

Problems V

Due date: 24.1.06

Up-to-date information and pdf-files of the tutorials also at

http://theorie3.physik.uni-erlangen.de/lectures/ws2005_2006/griesshammer/QFTII.html.

1. VACUUM POLARISATION: Calculate the fermion-loop contribution to the gluonic vacuum-polarisation

$$-i \Pi^{\mu\nu,ab}(k) = \text{diagram}$$

to one loop in dimensional regularisation. Perform the corresponding pieces of the BPHZ-renormalisation of the photon's mass and wave-function in the \overline{MS} -scheme.

You may make life easier by setting the fermion mass to zero and work in the Feynman gauge $\alpha = 1$. Check gauge-invariance, i.e. $k_\mu \Pi^{\mu\nu,ab}(k) = k_\nu \Pi^{\mu\nu,ab}(k) = 0$ by a Slavnov-Taylor identity.