# QFT2 Final Project

Your final project is to calculate the beta-function in pure SU(N) Yang-Mills theory at one-loop using dimensional regularisation. You should complete this computation by considering the corrections to the ghost-gluon vertex. You should write the work up (ideally in LaTeX) in the format of a 15-30 page research paper. [100 marks]

In particular you should:

a) Derive Feynman Rules for the model in Feynman gauge [6]

b) Draw the diagrams contributing to the beta function, explain how they enter into the relevant Z factors and write general equations for the β–function. [12]


c) Check the contribution from tadpoles [2] and write general integral expressions for dimensional regularization after Wick rotation together with relevant Lie Algebra properties [8]


d) Draw the ghost self-energy diagram, write the respective integrals and perform their evaluation – throughout the project you need only compute the coefficients of the 1/epsilon poles needed to compute the beta-function. [14]


e) Draw the gauge boson self-energy diagrams, write the respective integrals and perform their evaluation [17]


f) Draw the vertex correction diagrams, write their respective integrals and perform their evaluation [14]


g) Combine the above results to write the final expression for the β–function. Plot the running and explain its significance. [4]




You should write the work up (ideally in LaTeX) in the format of a 15-30 page research paper [16] with marks available for investigations beyond the basic set problem [7].