

# Homework Exercises for QCD and Collider Physics

2005/2006

## Exercises for Lecture 5 (7. Dec 2005)

Calculation for evolution equations:

- Show explicitly, how to include running  $\alpha_s$  into DGLAP equation
- Repeat the calculation leading to the Sudakov form factor and show that this is equivalent with the plus-prescription of the splitting functions.
- Write a small program using the brute-force method to solve DGLAP. Use only gluons and the gluon splitting  $P_{gg}$ . Calculate gluon distribution at  $Q^2 = 10 \text{ GeV}^2$  from a starting distribution  $xg(x, \mu_0^2) = 3(1-x)^5$  at a starting scale  $\mu^2 = 1 \text{ GeV}^2$ .
- Use brute-force method and calculate DLL limit (using  $P_{gg} = 6\frac{1}{z}$ ). Compare it with the DLL formula! What changes if the non-singular terms of the splitting function  $P_{gg}$  are also included ?
- Calculate the same gluon distribution using the integral equation with Sudakov form factors. Use the iterative method to solve the integral equation.