Renormalization group and its implications for variable vacuum energy and galaxies rotation curves

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The quantum effects of matter fields on a classical curved background may lead to the phenomenologically interesting contributions to the action of gravity. The present day knowledge of quantum field theory in curved space enables one to calculate some part of such corrections, mainly the ones in the higher derivative sector of the theory. At the same time, the derivation of the most interesting corrections to the cosmological constant and Einstein-Hilbert terms are beyond our possibilities, such that one has to rely, at least in part, to the phenomenological approach. In the cosmological setting the form of quantum contributions can be established from the covariance arguments. As a result we arrive at the form of the possible quantum terms which depend on a single free parameter. This parameter can be indeed restricted, e.g., from the analysis of the LSS data. In the astrophysical case we meet a bit more complicated situation, and the most challenging problem is to find an appropriate physical identification for the scale parameter of the renormalization group. It is remarkable that one of the natural choices of this identification provides an extremely good fit for the rotation curves for the sample of distinct galaxies without invoking the CDM concept.