Problem Set 6: Scattering amplitudes in gauge theories

Discussion on Wednesday 30.04 13:45-14:30, HIT H 51
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Exercise 10 – The \( n \)-point MHV superamplitude

Use the super-BCFW recursion

\[
A_{n}^{\text{NP-MHV}} = \int \frac{d^4 \eta_P}{P^2} A_{3}^{\text{MHV}}(z_P) A_{n-1}^{\text{NP-MHV}}(z_P) \\
+ \sum_{m=0}^{p-1} \sum_{i=4}^{n-1} \int \frac{d^4 \eta_{P_i}}{P_i^2} A_{i}^{\text{NP-MHV}}(z_{P_i}) A_{n-1-i+2}^{\text{NP-MHV}}(z_{P_i}).
\]


to prove the MHV super-amplitude formula

\[
A_{n}^{\text{MHV}}(\lambda_i, \tilde{\lambda}_i, \eta_i) = \frac{\delta^{(4)}(p) \delta^{(8)}(q)}{\langle 12 \rangle \langle 23 \rangle \ldots \langle n1 \rangle},
\]

at \( n \)-points.

Exercise 11 – Component level amplitudes

Use the above result for \( A_{n}^{\text{MHV}} \) to establish the four point gluino-quark component field amplitudes

\[
A_{4}(1_g^-, 2_g^+, 3_g^-, 4_g^+) = \delta^{(4)}(p) \frac{\langle 31 \rangle \langle 23 \rangle \ldots \langle n1 \rangle}{\langle 12 \rangle \langle n1 \rangle},
\]

\[
A_{4}(1_g^-, 2_g^+, 3_g^-, 4_g^+) = -\delta^{(4)}(p) \frac{\langle 31 \rangle \langle 24 \rangle \ldots \langle n1 \rangle}{\langle 12 \rangle \langle n1 \rangle}.
\]

What follows from this result for the 4-point single-flavor massless QCD tree-level amplitudes with one and two quark lines?