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 $A_4^{(1\text{-loop})}(1^-,2^-3^+,4^+)$ at the one-loop level. We derived the box coefficient to be

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

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

$$c_{3,a} \text{Disc}(t)I_{3,a} + c_{3,b} \text{Disc}(t)I_{3,b} + c_2 \text{Disc}(t)I_2 =$$

$$\frac{1}{(23)(34)(41)} \frac{1}{t^2} \left( \frac{\langle 13 \rangle \langle 2 \mid l_2 \mid 3 \rangle}{(l_2 + p_3)^2} + \frac{\langle 14 \rangle \langle 2 \mid l_2 \mid 4 \rangle}{(l_2 - p_4)^2} \right) \times$$

$$\times \left[ (4 - n_f) \left( \langle 41 \rangle^2 \langle 2 \mid l_2 \mid 4 \rangle^2 + \langle 23 \rangle^2 \langle 1 \mid l_2 \mid 3 \rangle^2 \right)$$

$$+ (n_s - 6) \langle 23 \rangle \langle 41 \rangle \langle 2 \mid l_2 \mid 4 \rangle \langle 1 \mid l_2 \mid 3 \rangle \right].$$

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