

# Updated Constraints on the *Minimal Supergravity Model*

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GDR-SUSY/LAL-Orsay

# New Inputs

- Improved calculation of the SUSY spectrum: **SuSpect 2.34**

- Two-loop QCD–EW corrections to the Higgs sector (P. Slavich et al.).

- Two-loop RGEs for all (including scalars)

- Improved calculation of some Rad. Cor. ( $m_t, m_b$ , etc..).

- New experimental data: **Tevatron, low energy, cosmology**

- new top mass value:  $m_t \simeq 173 \pm 5$  GeV ( $2\sigma$ ).

- new BELLE value for  $b \rightarrow s\gamma$ :  $2.65 \leq \text{BR} \times 10^4 \leq 4.45$

- include also info from  $b \rightarrow s\ell^+\ell^-$  (sign as in  $b \rightarrow s\gamma$ ).

- new value for muon  $g - 2$ :  $1 \lesssim a_\mu^{\text{SUSY}} \times 10^9 \lesssim 4.4$

- take into account only the more reliable  $e^+e^-$  data

- WMAP constraint on relic density:  $0.087 \leq \Omega_{\text{DM}} h^2 \leq 0.13$  (99%CL)

- New output

- update of constraints on  $(m_0, m_{1/2})$  space ( $h$ -pole region)

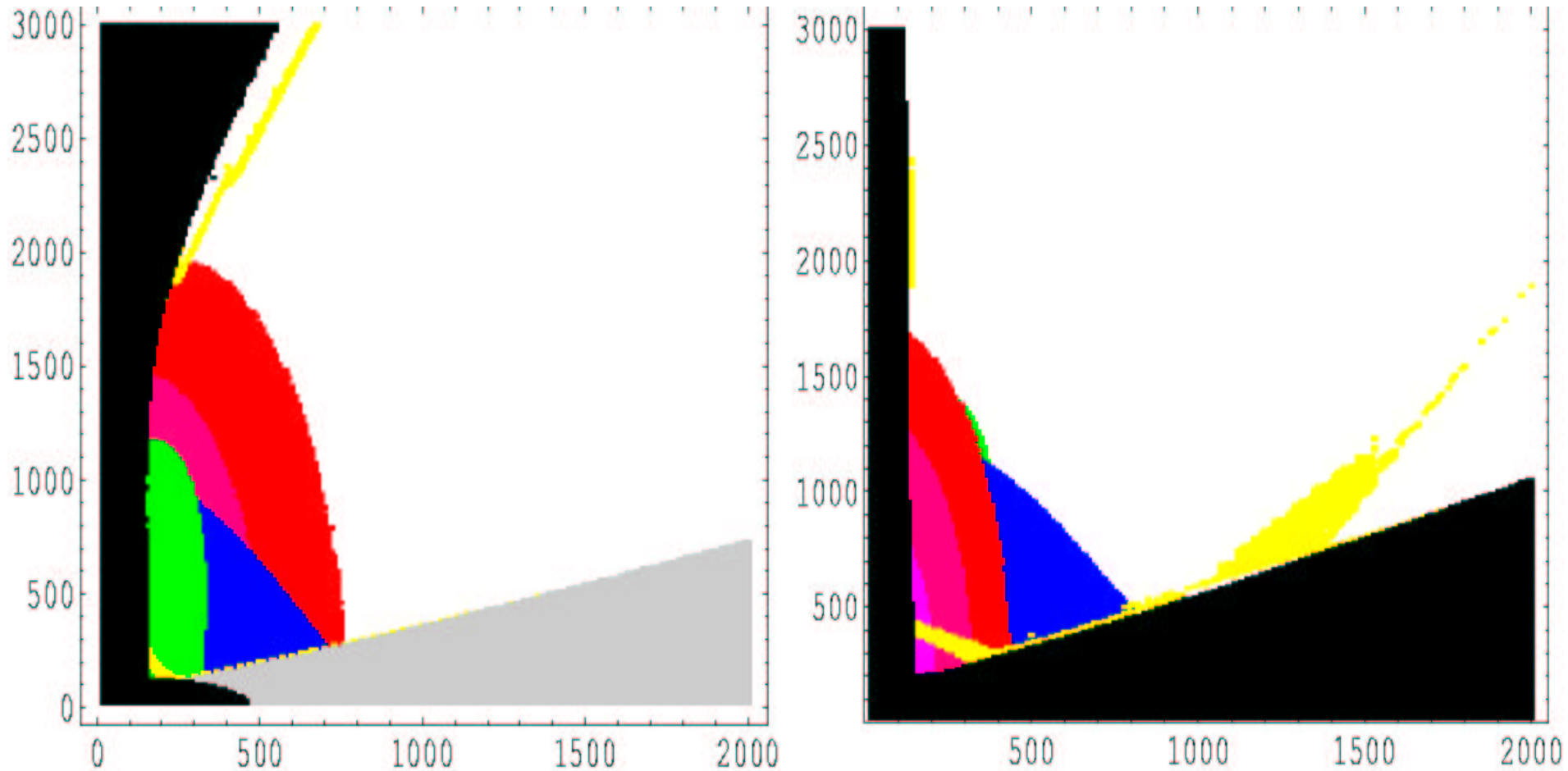
- plots in parameter space with physical masses (interesting!)

