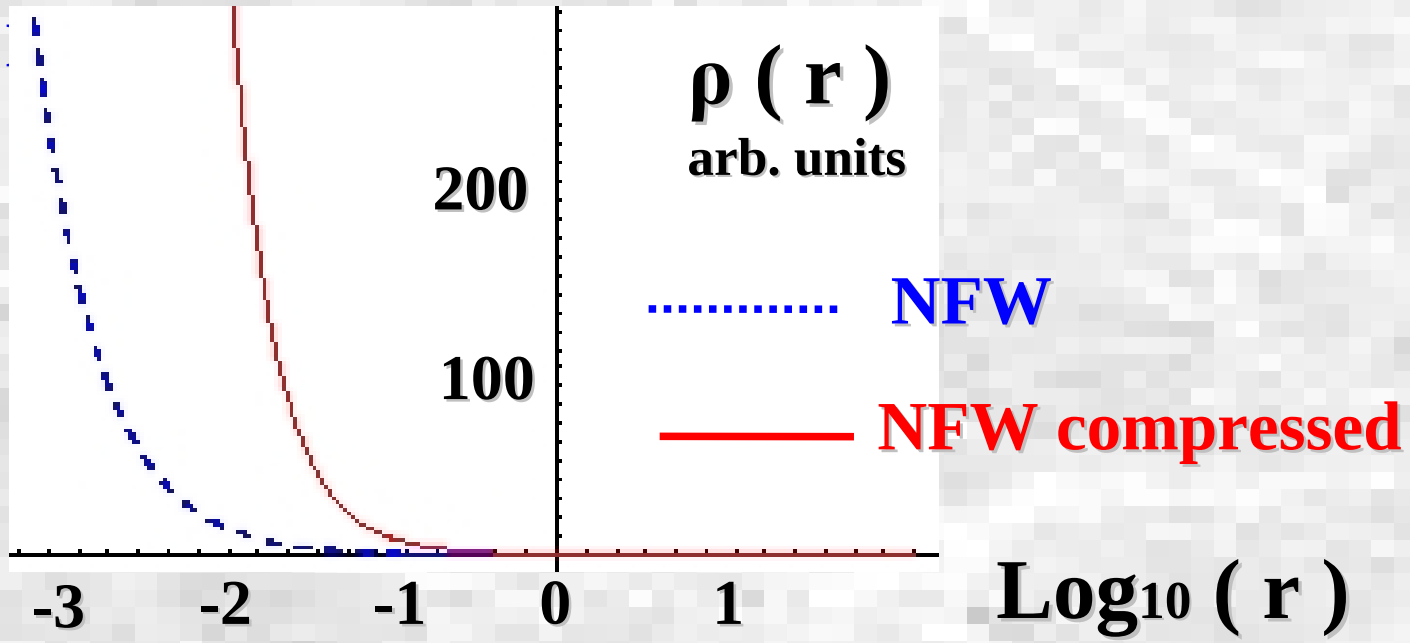
R0 = 8 – 8.5 kpc

$$\frac{d\,\Phi\gamma}{d\,\Omega\,d\,E} = \frac{1}{2}\frac{dN\gamma}{dE\gamma}\frac{<\sigma\,v>}{4\pi\,M^2}\int \rho^2 dl$$

$$\Phi\gamma(cm^{-2}, s^{-1}) \sim 10^{-13}\ 10\ \frac{<\sigma\,v>}{10^{-29}\ cm^3\ s^{-1}}\ \frac{(100\ GeV)^2}{M^2}\ J\,\Delta\Omega$$

$$\Omega h^2 \sim \frac{3.10^{-27}\ cm^3\ s^{-1}}{<\sigma v>} \sim 0.1 \rightarrow \Phi\gamma \sim 10^{-11}\ J\,\Delta\Omega$$

The adiabatic compression



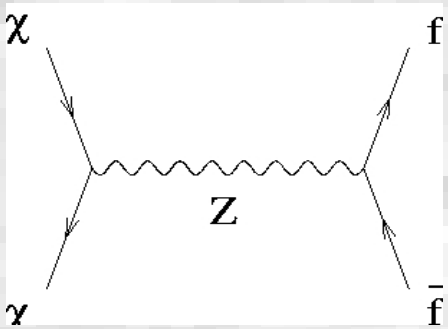
$$M_i(r_i)\, r_i = [\, M_{CDM}(r_f) + M_b(r_f)\,]\, r_f$$

N-Body simulation (NFW, Moore..)

???

