Expanding SUSY and Low-Scale SUSY Models that evade LHC limits—A Panel Discussion

Howard E. Haber

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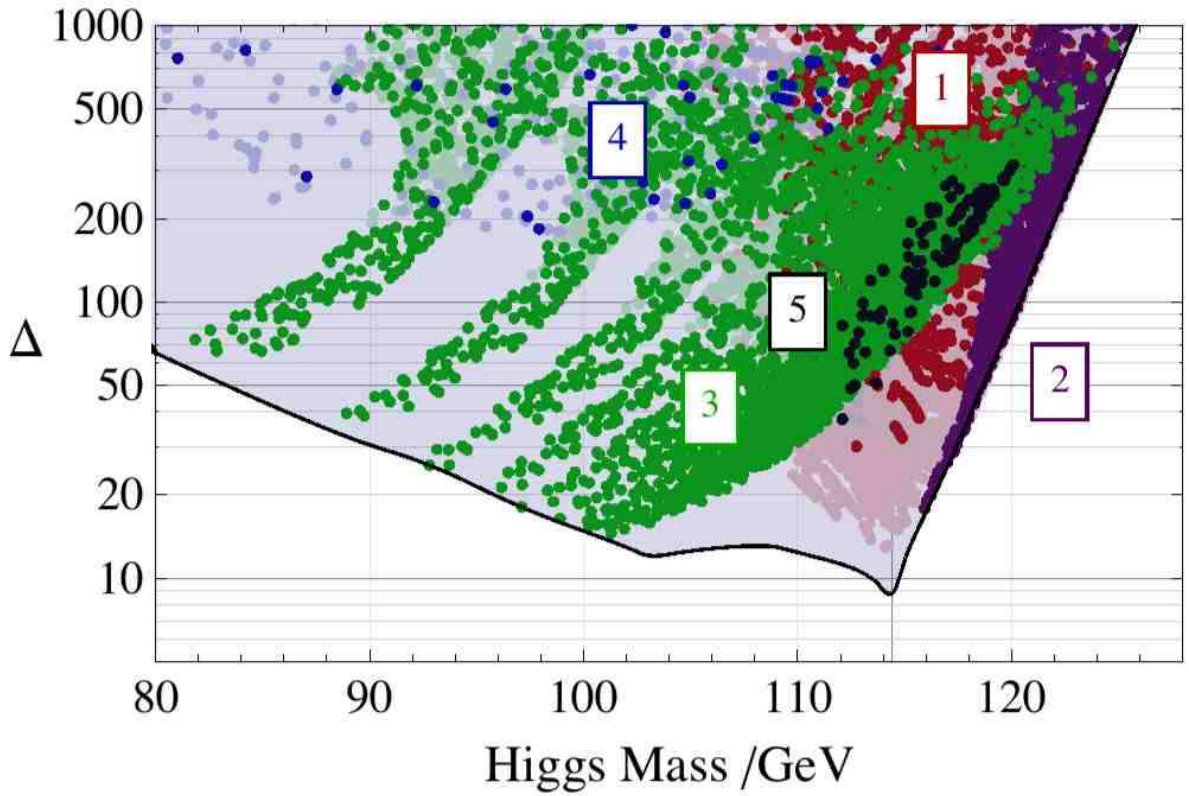
