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Quantum gravity predictions for particle physics and cosmology

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Contrary to general belief, quantum gravity can have important consequences for observations in present day experiments. It can predict parameters of the standard model of particle physics. Functional renormalisation permits the computation of fluctuation effects of the metric. Quantum gravity can be formulated as a non-perturbatively renormalisable quantum field theory, in close analogy to the other fundamental interactions. The quantum scale symmetry associated to the ultraviolet fixed point has far reaching implications for particle physics and cosmology.

Quantum fluctuations of the metric determine the quartic self-interaction of the Higgs-scalar at an energy scale close to the Planck mass. Extrapolating the running couplings to the electroweak scale, the mass of the Higgs boson has been predicted in the range found later by experiment.

The scaling solution of quantum gravity for scalar potentials in cosmology has a form that can account both for the inflationary Universe and for dynamical dark energy.

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