3/10/16 Homework 5. Due Mar 18

Consider a variant of QED, with the following fields:

(1) The photon field A_μ, and a (4-component) Fermion field ψ_q of electric charge q and mass m, as usual for QED.

(2) In addition, there is massless Fermion field λ of zero electric charge, $\mathcal{L} \supset \bar{\lambda} i \partial\!\!\!/ \lambda$.

(3) In addition, there is a complex scalar field ϕ of electric charge q and mass m.

(4) An interaction term $\mathcal{L} \supset h\phi^\dagger \bar{\lambda}\psi + h\phi\bar{\psi}\lambda$. There are also the usual interaction terms needed for the photon to couple to the charge fields, consistent with gauge invariance.

1. Write the Lagrangian and the Feynman rules.

2. Write the 1-loop correction to the λ propagator, including also effects from a counterterm for the λ kinetic term renormalization. Use the Feynman trick to combine denominators and evaluate the momentum loop integral.

3. Continuing the previous question, what should the counter term be in MS?