The Functional Renormalization Group Equation

The beta functional

In the traditional Wilsonian approach to renormalization, a single step of renormalization procedure consists of a functional integration of high-momentum fluctuations, followed by a rescaling of physical lengths and momenta, and renormalization of fields. All of this leaves the non-perturbed theory unchanged, affecting only the couplings. Before the rescaling and renormalization operations we are dealing with the so-called Wilsonian effective action (S_{eff}). It describes the behaviour of fields for the processes below certain energy scale $b\Lambda$, lower than original cutoff Λ. S_{eff} will generally contain the operators of all the higer dimensions in fields and derivatives. These corrections (...) but they allow us to neglect field modes larger than $\mu = b\Lambda$ and deal only with non-divergent diagrams.

However, S_{eff} is still a quantum action, in the sense that the functional integral is performed over it. It also in some sense lose some information about the high-energy physics. There is another object (...) quantum effective action