

EXTRACTING HIGGS COUPLINGS

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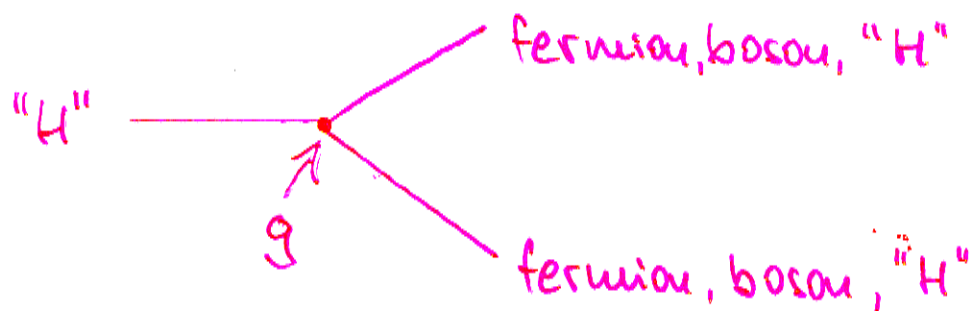
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SUPPOSE THERE IS A LIGHT "HIGGS-LIKE"
PARTICLE OBSERVED AT LEP/TEVATRON/LHC.
WHAT DO WE WANT TO KNOW?

① STRUCTURE OF COUPLINGS $\}^{PC}$

($\rightarrow$ Miller, $\rightarrow$ Kamoshita)

② MAGNITUDE OF COUPLINGS



- $g \sim m$?
- any pattern ? $u \leftrightarrow d$
 $w \leftrightarrow z$
quark $\leftrightarrow$ lepton etc.

METHOD

- MEASUREMENTS (BR's, CROSS SECTIONS) DEPEND IN GENERAL ON MORE THAN ONE COUPLING: e.g. $BR(H \rightarrow b\bar{b}) = f(g_b, g_w, g_c, g_z, \dots)$

- MEASUREMENTS ARE CORRELATED
e.g. $BR(H \rightarrow b\bar{b})$, $BR(H \rightarrow c\bar{c})$, $BR(H \rightarrow gg)$ come from a simultaneous fit

→ EXTRACT THE COUPLINGS FROM A
GLOBAL FIT ("HFITTER")

① PREDICT THE OBSERVABLES AS A FUNCTION OF THE COUPLINGS

② FIND THE SET OF COUPLINGS WHICH BEST FITS THE "MEASUREMENTS" (χ^2 -FIT)

→ ERRORS + COVARIANCE

HFITTER

Free parameters (so far):

$$g_t, g_b, g_c, g_\tau, g_w, g_z$$

Prediction: modified HDECAY (Spira et al.)
for BR's.

$$\text{assume } \sigma(HZ) \sim g_z^2$$

$$\sigma(\text{fusion}) \sim g_w^2$$

$$\sigma(HH) \sim g_t^2$$

for cross sections

Inputs: $m_H = 120 \text{ GeV}$ (as test case)

