On KLT and SYM-supergravity relations from 5-point 1-loop amplitudes

We derive a new non-singular tree-level KLT relation for the $n=5$-point amplitudes, with manifest $2(n-2)!$ symmetry, using information from one-loop amplitudes and IR divergences, and speculate how one might extend it to higher n-point functions. We show that the subleading-color ${\cal N}=4$ SYM 5-point amplitude has leading IR divergence of $1/\epsilon$, which is essential for the applications of this paper. We also propose a relation between the subleading-color ${\cal N}=4$ SYM and ${\cal N}=8$ supergravity 1-loop 5-point amplitudes, valid for the IR divergences and possibly for the whole amplitudes, using techniques similar to those used in our derivation of the new KLT relation.

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