Alberto Salvio

TH Retreat 2016

My work is supported by

Horizon 2020
European Union funding
for Research & Innovation

4^{th} of November 2016

Previous experience

(Focusing on that most relevant for ongoing personal activities)

- Tests of the SM at ultrahigh energies

- BSM: I worked on well established scenarios (e.g. SUSY, extra dimensions), but also on new scenarios (in Madrid):

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  1. Renormalizable local field theories of gravity $\rightarrow$ 4-derivative (in Madrid)
  2. Quantization of 4-derivative (in Madrid and at CERN)

Other previous experience

(less relevant for ongoing personal activities)

neutrinos, leptogenesis, axions, strongly coupled theories, Lorentz (a)symmetry in QFT

Current projects I: Tests of the SM at ultrahigh energies

(a) 3NLO contribution for the SM stability bound

In general we need

- n-loop SM $V_{\rm eff}$
- $(n+1)$-loop SM RGEs
- n-loop threshold corrections

(b) Vacuum decay during inflation

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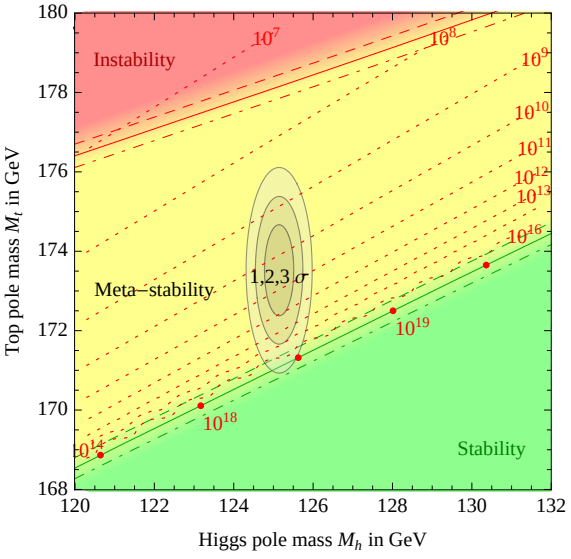

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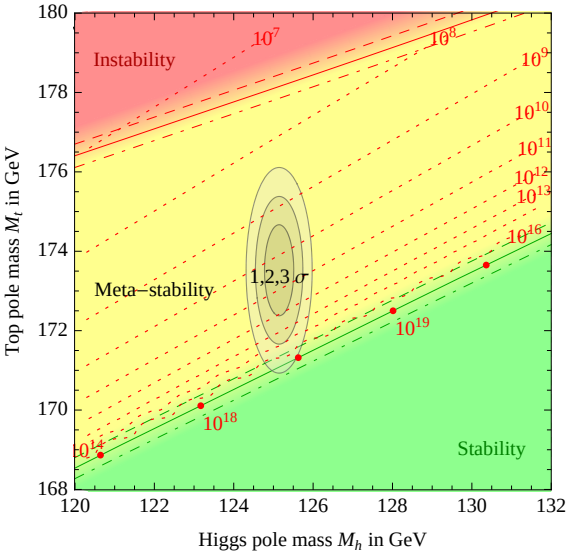

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- There is interesting interplay between theory and experiments

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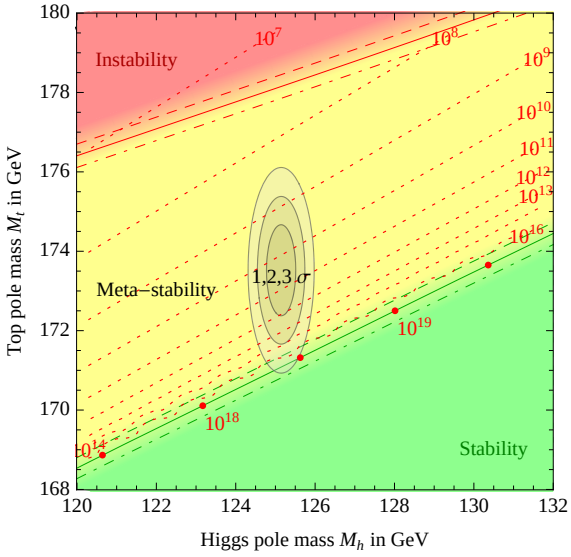

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(b) Vacuum decay during inflation

We are investigating the effect on vacuum decay of

- A cosmological constant (possibly huge during inflation) added to the SM $V_{\rm eff}$
- Different boundary conditions for the Coleman bounce due to a different topology:

Minkowski $\rightarrow$ de Sitter

Current projects II: Total asymptotic freedom (AF) and gravity

We are looking for an asymptotically free theory of all interactions (gravity included)

Renormalizability *generically* requires the introduction of 2 terms:

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Namely we consider a CFT (at tree-level)

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All these requirements lead to a predictive theory of all interactions

So much that it is excluded?

- Is such a theory compatible with cosmological observations?
- Can we also account for neutrino masses and DM?

More long term goals

- SM: the tests (such as those described) could show some other evidence of BSM
- BSM: Compare predictions of totally asymptotically free theories and results at present and future colliders
- QG:
  - Amplitudes in dimensionless gravity theories
  - Comparison of renormalizable field theories of gravity with observations of early universe quantities and with predictions of other QG theories: strings, Horava-Lifshitz, ...

Thank you very much for your attention!