Problem Set 8: Scattering amplitudes in gauge theories

Discussion on Wednesday 28.05 13:45-14:30, HIT H 51
Prof. Dr. Jan Plefka & Matteo Rosso

Exercise 14 – The triangle coefficients of the one-loop four point split helicity amplitude

In class we studied the split-helicity amplitude $A_4^{(1-loop)}(1^-,2^-,3^+,4^+)$ at the one-loop level. We derived the box coefficient to be

$$c_4 = st\, A_4^{(tree)}(1^-,2^-,3^+,4^+)\,,$$

from the study of 2-particle cuts in the t and s channel. Furthermore we arrived at the relation

$$\begin{aligned} c_{3;a}\,\mathrm{Disc}(t) I_{3;a} + c_{3;b}\,\mathrm{Disc}(t) I_{3;b} + c_2\,\mathrm{Disc}(t) I_2 = \\ \frac{1}{\langle 23\rangle\langle 34\rangle\langle 41\rangle}\,\frac{1}{t^2}\left(\frac{\langle 13\rangle\langle 2|l_2|3]}{(l_2+p_3)^2} + \frac{\langle 14\rangle\langle 2|l_2|4]}{(l_2-p_4)^2}\right) \times \\ \times\Big[(4-n_f)\,\left(\langle 41\rangle^2\,\langle 2|l_2|4]^2 + \langle 23\rangle^2\,\langle 1|l_2|3]^2\right) \\ +(n_s-6)\,\langle 23\rangle\langle 41\rangle\,\langle 2|l_2|4]\,\langle 1|l_2|3]\Big]\,. \end{aligned}$$

Start from here and show that the triangle coefficients $c_{3;a}$ and $c_{3;b}$ vanish!