

Beyond Standard Model and Asymptotically Safe Gravity

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Einstein gravity cannot be quantised using standard Quantum Field Theory techniques. Hence to describe gravity on quantum level then either a new, special quantisation prescription should be proposed or General Relativity should be replaced by another theory which can be properly quantised. If the first option is true, then General Relativity should possess an interacting UV fixed point (as an asymptotically safe theory) and then GR becomes a fundamental Quantum Field Theory to arbitrary scales. There are many hints that indeed it is so.

On the other hand there are many proposals on how to extend the Standard Model, designed to deal with its fundamental inconsistencies. Since no new particles have been detected experimentally so far, the models which add only one more scalar particle and possibly right-chiral neutrinos are favoured. One of such models is the Conformal Standard Model.

If there are no intermediate scales between electroweak and Planck scale then these type of models supplemented with asymptotically safe gravity can be valid up to arbitrarily high energies and give a complete description of particle physics and gravitational phenomena.

This assumption restricts the mass of the second scalar particle to 300 ± 28 GeV and the mass of Higgs boson at $125 \pm \text{few}$ GeV. This has also impact on the multiple Higgs inflation scenarios.

Whats more various theories of gravity gives various predictions for the Higgs boson masses. Hence then by accurate measurements we can investigate the quantum gravity in LHC.

Talk based on the articles: <https://arxiv.org/abs/1810.08461>, arXiv:1712.03778 and unpublished results in collaboration with Frederic Grabowski and prof. Krzysztof A. Meissner.

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