- lower/upper bounds on SUSY particle and Higgs masses.

# An $(m_{1/2}, m_0)$ scan in mSUGRA with $A = 0, \mu > 0$

$m_t = 173 \text{ GeV}, \tan \beta = 30$

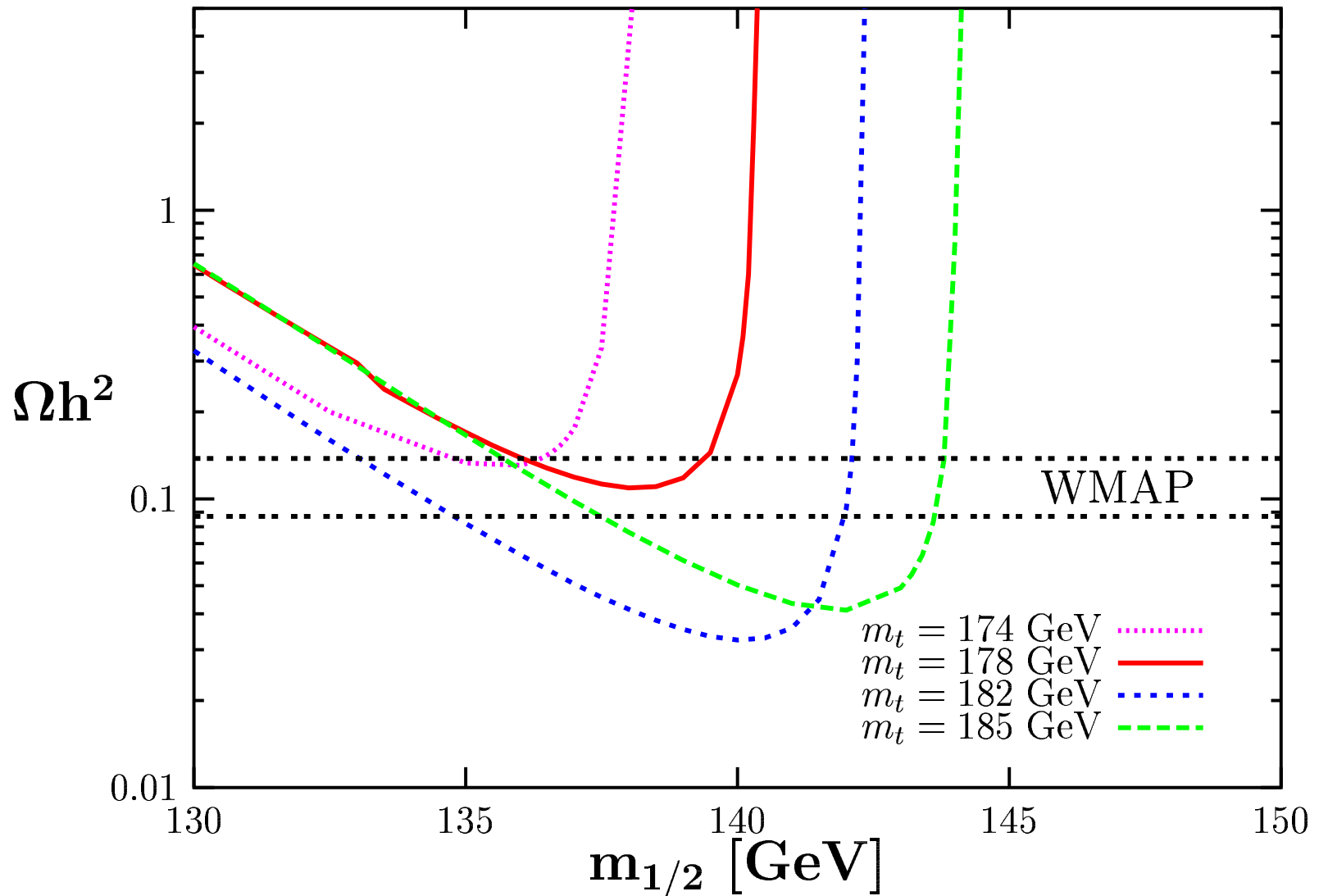
$m_t = 178 \text{ GeV}, \tan \beta = 50$