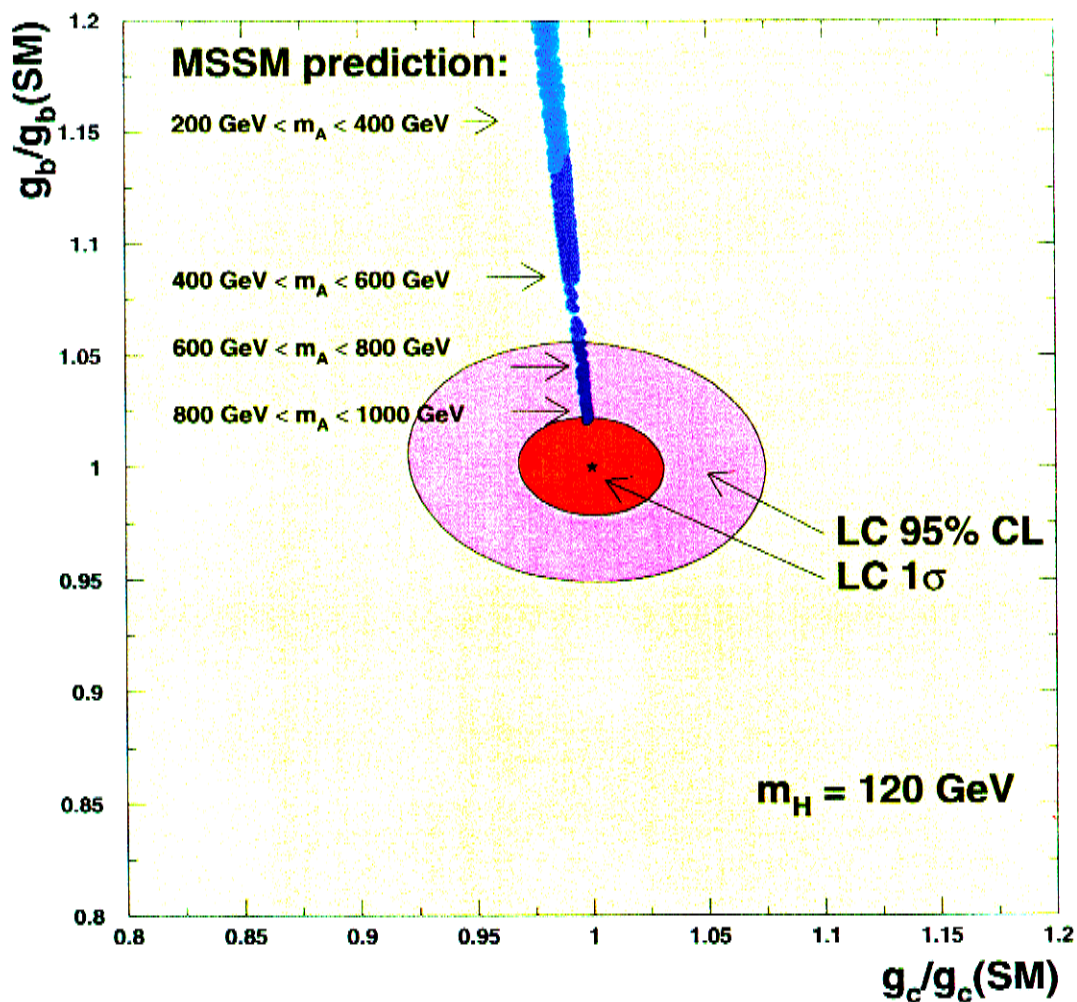
$BR(H \rightarrow b\bar{b})$	2.4%	} $\oplus$ correlation
$BR(H \rightarrow c\bar{c})$	8.3%	
$BR(H \rightarrow gg)$	5.5%	
$BR(H \rightarrow \tau\tau)$	5.0%	
$BR(H \rightarrow WW)$	5.1%	
$BR(H \rightarrow \gamma\gamma)$	24.0%	
$\sigma(HZ)$	2.4%	
$\sigma(WW \rightarrow H \rightarrow b\bar{b})$	2.0%	
$\sigma(t\bar{t}H)$	5.5%	

g_b vs. g_c

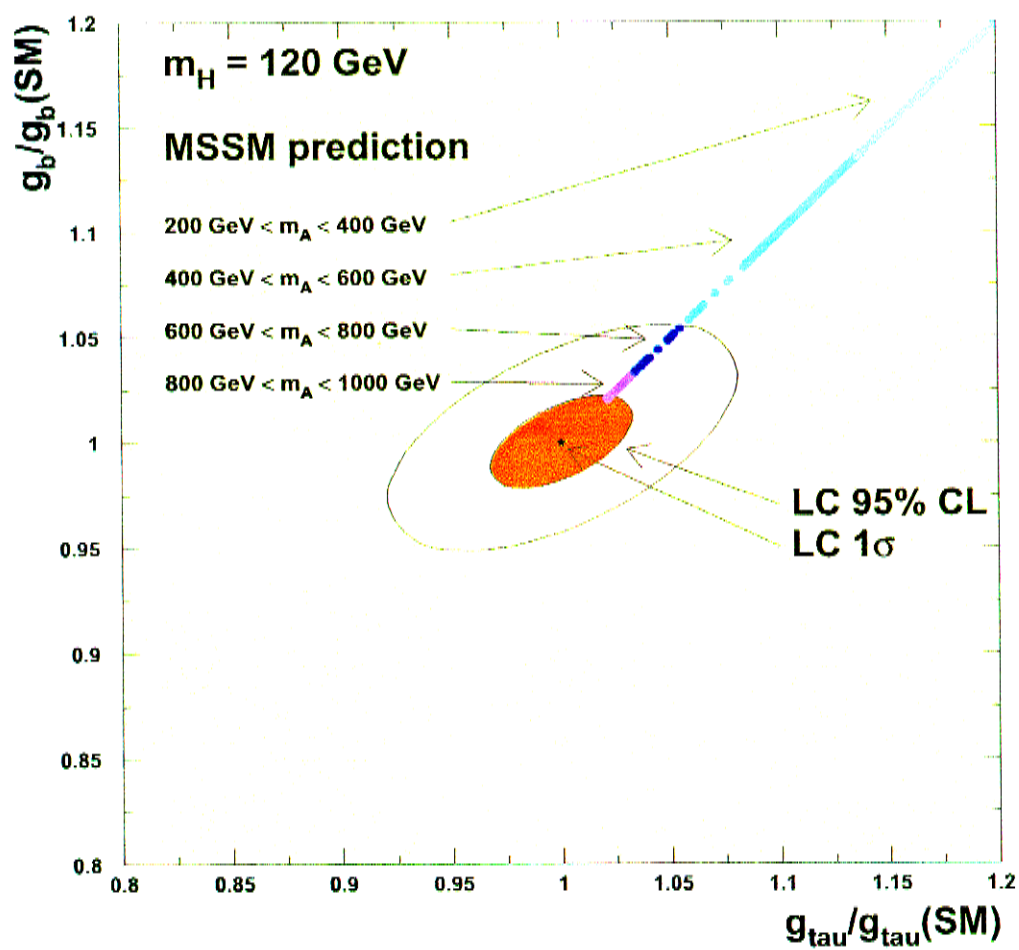
compare to MSSM prediction:

