BSM Physics

(informal* discussion)

BSM Physics

(informal* discussion)

*

informal
adjective
1 *an informal chat*: unofficial, casual, relaxed, easygoing, unceremonious; open, friendly, intimate; simple, unpretentious, easy; informal unstuffy, laid-back, chummy.
ANTONYMS official, formal.

Categorizing NP (I)

Categorizing NP (I)

- Models:

1. Weakly coupled (i.e MSSM) vs strongly coupled (i.e MCHM5).
2. Simplified models (plainer version of a complete model).
3. EFT: judicious parameterization of our ignorance.

Categorizing NP (I)

- Models:

  1. Weakly coupled (i.e MSSM) vs strongly coupled (i.e MCHM5).
  2. Simplified models (plainer version of a complete model).
  3. EFT: judicious parameterization of our ignorance.

- Issues:
  - Easier to report results in 2, 3 than 1.
  - Blurry lines between:
    - 1 and 2 : Nomenclature. # new particles > 2, 3, ... ?
    - 1 and 3 : Adopt EFT for $\Lambda\ [\mathrm{TeV}] = 1, 2, 5, 10, 100, 10^{16}$?
  - 1, 2. Benchmarking (last slide!). Choice of "representative" models?
  - 3. Choice of parameterization (wait for Florian's talk!)

Categorizing NP (II)

Categorizing NP (II)

- Effects:

1. Anomalous couplings (hhh, hhhh, hff, hVV, hhff, hhVV, VVVV, etc)
2. New particles in loops (triangles vs boxes)
3. New resonances (i.e: H, S, rho, ...)
4. hh from chain decays (n2 > n1 h?)
5. h/ hh exotic decays (h > n1 n1? h h > n1 n1?)

Categorizing NP (II)

- Effects:

  1. Anomalous couplings (hhh, hhhh, hff, hVV, hhff, hhVV, VVVV, etc)
  2. New particles in loops (triangles vs boxes)
  3. New resonances (i.e: H, S, rho, ...)
  4. hh from chain decays (n2 > n1 h?)
  5. h/ hh exotic decays (h > n1 n1? h h > n1 n1?)

- Issues:

  1: Parameterization: SB realization (L vs NL). Gauge invariance?

  2: Some may affect h production (i.e: tth coupling!)

  2, 3: Catalog by spin, color rep, ... ? Width: free? f(mass)?

  4, 5: Will h always dominate over hh?

Benchmarks for BSM HH Studies?

- LHC HXSWG seeks input. Strawman proposal:

1.) Higgs singlet
  - Fix mixing angle to largest allowed by precision EW
  - Free parameters: $M_H, \Gamma(H \to hh), BR(h \to \text{invisible})$

2.) Non-resonant 2HDM
  - Small tan β, $M_H < 2m_h$
  - Free parameters: $M_H, \cos\alpha, M_A, M_{H^+}, tan\beta, m_{12}^2$

3.) Enhanced b, τ 2HDM
  - Large tan β

4.) EFT following Higgs Cross section working group
  - Neglect b's, assume no CP or flavor /violation
  - Free parameters: $c_{gg},\ \delta y_t,\ y_t^{(2)},\ \delta\lambda_3$

[Dawson, Englert,Gouzevitch, Salerno, Slawinska]