CONTROVERSY IN THE TOP QUARK MASS

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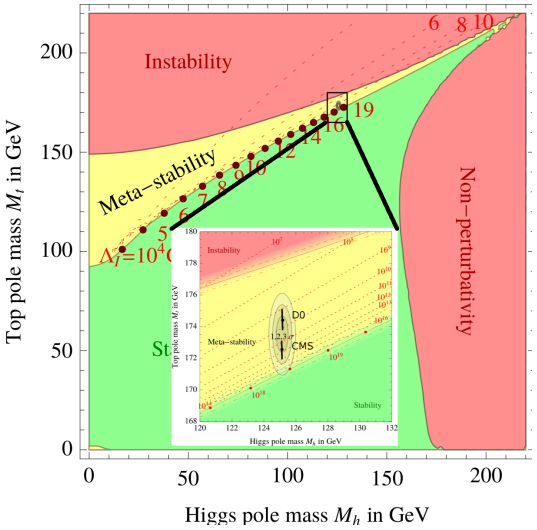
The LHC Run 2 has been successfully ongoing for two years. As the main goal of Run 1 was the Higgs boson, the second run has concentrated on finding new physics. During 2016 both the ATLAS and CMS collaborations collected almost 40 fb^{-1} of collision data. However, no new physics have been found.

The absence of new physics motivates studies of open questions in the standard model. An important problem of this kind is the one handling vacuum instability (Fig. 1). Given the measured Higgs boson and top quark masses it seems that the universe is metastable. The top quark mass is the greatest source of uncertainty in this result.



Vacuum instability. [1]

There have been tensions between different measurements of the top quark mass. The vagueness between the pole mass and the Monte Carlo mass for the top quark is one of the causes for such tensions. Nevertheless, theorists are getting closer to a solution in this issue. Moreover, there are currently unexplained differences between measurements. A recent Tevatron measurement produced a mass value of 174.3 GeV [2], as compared to the CMS result around 172.4 GeV [3].

At the Helsinki Institute of Physics CMS Project we have initiated a project to lower the uncertainty of the current best CMS measurement from 0.5 GeV to 0.2 GeV. In addition, we plan to explain the discrepancy between the D0 and CMS measurements. As seen in Fig. 1, this could bring the fate of the universe much closer to stability.

[1] D. Buttazzo, G. Degrassi, P. P. Giardino, G. F. Giudice, F. Sala, A. Salvio and A. Strumia, JHEP **1312** (2013) 089 doi:10.1007/JHEP12(2013)089 [arXiv:1307.3536 [hep-ph]].

[2] Tevatron Electroweak Working Group *et al.* [CD and D0 Collaboration], arXiv:1608.01881 [hep-ex].

[3] V. Khachatryan *et al.* [CMS Collaboration], Phys. Rev. D **93** (2016) no.7, 072004 doi:10.1103/PhysRevD.93.072004 [arXiv:1509.04044 [hep-ex]].