What is the meaning of Higgs with M_H=125 GeV?

1. SM --- from electro-weak fits **M_H=94 GeV (+29/-24)** **{<152 GeV at 95% CL**}

--- electro-weak fit = we have 4 very precise numbers: \alpha^em=1/137, G_F, M_W, M_Z
but only 3 parameters in SM: g, \Theta_W, M_Z
to fit this 4 precise numbers (plus other low energy data) we need something
not too heavy (\sim 100 GeV) in radiative loop correction.

If SM – nothing new to “search” at the LHC (may be up to GUT scale)

but plenty interesting SM physics to study:
* gluon jets
* low x partons
* Pomeron-Pomeron interactions
* new hadrons (glueball, pentaquark)
* multiparton and secondary interactions

……………………………………………

last TOTEM data are intriguing
(from 7 to 8 TeV sig_tot increases but the same slope B_el=(19.9 +/- 0.3) 1/GeV^2 ??)

SM – main problems:
1. (g_\mu – 2) --- 3\sigma
2. Br_{exp}(H-->2\gamma)\sim 1.3Br_{SM}
3. !!!! neutrino sector !!!!

So SUSY is not excluded

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arxiv:1212.0517

account for cold dark matter, B_s-->2\mu

tan(\beta)\sim 50

lightest superpartner M\sim 1 TeV
M(stau)\sim 1 TeV
M(H,A,H^{+/-}\sim 2 TeV

TABLE II: Input and output parameters, masses of the sparticles and Higgses and values of the low energy observables of our model in four cases (recall that 1 pb $\simeq 2.6\times10^{-9}$ GeV^{-2}).

Input Parameters				
$\tan\beta$	48	49	50	51
$-A_0/M_{1/2}$	1.4	1.6	2	2.5
$M_{1/2}$/TeV	2.27	2.411	2.824	2.808
m_0/TeV	1.92	2.295	3.156	3.747
Output Parameters				
$h_t/h_\tau(M_{\rm GUT})$	1.117	1.079	1.038	1.008
$h_b/h_\tau(M_{\rm GUT})$	0.623	0.618	0.613	0.607
$h_t/h_b(M_{\rm GUT})$	1.792	1.745	1.693	1.660
μ/TeV	2.78	3.092	3.823	4.129
$\Delta_{\tau 2}(\%)$	1.43	0.93	0.1	0.17
$\Delta_H(\%)$	3.08	1.30	0.11	1.76
Masses in TeV of Sparticles and Higgses				
$\tilde\chi$	1.023	1.110	1.309	1.303
$\tilde\chi_2^0$	1.952	2.117	2.489	2.481
$\tilde\chi_3^0$	2.782	3.088	3.815	4.114
$\tilde\chi_4^0$	2.785	3.091	3.817	4.116
$\tilde\chi_1^\pm$	1.985	2.117	2.489	2.481
$\tilde\chi_2^\pm$	2.785	3.091	3.817	4.116
$\tilde g$	4.809	5.190	6.042	6.040
$\tilde t_1$	3.806	4.097	4.761	4.781
$\tilde t_2$	3.226	3.458	3.967	3.902
$\tilde b_1$	3.838	4.141	4.853	4.947
$\tilde b_2$	3.763	4.058	4.733	4.757
$\tilde u_L$	4.687	5.138	6.186	6.483
$\tilde u_R$	4.485	4.923	5.946	6.257
$\tilde d_L$	4.687	5.138	6.187	6.483
$\tilde d_R$	4.459	4.896	5.914	6.227
$\tilde\tau_1$	2.082	2.347	2.979	3.293
$\tilde\tau_2$	1.037	1.121	1.310	1.305
$\tilde\nu_\tau$	2.075	2.342	2.975	3.289
$\tilde e_L$	2.453	2.819	3.690	4.201
$\tilde e_R$	2.112	2.476	3.339	3.901
$\tilde\nu_e$	2.451	2.818	3.689	4.200
h	0.1245	0.125	0.126	0.1265
H	2.109	2.249	2.621	2.652
$H^\pm$	2.111	2.251	2.623	2.654
A	2.110	2.25	2.622	2.652
Low Energy Observables				
$10^4{\rm BR}(b\to s\gamma)$	3.25	3.25	3.26	3.26
$10^9{\rm BR}(B_s\to\mu^+\mu^-)$	4.17	4.15	3.98	4.17
${\rm R}(B_u\to\tau\nu)$	0.975	0.977	0.982	0.982
$10^{10}\delta a_\mu$	1.11	0.89	0.57	0.49
$\Omega_{\rm LSP}h^2$	0.11	0.11	0.11	0.11
$\sigma^{\rm SI}_{\chi p}/10^{-12}$pb	6.17	4.55	2.44	1.75
$\sigma^{\rm SD}_{\chi p}/10^{-9}$pb	1.69	1.08	0.43	0.28

Light Higgs !

Betchle et al, arxiv 1211.1955

MSSM Higgs sector = h, H, A ($m_h<m_H\sim m_A$)
usually h is close to SM Higgs BUT not excluded that H is similar to SM Higgs
while $m_h\sim 60 – 85$ GeV but small coupling $g^2\sim 0.01 - 0.001$

	LHC only			LHC+Tevatron			LHC+LEO			LHC+Tevatron+LEO		
Case	χ^2/ν	χ^2_ν	p	χ^2/ν	χ^2_ν	p	χ^2/ν	χ^2_ν	p	χ^2/ν	χ^2_ν	p
SM	27.6/34	0.81	0.77	31.0/37	0.84	0.74	41.6/39	1.07	0.36	45.3/42	1.08	0.34
h	23.3/28	0.83	0.72	26.8/31	0.86	0.68	26.7/33	0.81	0.77	30.4/36	0.84	0.73
H	26.0/28	0.93	0.57	33.1/31	1.07	0.37	35.5/33	1.08	0.35	42.4/36	1.18	0.21

Table 4: Global χ^2 results with ν degrees of freedom from the fits of the SM and the MSSM with either h or H as the LHC signal, the reduced $\chi^2_\nu \equiv \chi^2/\nu$, and the corresponding p-values. The number of degrees of freedom are evaluated naively as $\nu = n_{\rm obs} - n_{\rm param}$.