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

$$\mathbb{A}_n^{\mathrm{N}^p\mathrm{MHV}} = \int \frac{d^4\eta_P}{P^2}\,\mathbb{A}_3^{\overline{\mathrm{MHV}}}(z_P)\,\mathbb{A}_{n-1}^{\mathrm{N}^p\mathrm{MHV}}(z_P) + \sum_{m=0}^{p-1}\sum_{i=4}^{n-1}\int \frac{d^4\eta_{P_i}}{P_i^2}\,\mathbb{A}_i^{\mathrm{N}^m\mathrm{MHV}}(z_{P_i})\,\mathbb{A}_{n-i+2}^{\mathrm{N}^{(p-m-1)}\mathrm{MHV}}(z_{P_i})\,.$$

to prove the MHV super-amplitude formula

$$\mathbb{A}_n^{\mathrm{MHV}}(\lambda_i,\tilde{\lambda}_i,\eta_i) = \frac{\delta^{(4)}(p)\,\delta^{(8)}(q)}{\langle 12\rangle\langle 23\rangle\ldots\langle n1\rangle}\,,$$

at n-points.

Exercise 11 – Component level amplitudes

Use the above result for $\mathbb{A}_n^{\mathrm{MHV}}$ to establish the four point gluino-quark component field amplitudes

$$A_4(1^-_{\bar{\tilde{g}}},2^+_{\tilde{g}},3^-,4^+) = \delta^{(4)}(p)\frac{\langle 31\rangle^3\langle 23\rangle}{\langle 12\rangle\ldots\langle n1\rangle}\,,$$

$$A_4(1^-_{\bar{\tilde{g}}},2^+_{\tilde{g}},3^-_{\bar{\tilde{g}}},4^+_{\tilde{g}}) = -\delta^{(4)}(p)\frac{\langle 31\rangle^3\langle 24\rangle}{\langle 12\rangle\ldots\langle n1\rangle}\,,$$

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