$$g_{bZ} \sim \frac{\sin \alpha}{\cos \beta} \quad g_{cZ} \sim \frac{\cos \alpha}{\sin \beta} \quad g_{W,2} \sim \sin(\beta - \alpha)$$

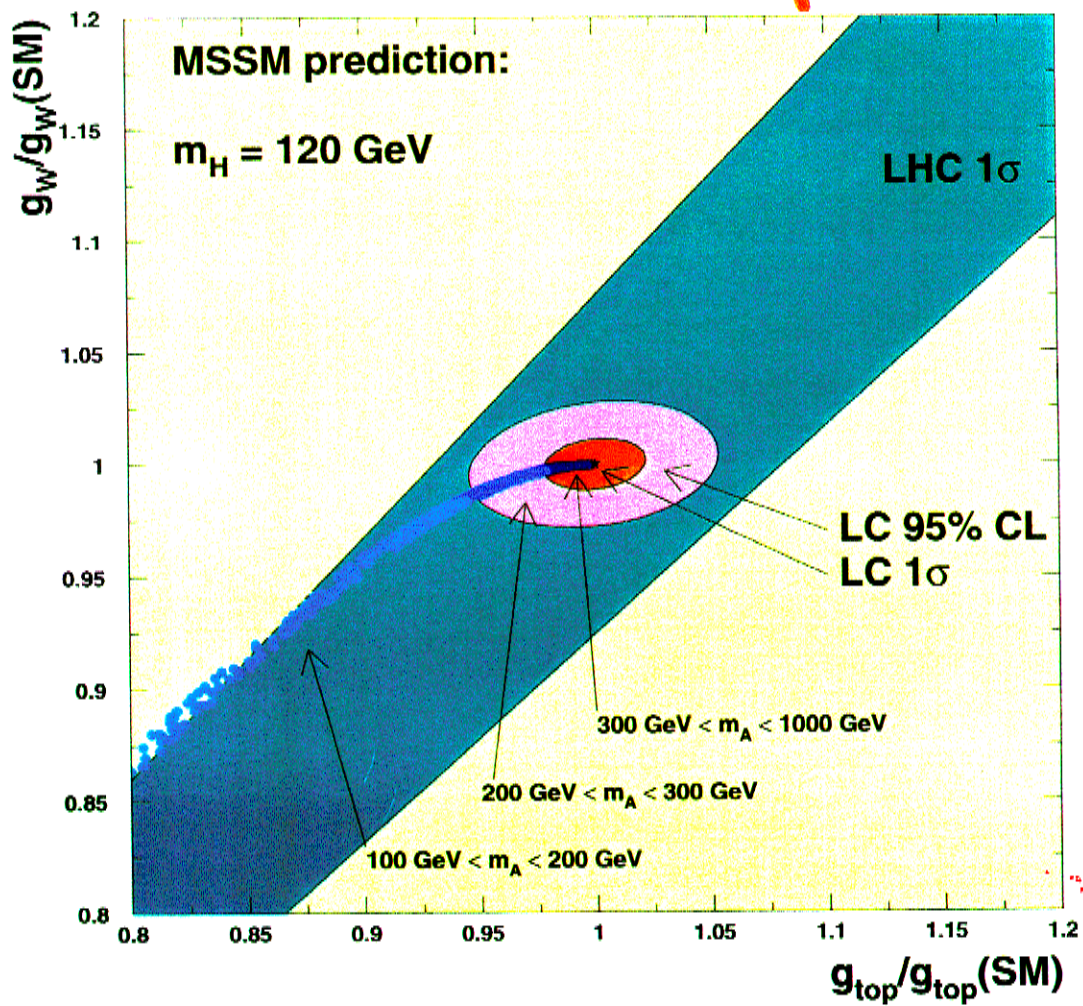
- get $\alpha(m_A, \dots)$ from 2-loop calculation (Heinemeyer, Hollik, Weiglein)



