

Exercise 27: One-loop structure in $\lambda\phi^4$

Calculate the one-loop correction to the scalar propagator in $\lambda\phi^4$ ($d = 4$), and the amplitude for elastic scattering to order λ^2 . Use both dimensional regularization and a momentum cut-off to regularize the theory, and renormalize employing both the OS and \overline{MS} schemes. Compare the results you obtain in all the approaches.

Exercise 28: β function in $\lambda\phi^4$

Calculate the β function in $\lambda\phi^4$ ($d = 4$) to order λ^2 . Solve the corresponding Callan-Symanzik equation. What is the asymptotic behavior of the running coupling constant?