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Monodromies and the structure of gauge and gravity amplitudes

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We show that different color-ordered tree-level amplitudes in gauge theories satisfy monodromy relations. These relations imply the existence of minimal basis of amplitude and provide the numerator factors of the amplitude for a parametrisation of the tree-level amplitude using only cubic vertices. Applications to supergravity amplitudes follow straightforwardly through the KLT-relations. Through the cuts, these tree-level relations give rise to non-trivial identities at loop level. At higher loop this constrains the critical ultraviolet behaviour of the four-graviton amplitude in $N=8$ supergravity to all order in perturbation. We argue this implies that the four-graviton $N=8$ amplitudes has a seven-loop logarithmic divergence in four dimensions.

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