Today baryon distribution

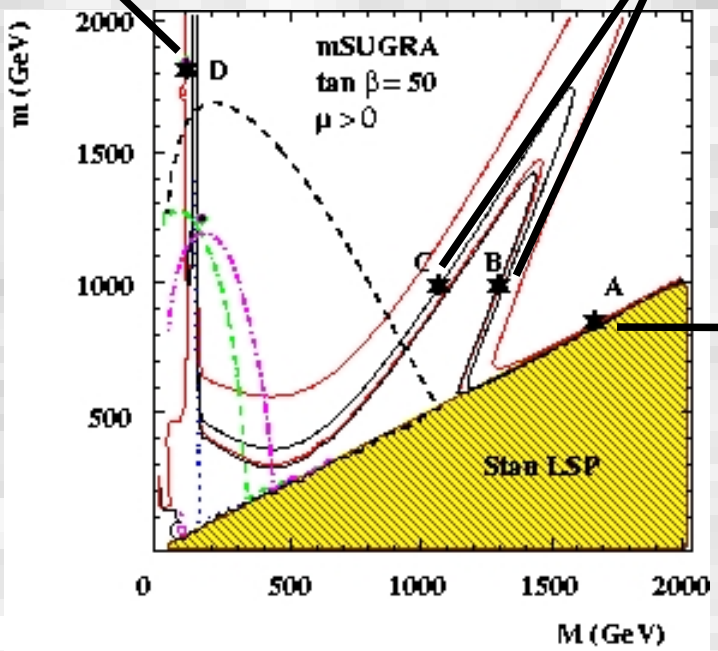
The relic density constraints

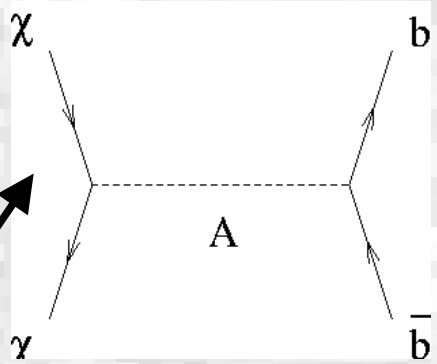


Neutralino ≡ Higgsino

Light

High fluxes

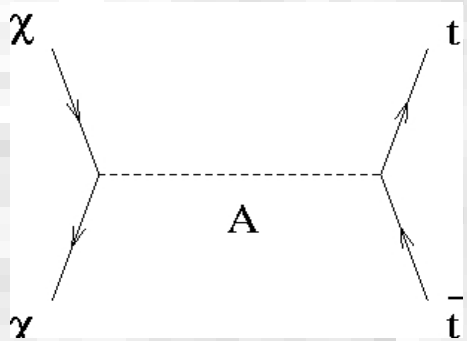




Neutralino ≡ Bino

M1= M / 2

High fluxes

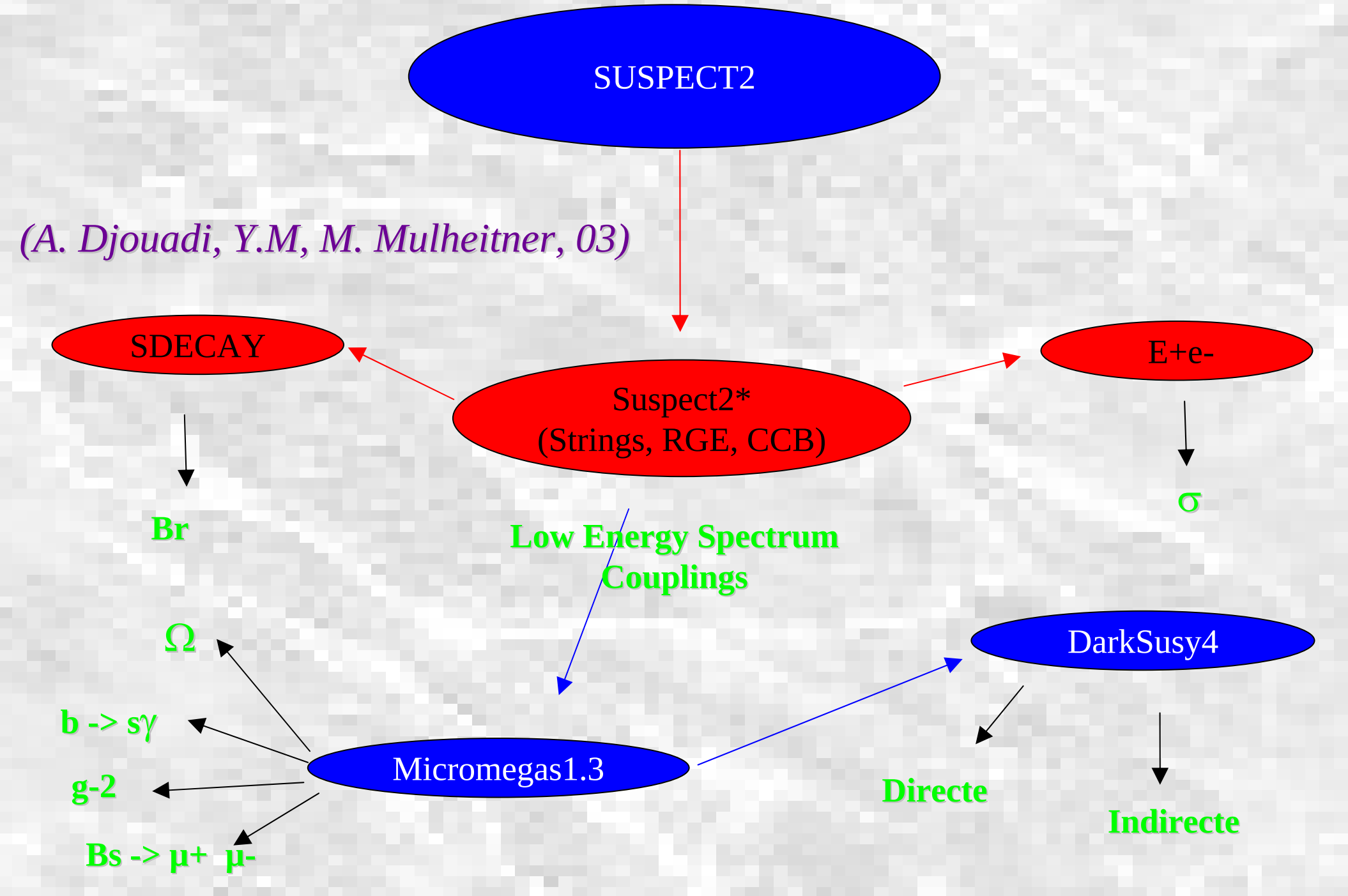