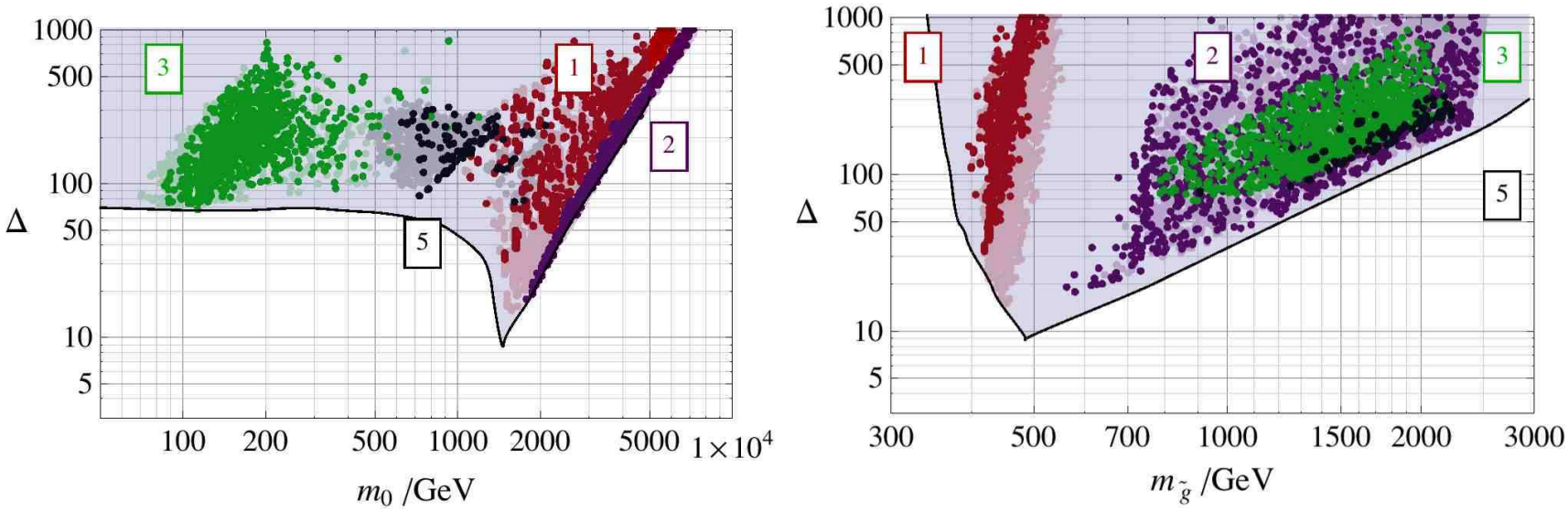
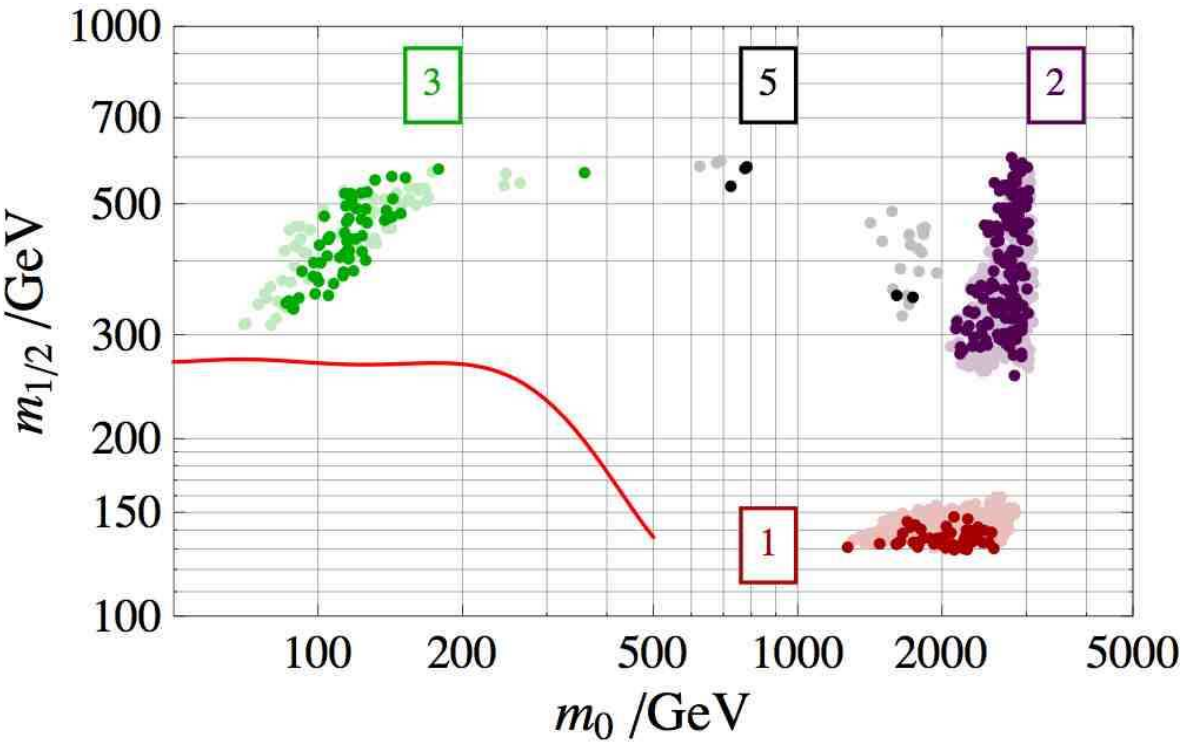
A few figures and table taken from a paper by S. Cassel, D.M. Ghilencea, S. Kraml, A. Lessa and G.G. Ross, arXiv:1101.4664, may be instructive.



