Random Dynamics, model for finetuning, dark matter, Tunguska

Random Dynamics, Model of Fine Tuning, Dark Matter, Tunguska

- Mainly concentrate on fine tuning to ``solve scale problem'' of why weak scale much smaller than Planck scale.
- This ``Scale problem'' is mainly work with C. D. Froggatt and L. Laperashvili, using the ``Multiple Point Principle'' developed (also) with D. Bennett.
- The application of alternative vacuum as interior of orange size dark matter balls were with C. D. Froggatt

Soon to be seen? Bound state``t-ball"=NBS=dodekaquark

- Second major point: Our fine tuning tunes the top-Yukawa-coupling so as to make a bound state of 6 top and 6 anti top quarks be for 12 top-quarks unexpectedly light.
- Really there is a little family of relatively light bound states of 11 to 12 top-quarks predicted in our just fine tuned Standard Model.
- Production of the lightest bound state NBS suggested to be via some of the heavier (in range 600 GeV around).
- We just heard strange events from CDF investigation of fourth family.

Plan for: Random Dynamics...Tunguska

- Problem of Fine Tuning: Give up avoiding fine tuning!
- Our – Bennett's and mine – Multiple Point Principle telling many vacua with essentially zero energy densities.
- Vacua in Standard Model.
- Bound state of 6 top and 6 anti top.
- The scale problem: weak to Planck scale ratio?
- Dark matter as balls of ``new'' vacuum. One fell in Tunguska!
- Conclusion

Fine Tuning?

- Cosmological constant problem (why so small cosmological constant) very hard, antropic principle, Woodards...it goes by itself ?(=? Polyakovs)
- Graham Ross just told us that even SUSY lacks still some factors 9 of fine tuning ...
- Even if SUSY solves hierarchy problem, it still requires complicated machinery to explain Higgs mass small in the first place.
- WHY NOT FINE TUNE ?

Our proposal for fine tuning: MPP

- Our proposal for fine tuning is ``Multiple point Principle'' (= MPP) meaning that we assume very small energy density(=cosmological constant) for a series of vacua, and not only for the vacuum we live in.
- Each time we add a new vacuum to the series of them, which we consider, we get one more relation between the coupling constants and masses in the Lagrangian of the model we consider(in e.g. Standard Model).

The three vacua, we popose for Standard Model

- The vacuum, we live in with <Higgs field> =246 GeV.
- A vacuum with a Higgs field average <Higgs field> of the order of the ``fundamental'' scale, say Planck scale.
- A vacuum in which there is a Boson-condensate of a bound state consisting of 6 top and 6 anti top quarks(for which the binding force must then be adjusted by the ``fine tuner'' behind the ``multiple point principle'' so as to barely make it a (formal) tachyon, able to form the condensate.

Bound state of 6 top & 6 antitop

C. D. froggatt and H.B.N. estimate the existence of a bound state of 6 top-quarks and 6 anti-top-quarks with just such a small mass that there should a phase of vacuum in which there is a boson condensate of such bound states with the same energy density as the presnt vacuum to happen for just the top-quark Yukawa coupling being about 1.02. This special top-Yukawa value is consistent with the experimental value – fitted to the top-mass – of 0.93 !

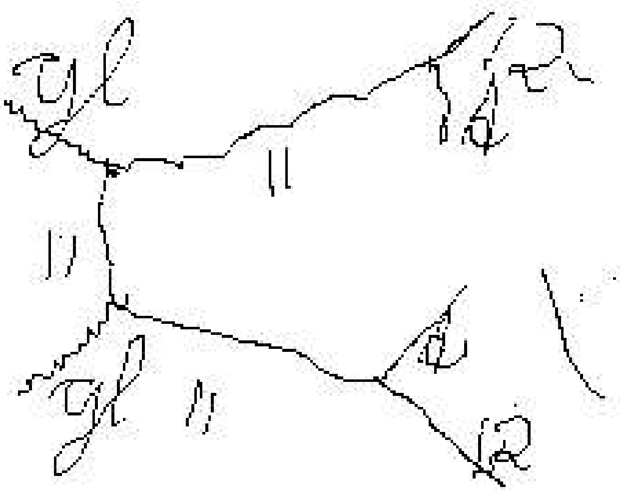
Simple or Nice Fine Tuning:

- In any case we need to fine tune the vacuum, we live in to have very small energy density.
- What if there existed other vacua, should they also have small energy densities?
- Our -Bennett and mine – Multiple Point Principle says: There are many vacua with almost zero energy densities.
- Each time we postulate a vacuum to have approximately zero energy density we get a relation more between the coupling constants in say the Standard Model

