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The Three-Loop Four-Point Amplitude in planar $\mathcal{N} = 4$ Super Yang-Mills via the Amplituhedron ANATOLIY DOVBNYA, UC Davis — The traditional approach to quantum field theory leads to the introduction of unnecessary and unphysical redundancies, obscures certain symmetries, and results in computational difficulties associated with calculating scattering amplitudes for almost all interesting non-trivial processes. However, the apparent complexity is usually not present in the final answer. In recent years, a new perspective on reformulating quantum field theory involving the purely geometric object known as amplituhedron has been proposed. In this approach, locality and unitarity do not play a central role but rather emerge as derived features from the positive geometry of the amplituhedron. Scattering amplitudes can then be calculated through the computation of amplituhedron volume with a specific volume form. Following these recent discoveries, we continue to explore the amplituhedron in the simplest case of the integrand for four-particle scattering amplitude in planar $\mathcal{N} = 4$ SYM and give an explicit calculation for the three-loop case. This result is compared with the known result obtained by unitarity methods found in literature.

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