Generically, five regions with the required amount of DM:

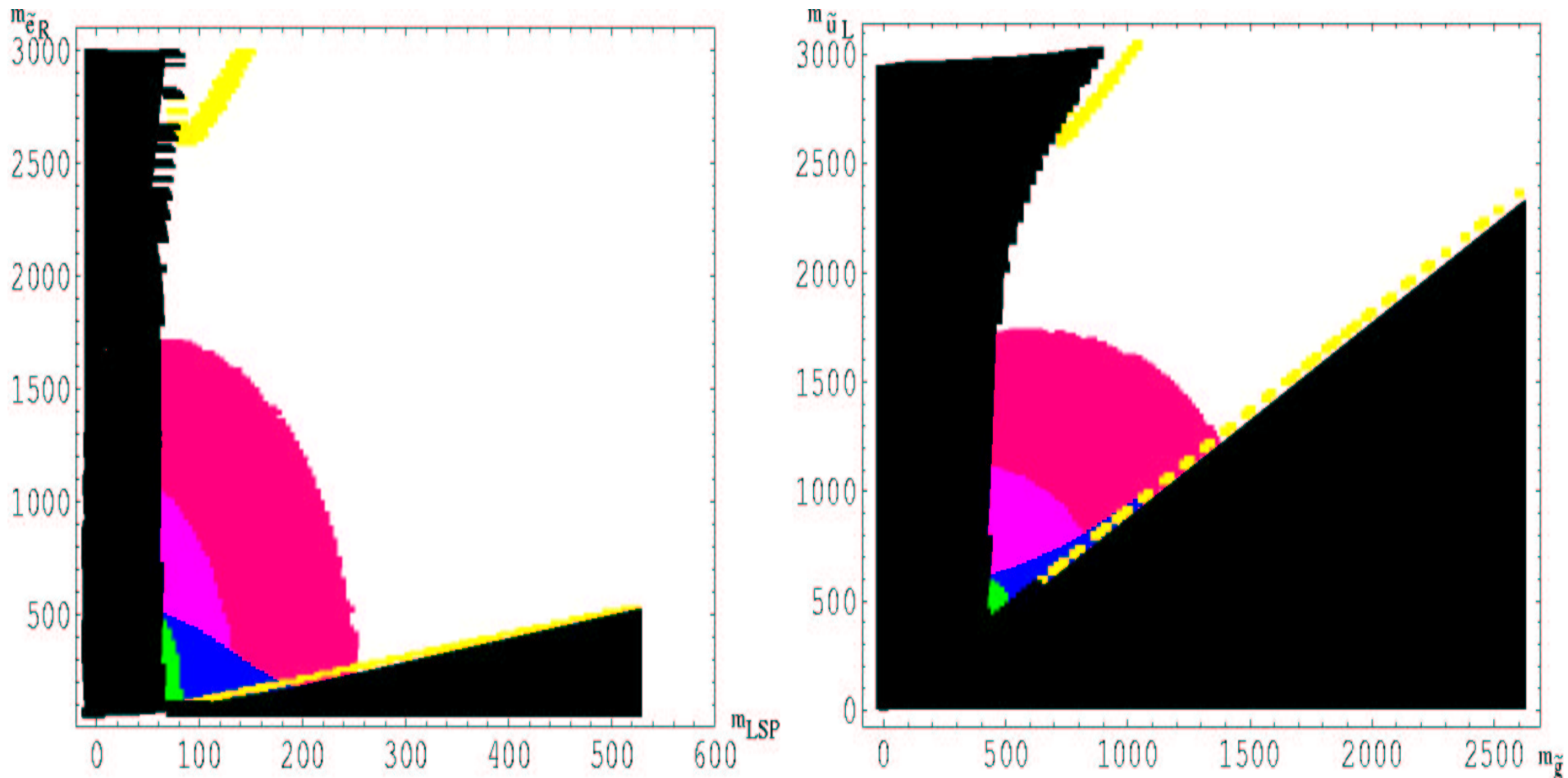
bulk region, focus point, co-annihilation, A pole and **h pole**.....

