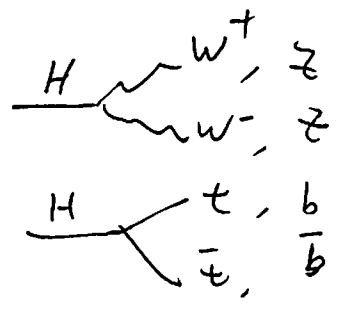


Smoking Gun of New physics

1. Testing SM:

Higgs Boson & its interactions with W/Z and fermions



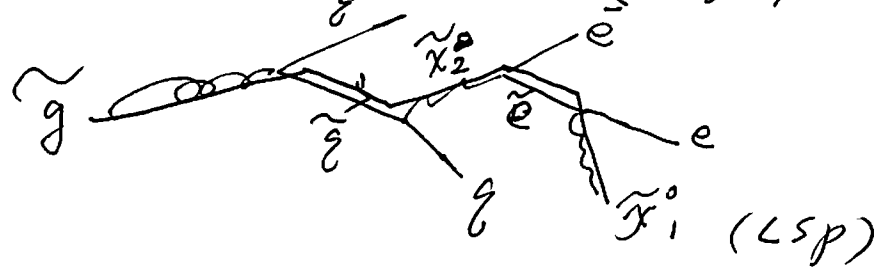
2. Weakly interacting New Physics Models:

1) SuperSymmetry: MSSM (R-parity conserved)

— missing \cancel{E}_T (LSP)
 lightest supersymmetric particle
 (Candidate for Dark matter)

— susy partners have to be "light"
 (less than ~ 1 TeV)

\Rightarrow gluinos
 squarks (most likely, light stop)

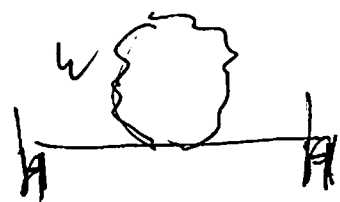
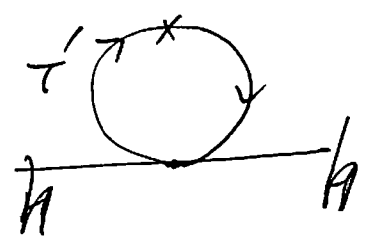
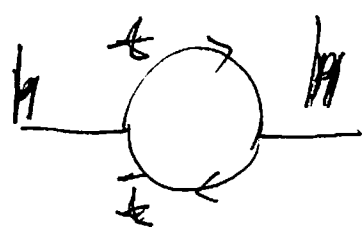


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 100 SHEETS, EYE EASE, 5 SQUARE
 100 SHEETS, EYE EASE, 5 SQUARE
 100 RECYCLED WHITE, 5 SQUARE
 200 RECYCLED WHITE, 5 SQUARE
 Made in U.S.A.



3) Little Higgs Models:

— New particle states are required to cancel Λ^2 in M_H^2 .

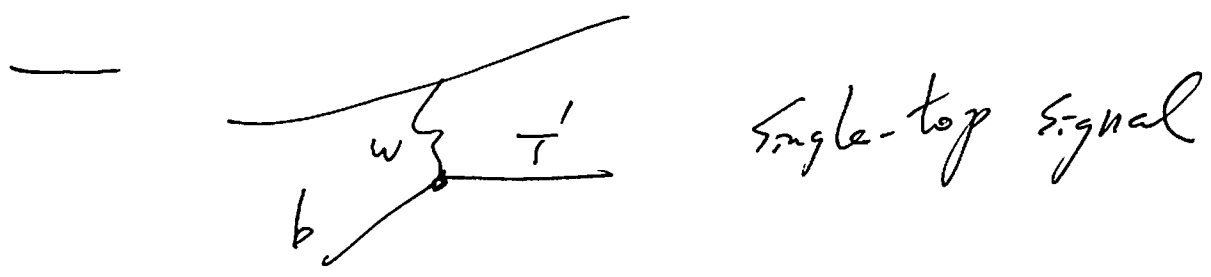


\Rightarrow Predict T' & W'/Z'

— With T-parity,

\Rightarrow DM candidate

& Agree with Z -pole data

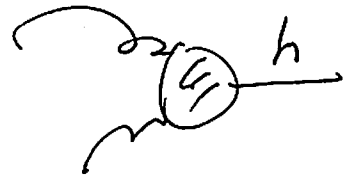
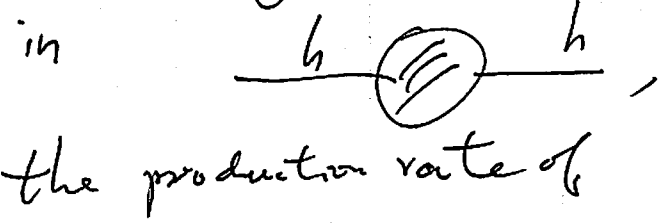


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Made in U.S.A.

— Because of the needed cancellation



in LHT
 (Littlest Higgs Model
 with T-parity)

is always
 smaller than the SM rate.

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 42-334 100 SHEETS, EYE-CASE 5 SQUARE
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 Made in U.S.A.

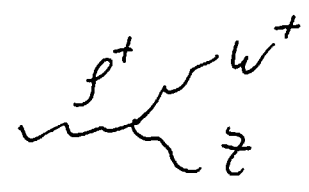


3. Strongly interacting New physics Models

1) Technicolor

— New resonance states:

- Techni-pion, π
- Techni- ρ
- Techni- ω , etc.

