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Vacuum stability, Higgs and top masses, and new physics

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One of the scenarios considered in these days explores the possibility for the SM to be valid up to the Planck scale. The phase diagram for the stability of the EW vacuum is then derived assuming that new physics interactions at this scale have no impact on it. In particular, for the central values of M_H and M_t , the EW vacuum is metastable, and its lifetime is obtained ignoring new physics. I show that, although new physics interactions appear in terms of higher dimensional operators (and we could naively expect their contribution to be suppressed), due to the non-perturbative nature of the tunnelling, they can have great impact on the EW vacuum lifetime. As a result, the SM phase diagram, far from being universal, strongly depends on new physics. This has a far reaching consequences, as specific BSM candidates can be tested against this stability analysis. Finally, contrary to some claims, higher precision measurements of M_t and M_H cannot provide any definite response on the stability of the EW vacuum. The latter strongly depends on new physics.

Summary

Primary author(s) : Prof. BRANCHINA, Vincenzo (University of Catania)

Presenter(s) : Prof. BRANCHINA, Vincenzo (University of Catania)

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