# New region: annihilation via h exchange



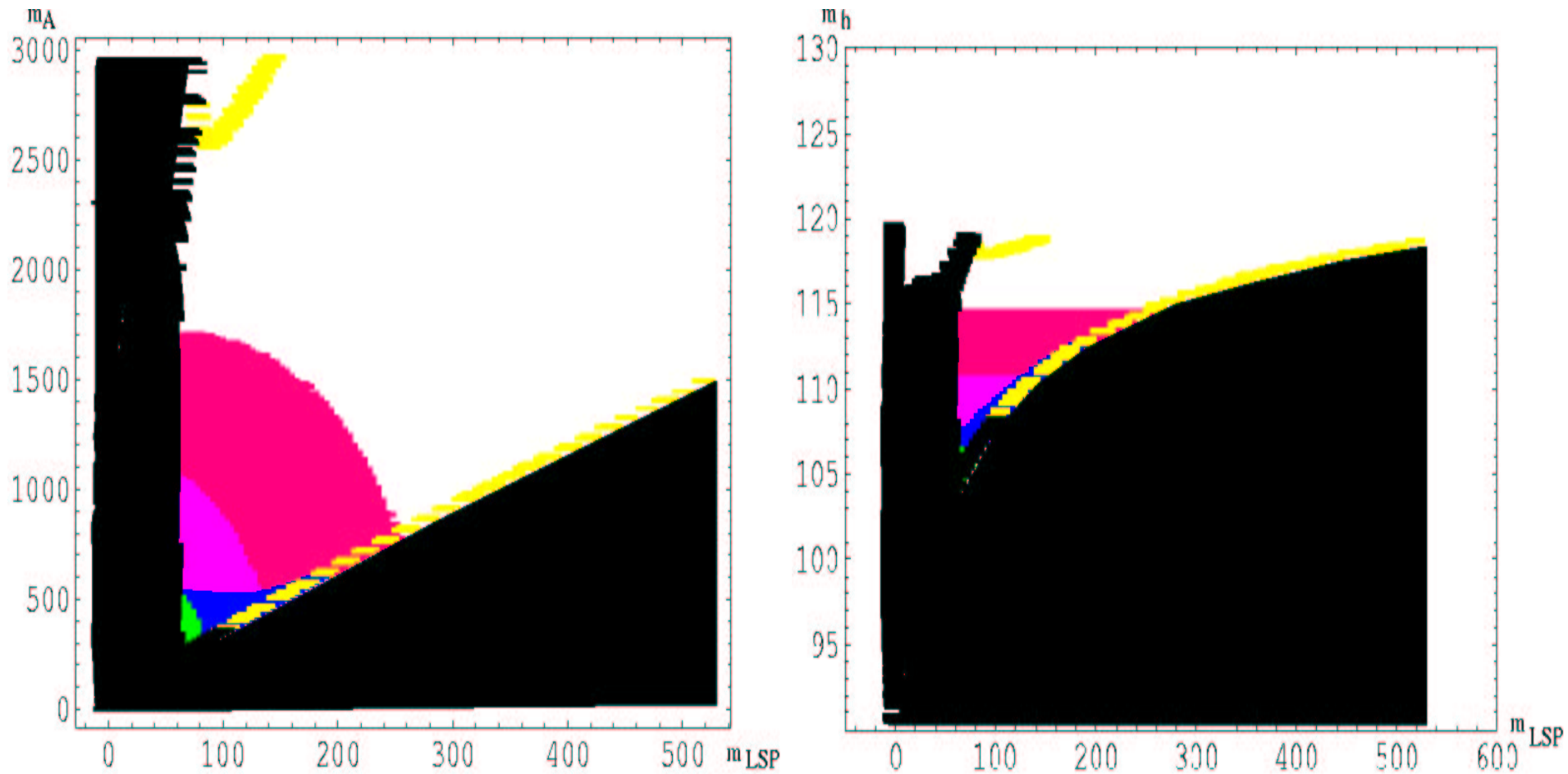
Drees, Kneur, AD, PLB624 (2005) 60

# Plots with physical masses (1)