Smallness of the bound state mass makes it possibly observable at LHC

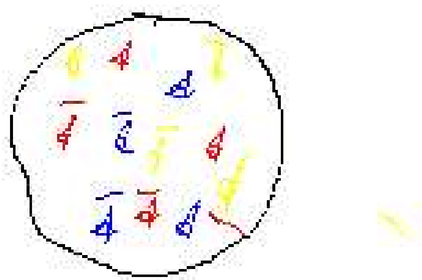
- The coincidence of the top-Yukawa coupling for degenenerate vacua with experiment
- Small mass & small radius ==> chance of producing it
- How it could be produced, heavier bound states in the family
- Attaching a W-boson, what Tevatron saw??
- Using our bound state for dark matter, only with Standard Model!

Producing our bound state



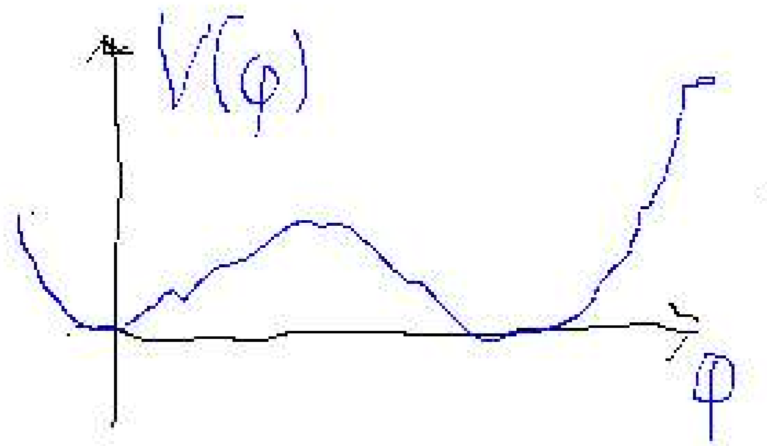
- The 6 top + 6 anti top bound state is globally colorless and thus essentially does not couple to gluons.
- But a bound state where there is say missing an anti top – so that it has 11 constituents – is a color triplet.

Our Bound State (=NBS=dodekaquark)



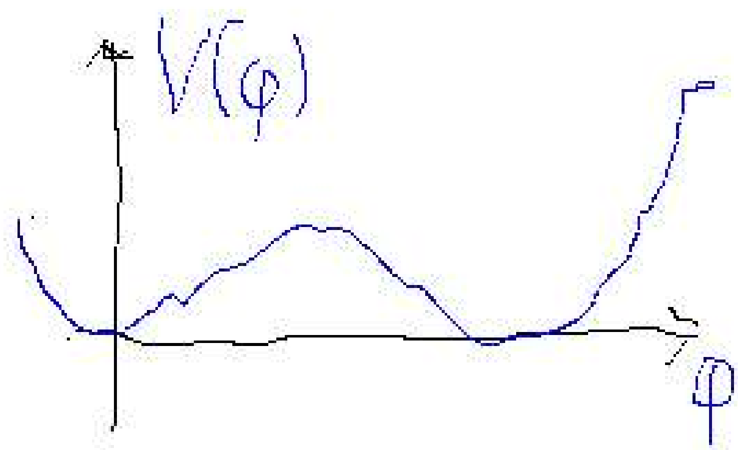
- Really our bound state is superexcotic in the sense of excotic resonases, but...
- the idea is that it is held together largely by Higgs-boson-exchange.
- Note that Higgs exchange cause attracktion all the time.

Multiple Point Principle



- D. Bennett and have proposed some ideas of commodities being specified meaning now that we posutlate that there be many degenerate vacua. This multiple point principle has been developped and worked on by many collaborators, Froggatt, Laperashvili,Nevzorov.

Multiple Point Principle



- For the effective potential for a boson field, say, the many degenerate vacua could show up as many different minima with zero effective potential at these minima.

Conclusion 1.

- We proposed as a simple way to fine tune to postulate several vacua with the same – actually zero – energy densities.
- In Standard Model we postulate three vacua being degenerate with zero cosmological constant this way.
- THAT LED TO THE EXPONENTIAL SMALLNESS OF THE WEAK SCALE COMPARED TO THE SCALE of the Higgs field in one of the vacua taken to be the PLANCK SCALE.

Conclusion 2

- It is viable to form orange sized balls of the vacuum with a condensate of bound states of 6 top and 6 anti top quarks stuffed with white dwarf like material, and such balls could make up dark matter.
- It can fit that the Tunguska event in 1908 in Siberia were the fall of such a ball penetrating deeply into the earth, emmitting matter back.
- Also Sodoma and Gomorra might be such a case.