Composite Higgs(?) Report (LH, GHU, ExD)

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Investigation Strategy with Kitano-san quality

Rule1: Focusing on Physics of EWSB
Rule2: Better than Glashow's model

～ Reports ～

1. Little Higgs Model (S. Matsumoto)
2. Gauge-Higgs Unification (T. Yamashita)
3. Extra-dimension Model (K. Oda)
4. ~~Multi-Higgs Models (S. Kanemura)~~

Pr … s

(Postpone 可) (Postpone 不可)

↓

Solutions?

Yes! No!

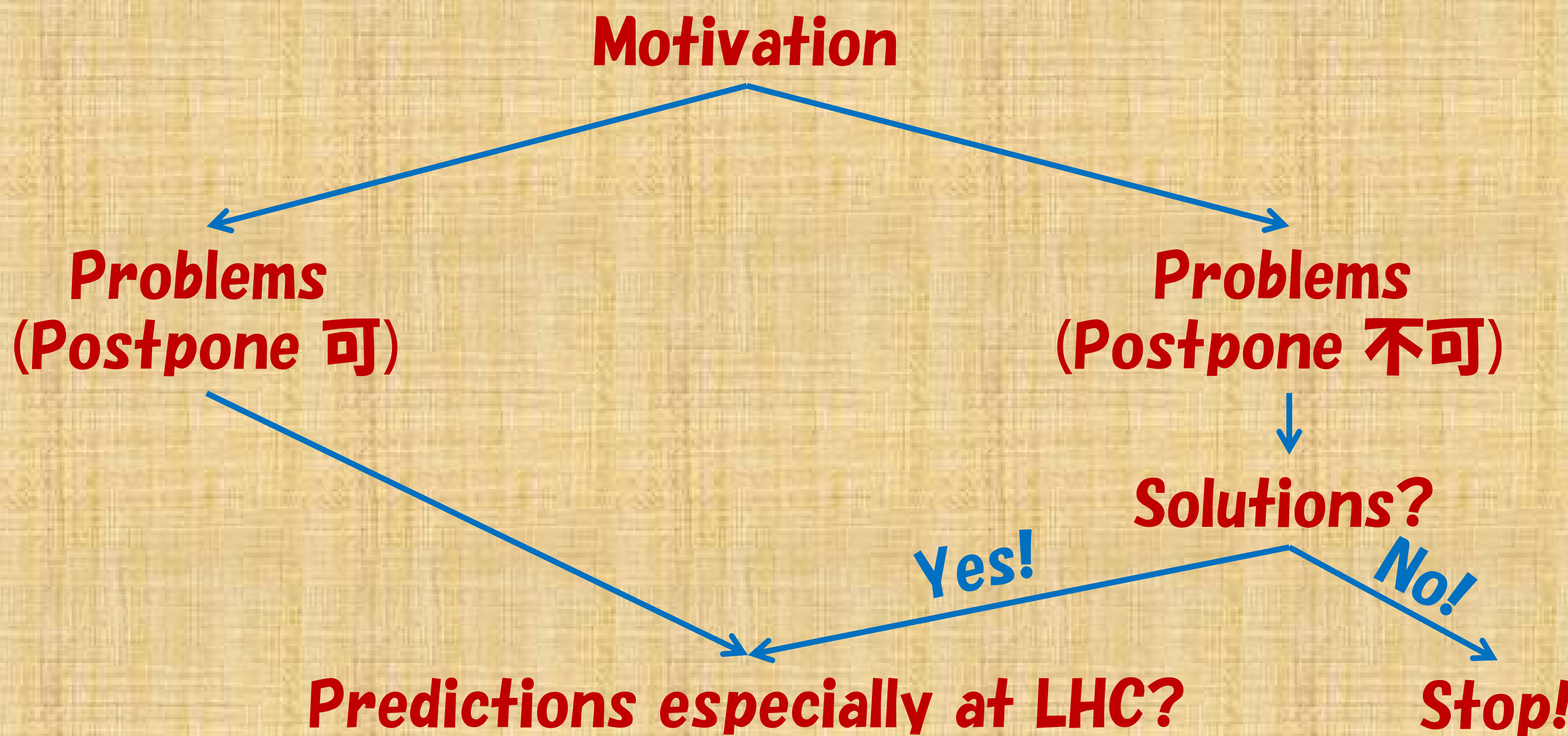
Predictions especially at LHC? Stop!

