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Massive sunset and kite diagrams with elliptics

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One of the most important tasks of modern science is the search for the so-called “new physics” beyond the SM (BSM). The most promising method which is used in this quest is the search for deviations from the SM at the LHC as well as on other accelerators and experiments. At the same time, it should be noted that the vast majority of calculations in the SM are done within the framework of perturbation theory. The latter means that we need to calculate a sufficient number of terms in perturbation series. This is necessary in order to be able to distinguish the hypothetical signals of new physics from the unaccounted effects of the Standard Model. However, we cannot always accurately calculate two and higher-loop corrections. This difficulty is due to the fact that we do not have a single reliable method for the analytical calculation of the so-called elliptic Feynman integrals. The latter often appear in practical calculations. In this case, the analytical result would be most preferable to us, since it allows to obtain the most accurate predictions. In matters of analytical computations of such integrals, great success has been achieved in connection with the use of the so-called elliptic multiple polylogarithms (eMPLs). Nevertheless, we know that not all problems can be solved in terms of eMPLs. In this report, we present the results for two-loop kite diagrams with one, two, and zero massless lines. The last two cannot be expressed in terms of eMPLs, so we introduce a new class of functions that can be called iterated integrals with algebraic kernels. These results were obtained with the help of a new integral representation for sunset subgraphs and with the use of the differential equation method for the system of master integrals. We will also discuss the potential of the developed method for solving specific phenomenological problems.

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