Neutralino ≡ Bino

M1 = M / 2

Low fluxes

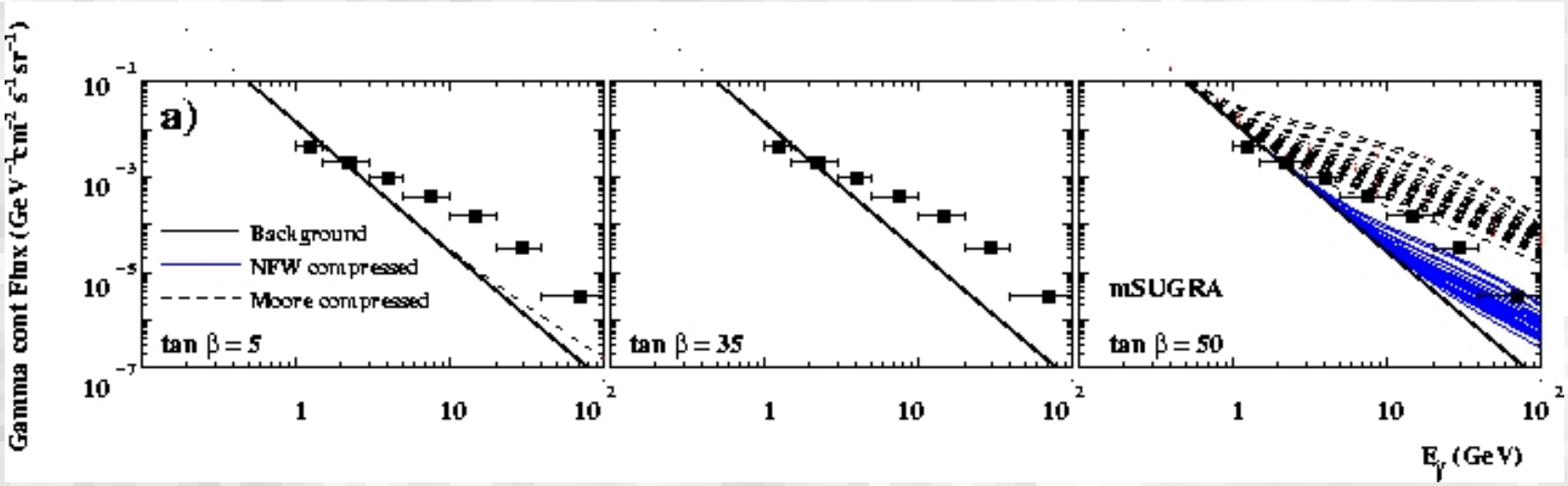
TOOLS


SUSPECT2
(A. Djouadi, Y.M, M. Mulheitner, 03)
SDECAY
Suspect2*
(Strings, RGE, CCB)
E+e-
Br
Low Energy Spectrum
Couplings
σ
Ω
DarkSusy4
b -> sγ
g-2
Bs -> μ+ μ-
Micromegas1.3
Directe
Indirecte