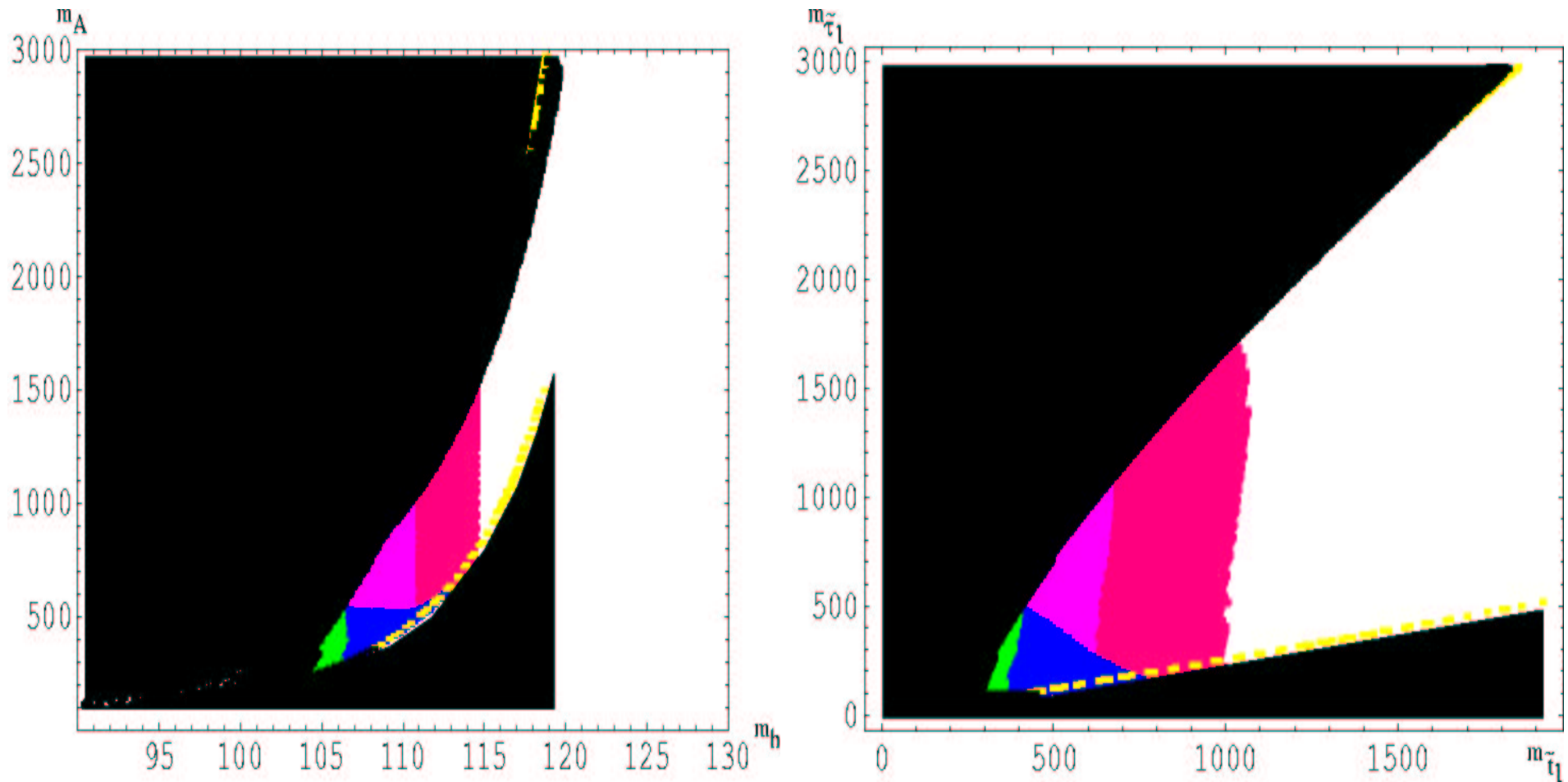
**Figure 1:** The mSUGRA parameter space with all constraints imposed for  $A_0 = 0$ ,  $\mu > 0$ ,  $\tan \beta = 10$ ,  $m_t = 173$  GeV.

