The mass of the Higgs boson and the great desert to the Planck scale

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Based on a scenario for asymptotic safety for gravity the Higgs boson mass was predicted in 2009 to be 126 GeV, with a few GeV uncertainty. We review this proposal and its implications for a desert between the Fermi- and Planck- scales, the possible solutions to the gauge hierarchy problem and the unification of all interactions.

A crucial ingredient for the robustness of the prediction of the Higgs boson mass is the existence of a partial infrared fixed point for the ratio between squared Yukawa coupling of the top quark and quartic scalar coupling, and the properties of the associated infrared interval.

The prediction of a great desert depends sensitively on the top quark pole mass which still has an uncertainty in the few GeV range. Identifying the Fermilab value with the pole mass would give a lower bound for the Higgs mass of 129 GeV. A value of 126 GeV is then often quoted as a sign of metastability of the vacuum. Rather than that , it would only indicate that physics beyond the standard model is needed at a scale around 10^12 GeV, such that the great desert could have an oasis.