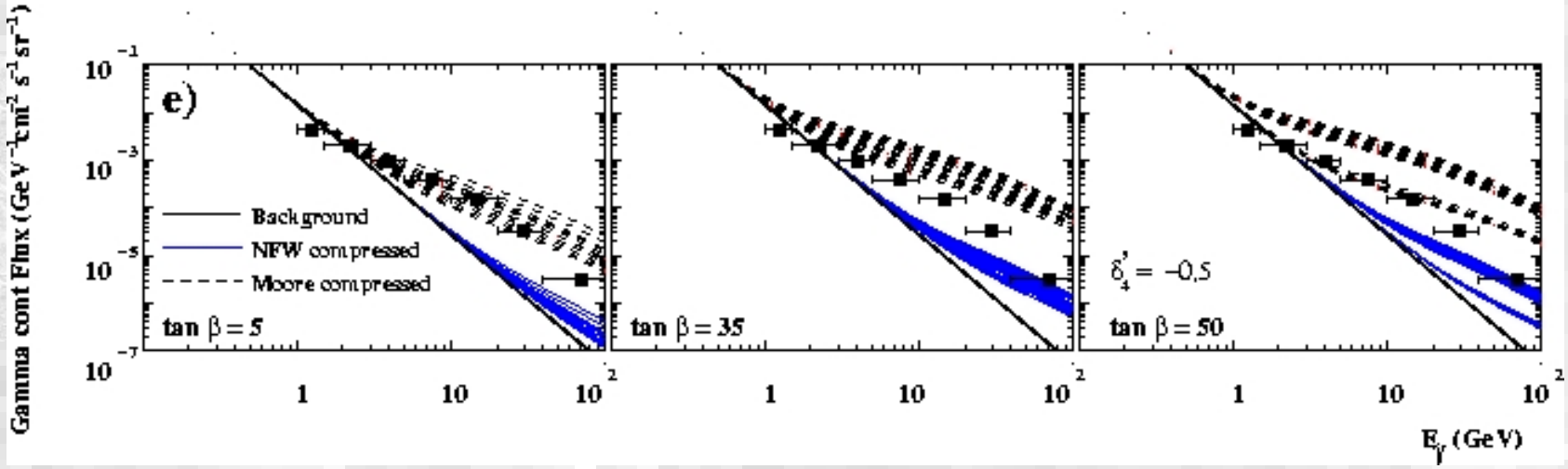
Exp. Part I
EGRET

(Y.M, C. Munoz, 05)

MSUGRA
Ω_{MAP}
Acc. Const.

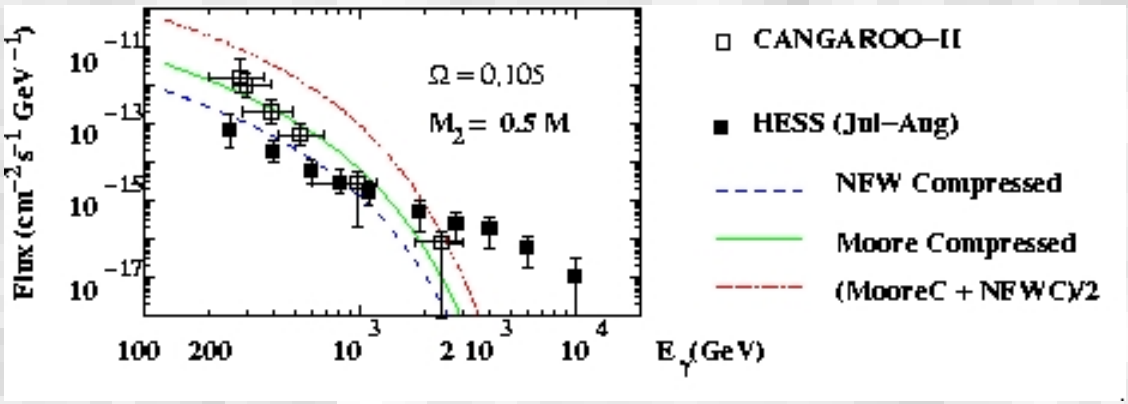


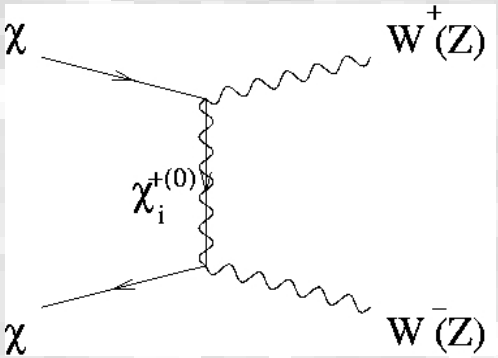
M3 = M/2
Ω_{MAP}
Acc. Const.



