ELEMENTARY PARTICLE PHYSICS

WS 2016/2017: Exercise sheet 7

23. Starting from the expression for the photon field operator

$$\hat{A}^\mu(x) = \int \frac{d^3k}{(2\pi)^3\sqrt{2E_k}} \sum_\lambda \epsilon^\mu_\lambda(k) \left(\hat{a}(k)e^{-ikx} + \hat{a}^\dagger(k)e^{+ikx}\right)$$

show that the photon's Feynman propagator $\langle 0|T\{\hat{A}^\mu(x)\hat{A}^\nu(y)\}|0\rangle$ in momentum space is proportional to $\sum_\lambda \epsilon^\mu_\lambda(k)\epsilon^\nu_\lambda(k)$

24. Compute the transition matrix element from an initial $|e^-(k,s)e^+(k',s')\rangle$ state to the final state $\langle\mu^-(p,t)\mu^+(p',t')|$ for a theory with the interacting part of the Hamiltonian as $\mathcal{H}_{int} = g\bar{\chi}\gamma_\mu\chi A^\mu + g\bar{\psi}\gamma_\mu\psi A^\mu$ where χ, ψ denote the muon, electron field resp. and A^μ is the photon field.