## Plots with physical masses (2)



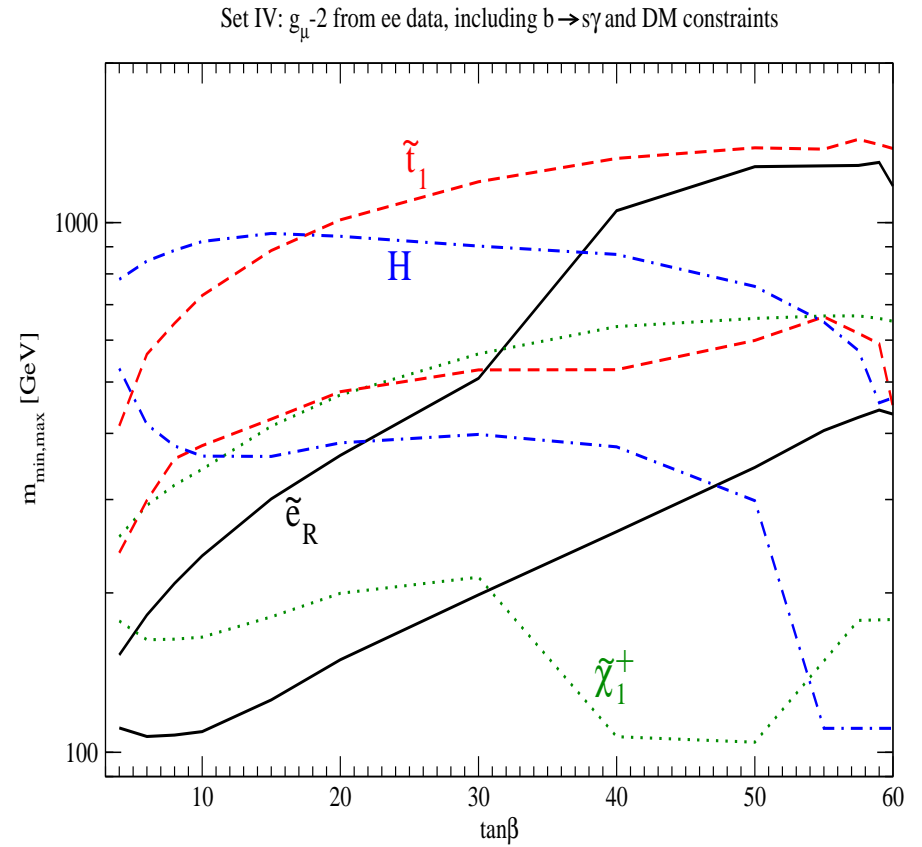
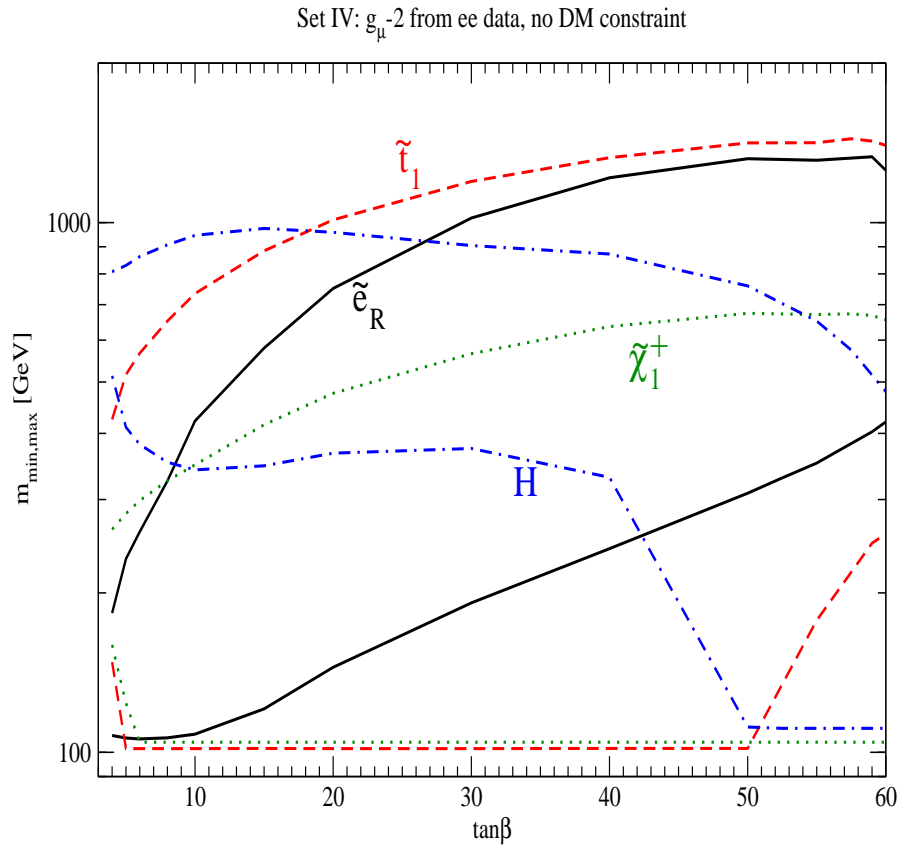
**Figure 2:** The mSUGRA parameter space with all constraints imposed for  $A_0 = 0$ ,  $\mu > 0$ ,  $\tan \beta = 10$ ,  $m_t = 173$  GeV.

## Plots with physical masses (3)



**Figure 3:** The mSUGRA parameter space with all constraints imposed for  $A_0 = 0$ ,  $\mu > 0$ ,  $\tan \beta = 10$ ,  $m_t = 173$  GeV.

# Upper and lower bounds from scans



**Figure 4: Lower/upper bounds with some/all constraints imposed.**