Exp. Part II
A.C.T. : CANGAROO II, HESS

(Y.M, C. Munoz, 05)



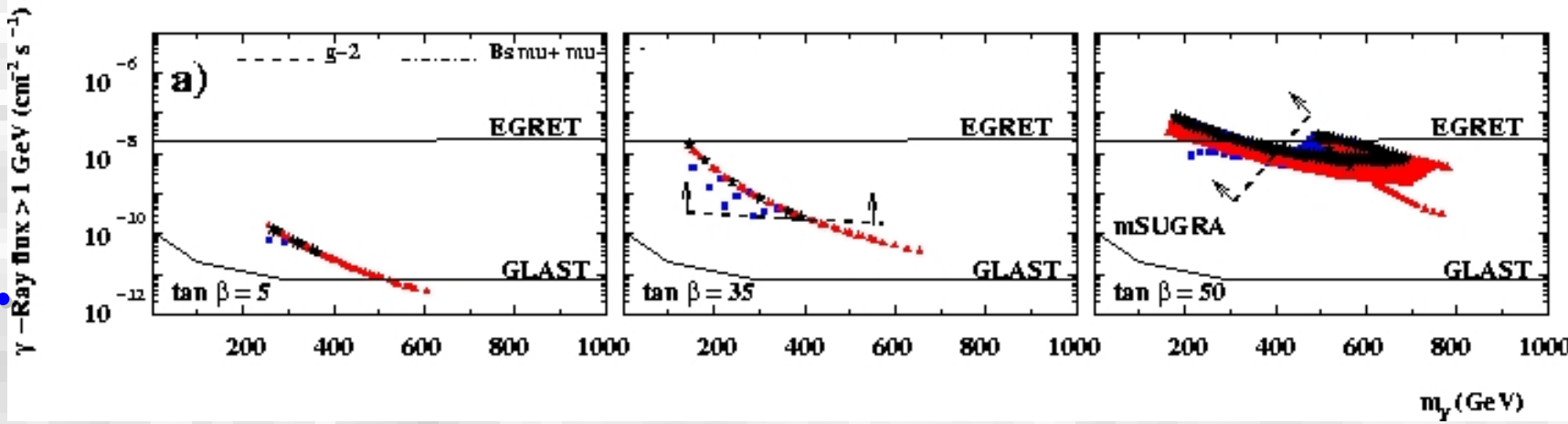


$$\sigma \approx \frac{\left(Z_{12} V_{11} \right)^2}{M_{\chi^0}^2 + M_{\chi^+}^2 + Mw^2}$$