Two-loop fine-tuning versus Higgs mass for the scan over CMSSM parameters with no constraint on the Higgs mass. The solid line is the minimum fine-tuning with $(\alpha_s, m_t) = (0.1176, 173.1\ \mathrm{GeV})$. The dark green, purple, crimson and black colored regions have a dark matter density within $\Omega h^2 = 0.1099 \pm 3 \times 0.0062$, while the lighter colored versions of these regions lie below this bound. The colors and associated numbers refer to different LSP structures. Regions 1,3,4 and 5 have an LSP that is mostly bino-like. In region 2, the LSP has a significant higgsino component.



In the left panel, the fine-tuning versus the scalar mass parameter is exhibited. In the right panel, the fine-tuning versus the gluino mass is exhibited. In both cases, the constraint on the Higgs mass, $m_h > 114.4$ GeV is applied.



Regions of low fine-tuning ($\Delta < 100$) in the m_0 versus $m_{1/2}$ plane, summed over $\tan\beta$ and A_0. All points satisfy the SUSY and Higgs mass limits, $\Omega h^2 < 0.1285$ (dark points having $0.0913 < \Omega h^2 < 0.1285$), the B-physics and δa_μ constraints, and the CDMS-II bound on the dark matter detection cross section. The area below the red line shows the CMSSM exclusion (for $\tan\beta = 3$ and $A_0 = 0$) from the CMS dijet+$E_T^{\rm miss}$ analysis.

	SUG0	SUG1	SUG2	SUG3	SUG5
m_0	1455	1508	2270	113	725
$m_{1/2}$	160	135	329	383	535
A_0	238	1492	30	-220	1138
$\tan\beta$	22.5	22.5	35	15	50
μ	191	433	187	529	581
$m_{\tilde{g}}$	482	414	900	898	1252
$m_{\tilde{u}_L}$	1469	1509	2331	826	1315
$m_{\tilde{t}_1}$	876	831	1423	602	1000
$m_{\tilde{\chi}_1^+}$	106	104	168	293	416
$m_{\tilde{\chi}_2^0}$	108	104	181	293	416
$m_{\tilde{\chi}_1^0}$	60	53	123	155	222
Δ	9	50	45	68	84
$\Omega_{\tilde{\chi}_1^0}h^2$	0.41	0.13	0.10	0.13	0.10
$\mathrm{BR}(b\to s\gamma)\times 10^4$	3.4	3.7	3.4	3.2	3.2
$\mathrm{BR}(B_s\to\mu^+\mu^-)\times 10^9$	3.0	2.9	2.9	3.4	1.7
$\delta a_\mu\times 10^{10}$	4.5	3.2	3.2	22.5	16.6
$\sigma^{\mathrm{SI}}_{\chi p}$ (pb) $\times 10^{10}$	108	5	432	24	101
$\sigma^{(LO)}$(7 TeV) (pb)	8	12	0.9	0.4	0.02
$\sigma^{(LO)}$(14 TeV) (pb)	40	75	3	5	0.4

Table 1: CMSSM parameters and sparticle masses in GeV for the points used in our LHC analysis. We also show for each of the points the amount of fine-tuning, the neutralino relic density, the branching ratios of $b\to s\gamma$ and $B_s\to\mu^+\mu^-$, the SUSY contribution to the muon anomalous magnetic moment δa_μ, the spin-independent LSP scattering cross section off protons $\sigma^{\mathrm{SI}}_{\chi p}$, and the total leading-order sparticle production cross-sections for the LHC at $\sqrt{s}=7$ and 14 TeV.