Investigation Strategy with Kitano-san quality

Rule1: Focusing on Physics of EWSB

Rule2: Better than Glashow's model

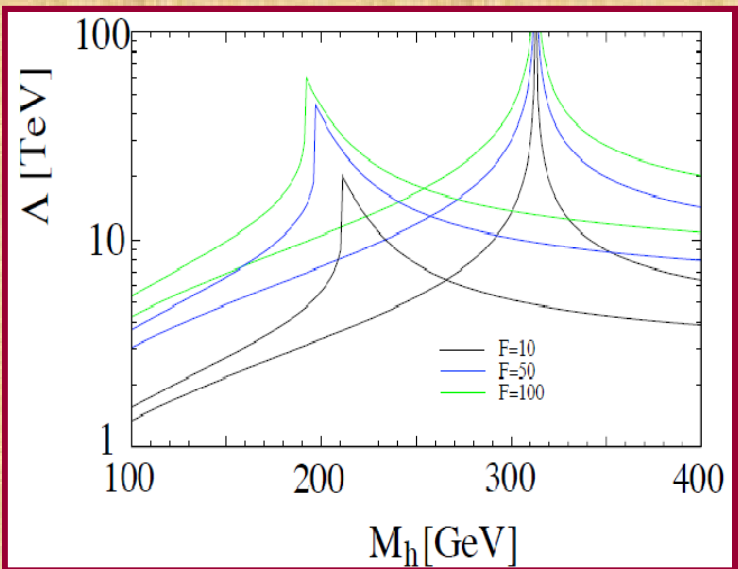
Rule3: Are there some predictions?



1. Motivations of LH

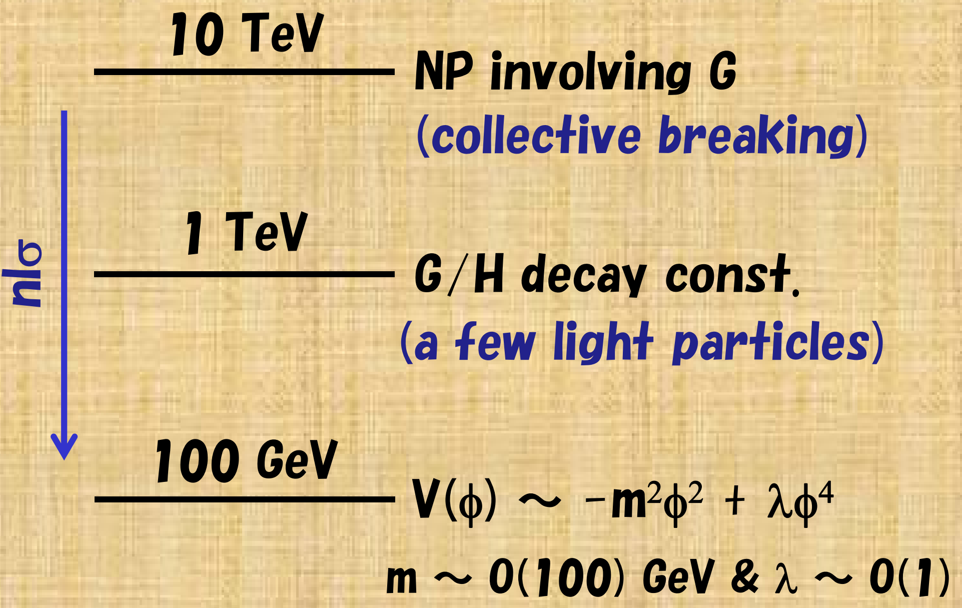
1. Solving the little hierarchy (Put any difficulties on 10 TeV!)
2. Natural WIMP Dark Matter (Mass scale, Interactions, Stability)
3. Few NP parameters at GH sector (VEV and Top partner mass)
4. Calculable with small ambiguities (Non-liner sigma model)
5. Predicting Light Higgs mass (Higgs mass is O(100) GeV)
6. Possibility to construct Techni-color type UV completion.

~ Little Hierarchy Problem ~



Unwanted higher dimensional operators suppressed by Λ!

~ Basic structure of LH ~



2. Problems in LH

～ Matter sector ～

Method w/ incomplete multiplet
to implement collective breaking.
Too unnatural!
→ Postponed!
(より自然なものを作れないかな？)

～ UV completion ～

Gauge-Higgs sector
Not so difficult
Matter sector
Seems to be difficult
→ Postponed!