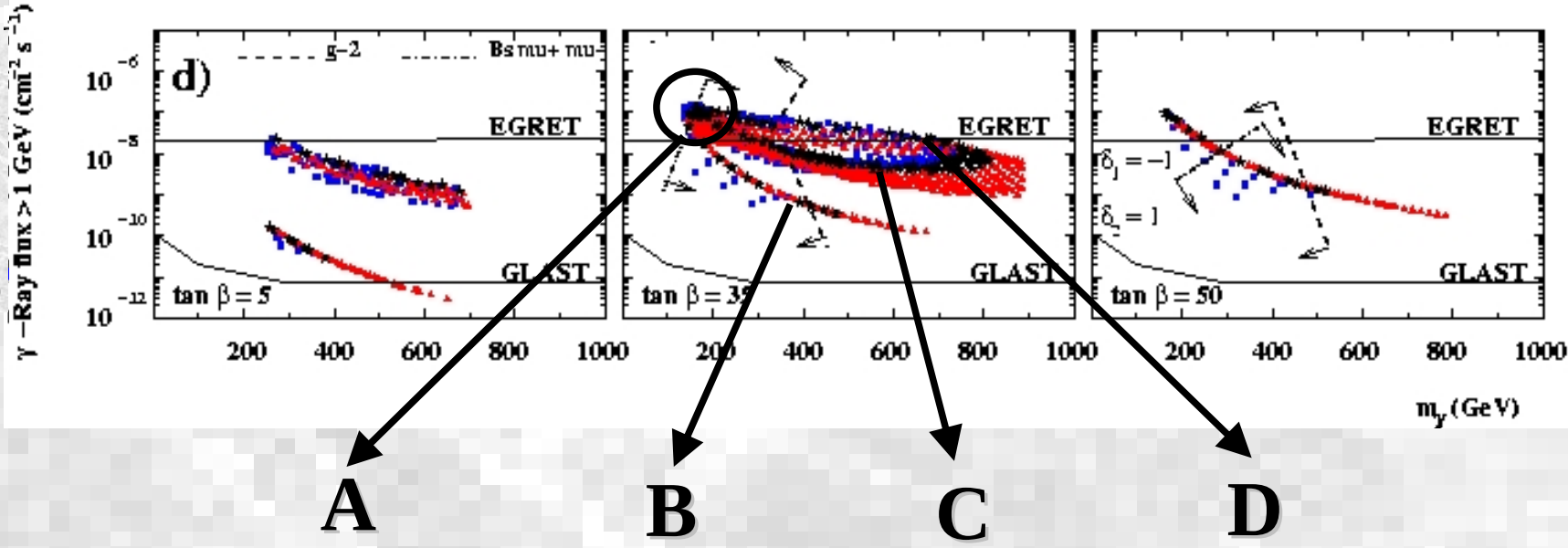
Exp. Part II
Satellite GLAST

(Y.M, C. Munoz, E. Nezri 05)

MSUGRA
Ω_{MAP}
Acc. Const.

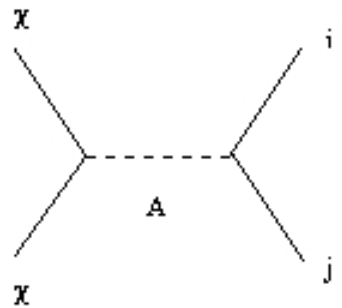


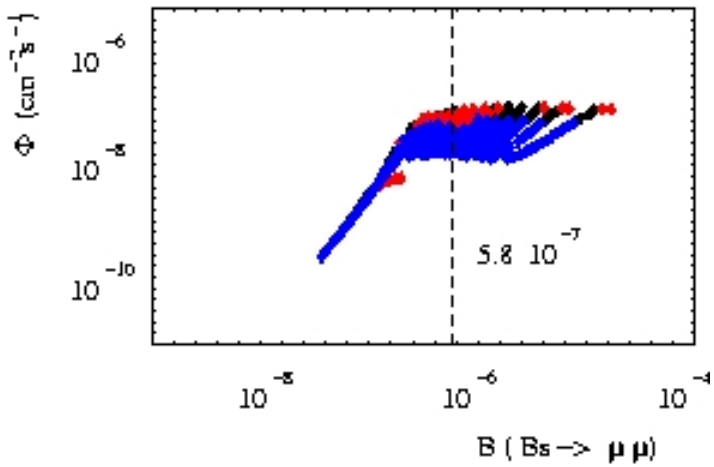
M3 = M/2
Ω_{MAP}
Acc. Const.

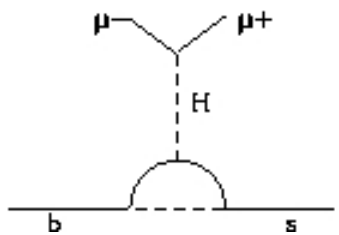


Accelerator vs Astroparticle

(Y.M, C. Munoz, 05)