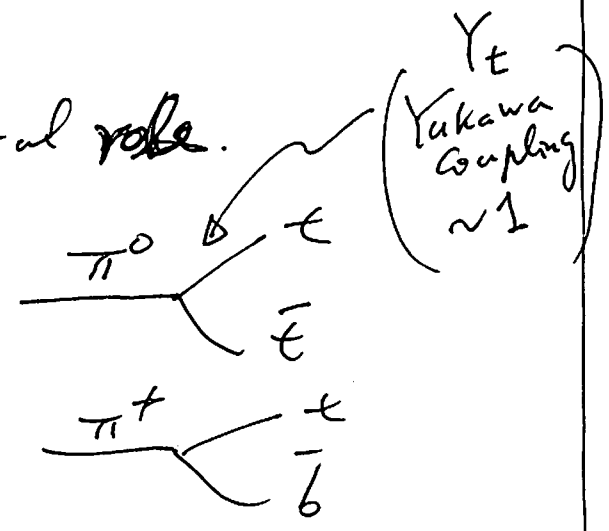


⇒ Modify WW, ZZ, WZ pair productions.

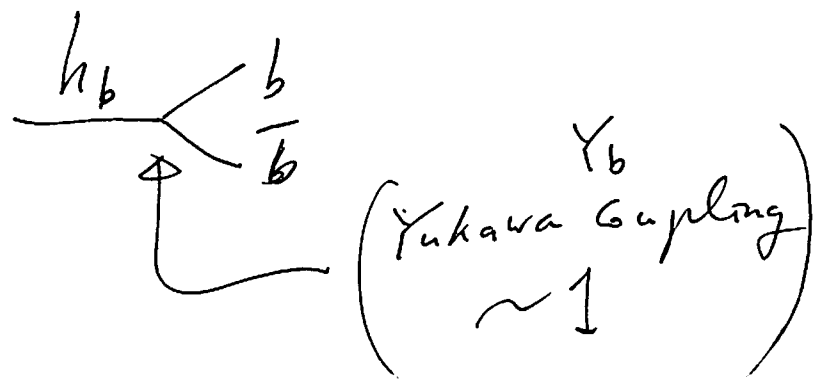
2) TopColor model:

— Top quark plays a special role.

⇒ ① Top-pion



② $\begin{pmatrix} t_L \\ b_L \end{pmatrix}$ ⇒ bottom quark Yukawa interaction is enhanced



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 42-388 100 SHEETS FULLER 5 SQUARE
 42-389 200 RECYCLED WHITE 5 SQUARE
 Made in U.S.A.



— The effective Lagrangian at weak scale is a Two-Higgs-Doublet model in which one Higgs doublet couples strongly to top quark, another to bottom quark.

Hence

$$Y_t \sim 1 \quad \text{and} \quad Y_b \sim 1$$

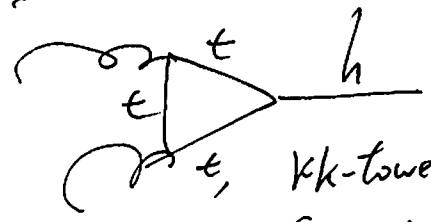
which is very different from the usual Two-Higgs-Doublet model :

$$Y_t \sim \frac{1}{\tan\beta} \quad - \quad Y_b \sim \tan\beta$$

($\tan\beta$ is the ratio of two VEV's.)

3) Universal Extra-dimension models:

— For every particle, there are KK-tower's new particles.
(Kaluza-Klein)

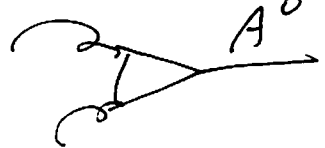


t , KK-tower top partners ($spin = \frac{1}{2}$ fermions)
(with the same SM quantum numbers as top quark)

Hence, its production rate is always larger than the SM rate.

— In the minimal UED model, the effective Lagrangian at the weak scale is a Two-Higgs-Doublet Model!

But, the heavy Higgs bosons (H, A^0, H^\pm) can not be singly produced.

Namely,  A^0 is not allowed.

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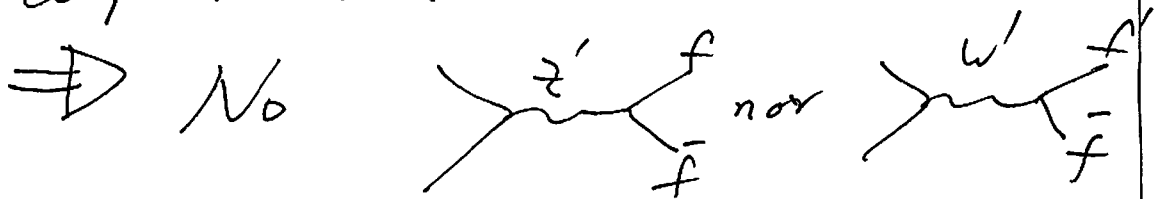


4) Higgsless models:

— To delay the breakdown of unitarity in TeV region, it must have additional

$$W', Z'$$

— To be consistent with Z-pole precision data, W' & Z' can not directly couple to SM fermions.



— Instead, it could "largely" (in relative sense) modify the $Z_{\mu\nu} W^{\mu\nu}$ coupling.

