# Exercise for Scattering Amplitude (F, T6)

## Problem set 7, due to 3 July, 2019

**1) Consider the six–gluon alternating–helicity NMHV amplitude $A_6(1^+, 2^-, 3^+, 4^-, 5^+, 6^-)$**

a) How many diagrams contribute to the recursion relation following from the $[2, 3\rangle$ shifts, i.e.: $\hat{\tilde{\lambda}}_2 = \tilde{\lambda}_2 + z\tilde{\lambda}_3$ and $\hat{\lambda}_3 = \lambda_3 - z\lambda_2$ ?

b) Is the $[2, 3\rangle$ shift allowed, i.e. what can be said about behaviour of the amplitude for large $z$ ?

c) Compute the contributions of the non–vanishing diagrams and show:

$$A_6(1^+, 2^-, 3^+, 4^-, 5^+, 6^-) = g_{YM}^4 \left\{ R_2 + R_4 + R_6 \right\}, \quad (*)$$

with:

$$R_i = \frac{1}{t_i} \frac{\langle i, i+2\rangle^4 \, [i+3, i-1]^4}{\langle i|p_{i+1} + p_{i+2}|i+3]\, \langle i+2|p_i + p_{i+1}|i-1]\, \langle i, i+1\rangle\, \langle i+1, i+2\rangle\, [i+3, i-2]\, [i-2, i-1]},$$

with $\langle a|p_b + p_c|d] = \langle ab\rangle[bd] + \langle ac\rangle[cd]$ and $t_i = (p_i + p_{i+1} + p_{i+2})^2$. Note, that in $R_i$ all entries are assumed to be defined mod 6, i.e. e.g. $\langle 10\rangle = \langle 16\rangle$, $\langle 78\rangle = \langle 12\rangle$, $[94] = [34]$, etc.

d) What is the behaviour of $(*)$ for large $z$ ?