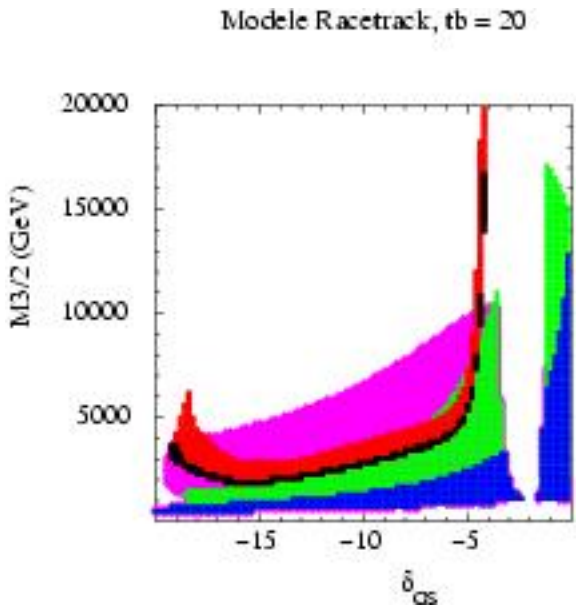




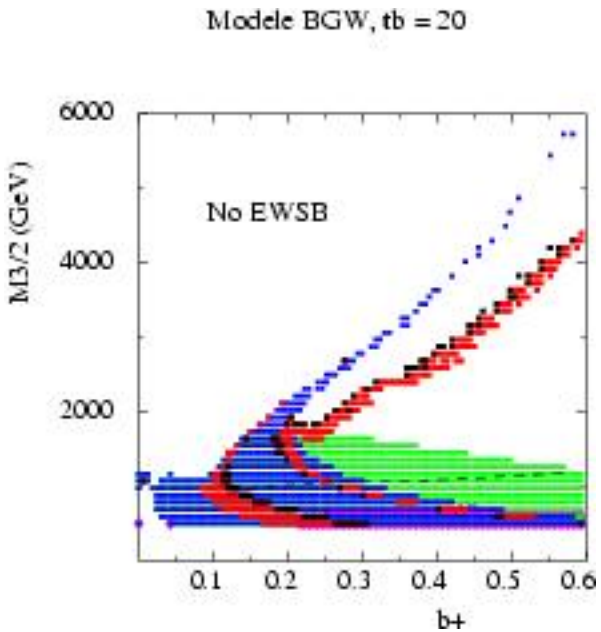
Results I : Accelerators physics

(A. Birkedal, P. Binetruy, Y.M., B. Nelson 03)