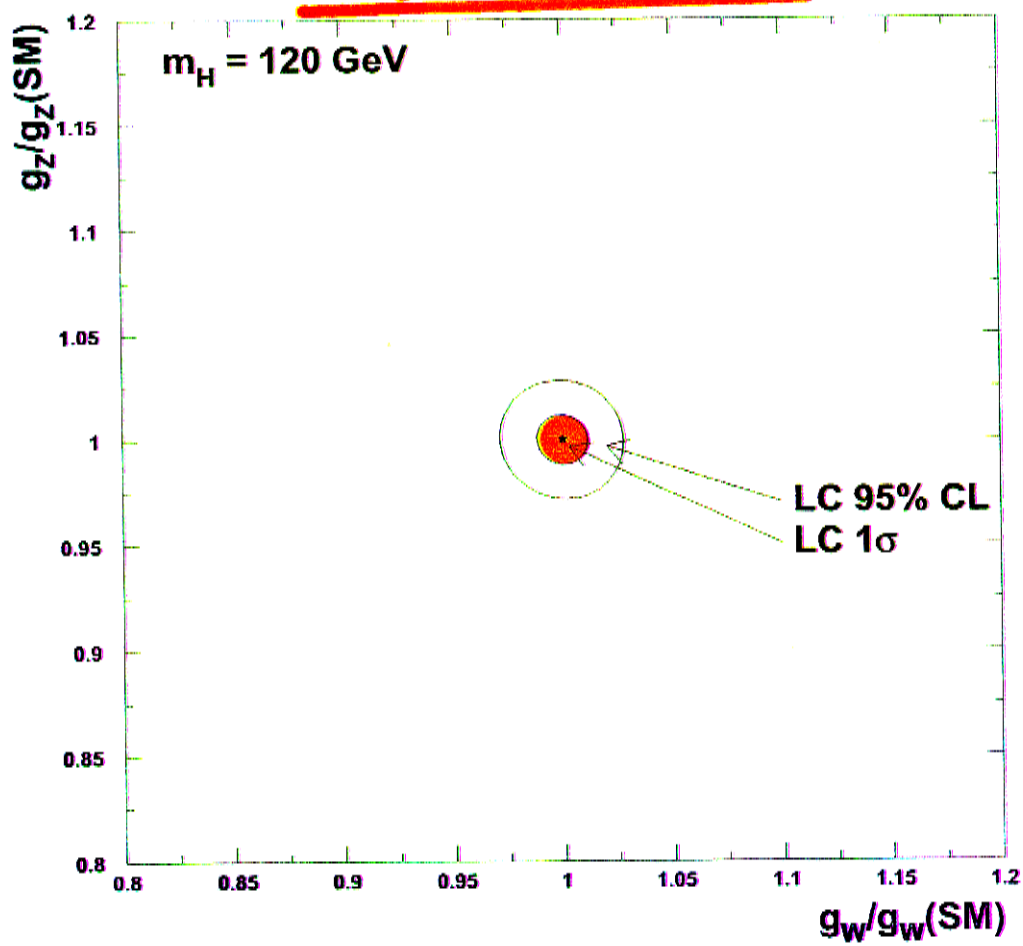
g_b vs g_τ



g_W vs. g_{top}



g_z vs. g_w



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SUMMARY

- PROGRAM TO EXTRACT HIGGS COUPLINGS "HFITTER" STARTED
- FOR $m_H = 120$ GeV:
ALL RELEVANT COUPLINGS CAN BE EXTRACTED W/O ASSUMPTIONS
- YUKAWA COUPLINGS $\sim \overset{3}{\cancel{10}}\%$
GAUGE COUPLINGS $\sim 2\%$
- TO BE CONTINUED...