～ EW precision test ～

EW precision test often gives
severe constraints on models.
(e.g. Z-Z' mixing, triplet VEV)
→ Cannot be postponed!
Imposing T-parity
(Existence of WIMP DM)
(他の方法を考えるのも面白い)

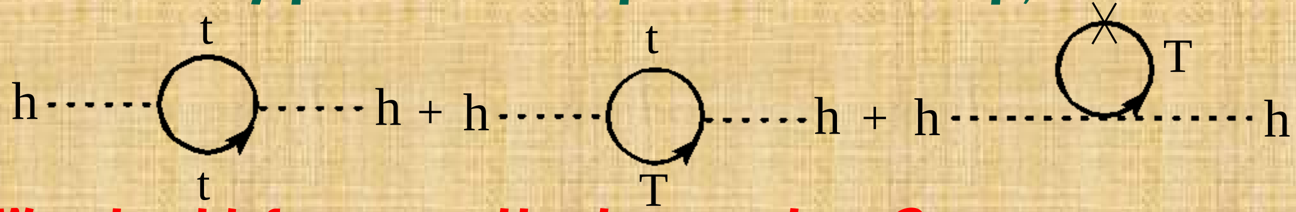
～ FCNC/CP Problems ～

→ Postponed !
(でもきちんと考えるのは大事)
1H + SM + Top partner @ low E
→ No Problem (But …)
2H + SM + Top partner @ low E
or LH wit T-parity
→ Problem in general

3. Predictions of LH at LHC

1. LHC is a hadron collider aiming to discover new particles.
   → We should focus on new colored new particles.

2. LH inventively predicts the partners of top, weak bosons, h.



   → We should focus on the top partner?

3. How heavy the top partner is? (Accessibility at the LHC)
   → OK in terms of the fine-tuning! (the same as the stop.)

4. Cross sections & Branching ratio in LHT with T-parity.
   → See the table (14 TeV case).

5. How can we confirm LH using the top partner?
   → Three independent observables, TTh coupling.

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   → We

3. How h ... the LHC)
   → OK ... the stop.)

4. Cross ... parity.
   → See

	Point 1	Point 2	Point 3
f (GeV)	570	600	570
λ_2	1.0	1.1	1.4
$\sin\beta$	0.20	0.16	0.11
m_h (GeV)	145	131	145
m_{A_H} (GeV)	80.1	85.4	80.1
m_{T_-} (GeV)	570	660	798
m_{T_+} (GeV)	772	840	914
$\sigma(pp \to T_-\bar{T}_- + X)$ (pb)	1.26	0.54	0.17
$\sigma(pp \to T_+\bar{T}_+ + X)$ (pb)	0.21	0.13	0.07
$\sigma(pp \to T_+ + X)$ (pb)	0.29	0.15	0.05
$\sigma(pp \to \bar{T}_+ + X)$ (pb)	0.14	0.07	0.02
$\mathrm{Br}(T_+ \to W^+b)$	50.8 %	50.8 %	53.3 %
$\mathrm{Br}(T_+ \to Zt)$	21.1 %	21.8 %	23.6 %
$\mathrm{Br}(T_+ \to ht)$	15.8 %	17.4 %	19.1 %
$\mathrm{Br}(T_+ \to T_-A_H)$	12.3 %	10.0 %	4.03 %

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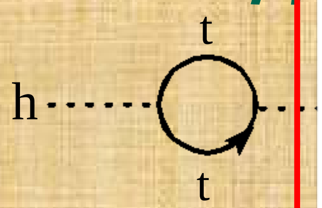
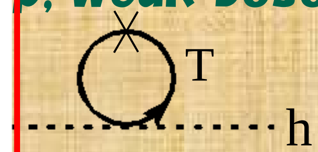
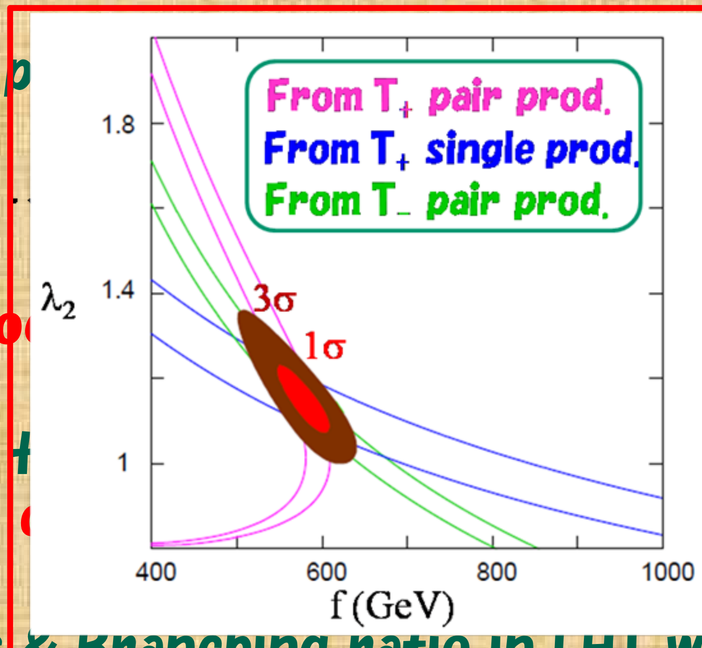




   → We should fo...



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