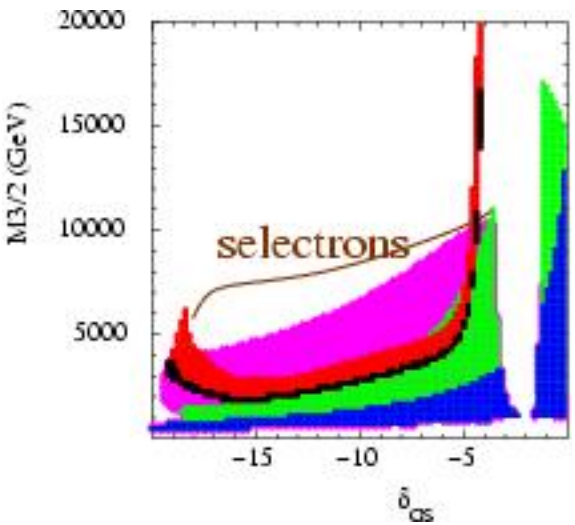
RACETRACK

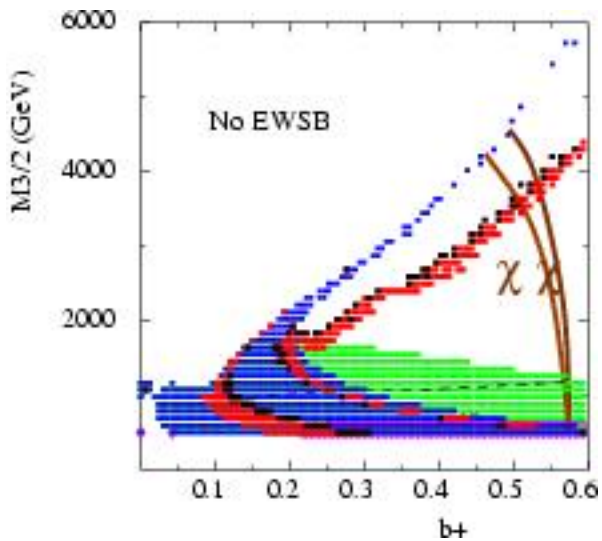


BGW



Linear Collider 800 GeV





Mh < 113.5 GeV

Mx+< 103.5 GeV

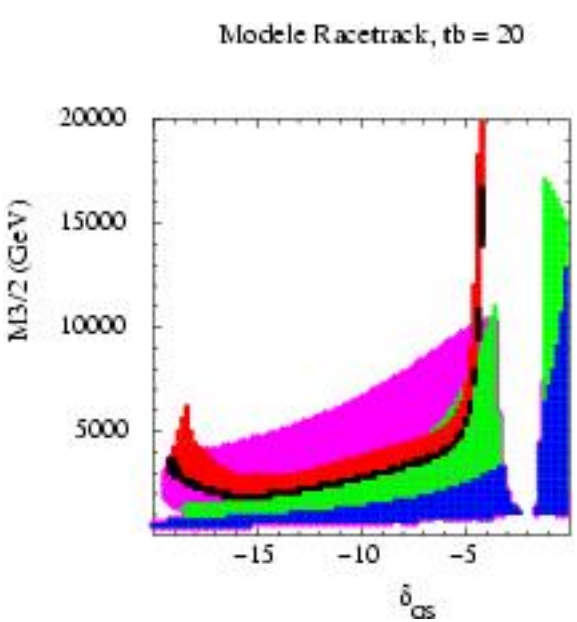
b -> s γ

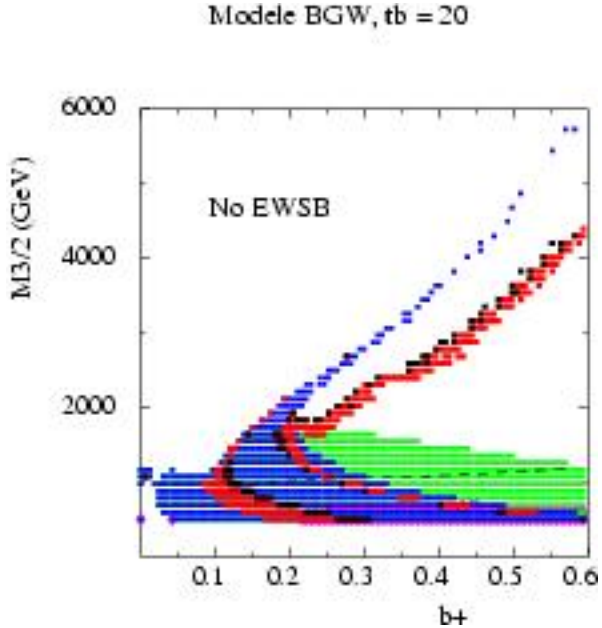
0.1 < Ω < 0.3

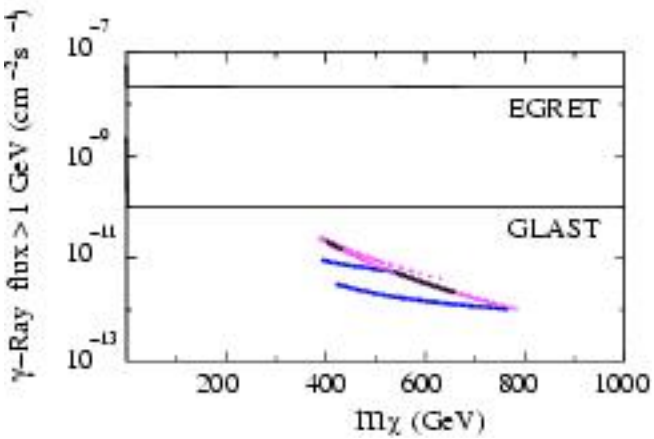
ΩMAP

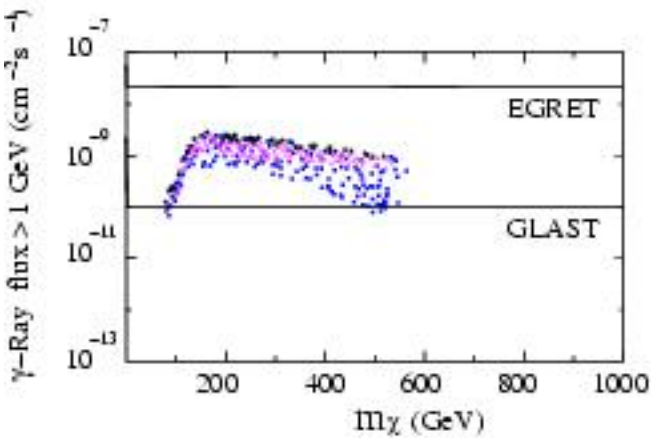
Results II : Fluxes

(P. Binetruy, Y.M, E. Nezri, 04)





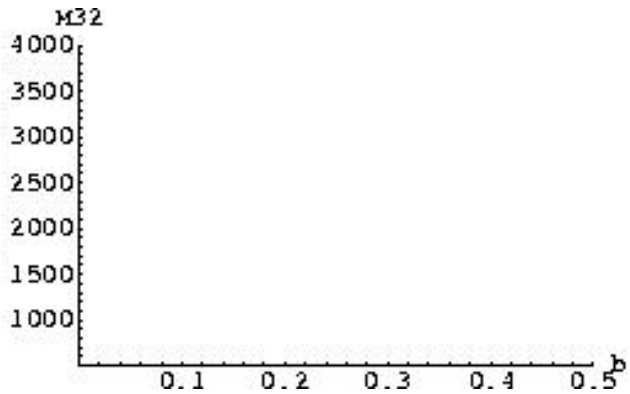




Results III : Exclusion?

Indirect detection from Galactic Center

M3/2



b+

Conclusion

Compressed profiles can fit experimental data excesses

Futur experiment (GLAST) will be able to reach all the parameter space of SUGRA

Direct application to string motivated models

Restriction of the parameter space using collider/astro complementarity