

Les Houches 2007  
New Physics WG  
Session II:

Mostly on non supersymmetric  
theories at the the TeV scale

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(EXP)

- LHC will dig into the EWSB sector and will provide with answers to the following questions:

- \* Is the higgs mechanism the correct description for EWSB?

- \* Is there any neutral scalar, i.e. the higgs, to be discovered? if not, what unitarizes  $WW$  scattering?

- \* Is the higgs a fundamental particle, is it composite, is it “half-n-half”?

- From the point of view of model building there are the following categories for EWSB:
  - \* models where the higgs is a fundamental resonance: SM, MSSM (or more general SUSY models), little higgs
  - \* models where the higgs is composite: RS, gauge-higgs unification in warped space
  - \* models with no higgs: technicolor or higgsless, in general related to some strong dynamics

## Pros and cons of the different models

- The SM provides with an ad-hoc (fine-tuned) explanation to EWSB, but is the only one that agrees with observation....
- In general SUSY provides a solution to the fine-tuning up to  $M_{\text{gut}}$  and EWSB is achieved radiatively but lately also suffers from some kind of fine-tuning
- The little higgs models provide a solution to the fine-tuning problem protecting the higgs with global symmetries (linearly realized) but are only valid up to few TeV.

- Models where the higgs is partially or totally composite like RS with(out) gauge-higgs unification provide, in general, a non-linear realization of little higgs theories which are valid to higher scales but require, in general, further structure to agree with EW observables
- The limit of the composite theories is the one where there is no higgs and EWSB is explain **à la technicolor** in general these theories have their weakest point in the S parameter.

# Experimental signatures

- From the experimental point of view these theories can be classified in the following way:
  - \* Theories with a parity (R, T, KK): Cascade decays ending in missing energy
  - \* Theories without any parity: mainly resonant production of new particles

**Friday 22nd:** heavy resonances in composite Higgs models  
(R. Contino + G. Servant)

**Saturday 23rd:** Twin Higgs models (M. Vos + S. Su)

**Monday 25th:** signals and properties of low-scale  
technicolor (K. Lane + V. Sanz + A. Martin + K. Black + M.  
Narain)

**Tuesday 26th:** multi-jet and multi-lepton SM signals/  
background (joint session with the Multi-leg working  
group)

**Wednesday 27th:** CMS discovery potential for minimal  
Universal Extra Dimensions (B. Dobrescu + P. Ribeiro)