Exercise 9 Return by 12.00 on Wednesday 27.11

This weeks only problem assignment is to compute the **Coleman-Weinberg potential** in scalar quantum electrodynamics (S. Coleman and E. Weinberg, Phys. Rev D7 (1973), 1888-1909).

The accurate description for the problem is given in Peskin and Schröder "Final project" on pages 469-450. You should try to work out the parts (a), (b), (c), (d), (f) and (g) of the problem. The part (e) was already worked out last week, and the application to superconductors, part (h), is not required in these excercises.

You can borrow the results from the lectures for the R_ξ-gauge propagators and the vertex functions. Also the part (a) about Higgs-mechanism is actually given there. Note that Peskin suggests to use Landau gauge in computing the potential. This is good advice, the reason being that in Landau gauge ghosts do not couple to scalars and hence you do not need to worry about them at a one-loop level calculation. Compute the potential using the tadpole method. The point about studying the limit of vanishing μ^2 and small λ is to show that in this limit the radiative symmetry breaking mechanism works and is reliable at the potential minimum.