Could several Vacua be Accurately Degenerate?

H.B. Nielsen(Copenhagen) Larisa Laperashvili and much from
Colin D. Froggatt, and Multiple Point Principle with also D.
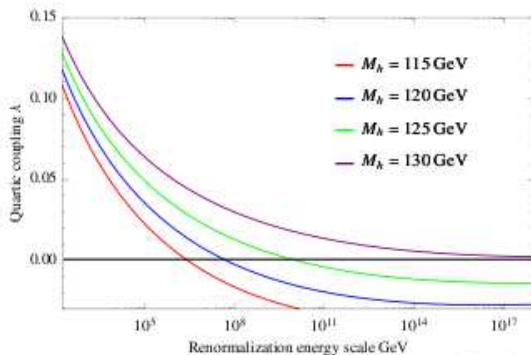Bennett

Warszawa , 4th of December, 2015

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Multiple Point Principle Exact ?...

Motivation New Law of Nature!

We have long been working on the postulate that a principle - Multiple Point Principle (many degenerate vacua) - should solve the fine tuning problems by actually making a rule for finetuning. To day Larisa Laperashvili and I want to tell about a little correction, that allows this MPP to be very accurate! If it is very accurate we may have a very accurate new law of nature, that can help us restrict coupling constants from a theoretical principle.

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Introduction
SM effective potential
Stability of the EW vacuum
Results
Conclusions

For large field values $V_{eff} \sim \frac{\lambda(\phi)}{4}\phi^4$.

$\lambda(\mu)$ for $M_t = 173.1 GeV$:

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Potential New Law of Nature: Multiple Point Principle

This principle - originally we HBN and Don Bennett proposed, and also Colin D. Froggatt the postulate:

The couplings constants are adjusted so as to make several vacua have the same energy density.

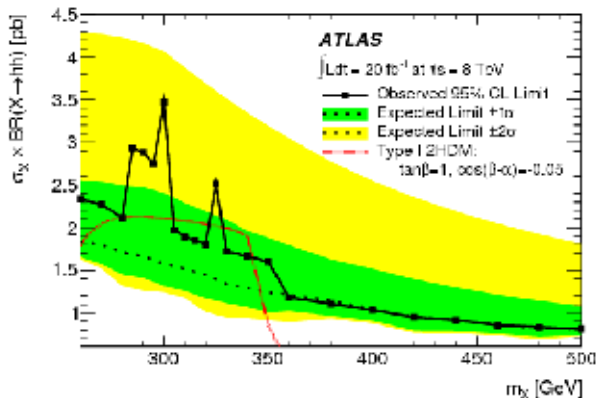The accuracy may be discussed but now I want to sya that it could be *very accurate*!

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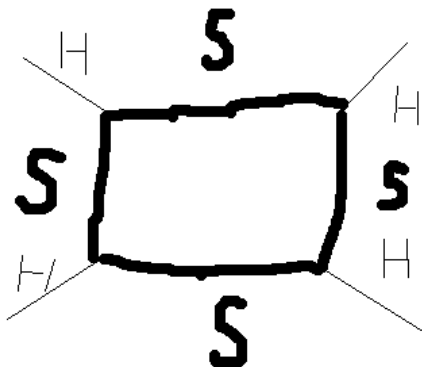
We PREdicted the Mass of the Higgs Boson long before it were found !

Actually to 135 GeV $\pm$ 10 GeV, but with present knowledge of top-mass and loop corrections DeGrassi et al. gets 129.4 GeV for the mass that makes the boarderline for stabily in pure Standard Model.

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Laperashvilis and Mine main point to day:

We make a correction so as to bring the agreement with stabilty just on the borderline possibly (almost) exact. This is based on:

- A 2.7 σ resonace decaying into two Higgs bosons, and having the mass 300 GeV.

- Believing that we have a THIRD with the two other ones degenrate vacuum with a condensate of a bound state S consisting of 6 top + 6 anti top quarks.

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$$\frac{A_{\text{to be used}}}{(N/6 * \alpha_{H \text{ to be used}})^2} = \tag{1}$$

$$= -\frac{6}{\pi} * (1 - 4z^4) + \tag{2}$$

$$+\frac{12}{\sqrt{\pi}} * \exp(z^2) erfc(z)(z - 2z^3 - 4z^5) + \tag{3}$$

$$+24(\exp(z^2) erfc(z))^2 * z^4(1 + z^2) . \tag{4}$$

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Conclusion

- Taking MPP serious ti could even WITH ONLY STANDAR MODEL possibly be valid with HIGH ACCURACY, say degeneracy with the order of magnitude of present cosmological constant!

- This were done in a picture taking as our bound state of 6 top + 6 anti top quarks S the by 2.7 standard deviations at LHC seen Higgs + Higgs resonance.

- The correction is a slight correction to the effective Higgs self coupling λ active at low energy - i.e. weak scale - only making the Higgs mass observed shifted from the 129.4 GeV to the observed 125 GeV.

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Conculion , an Outlook

Since we have *pure Standard Model* only, in principle - if you can do a bit non-perturbative caculations - everything is calculable! We should be able to *calculate* say the mass of the 300 GeV higgs + higss resonance, and calculate more accurately if indeed the higg Higgs field vacuum is just degenerate with the present vacuum. Experiments only shall support us.

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