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(G*) Numerical Loop-Integration Methods for Thermal Field Theory

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The basic structure of quantum field theory that is used to describe the Standard Model of fundamental interactions of nature is usually formulated for zero temperature. However, the effects of temperature are extremely important for understanding a number of physical processes such as the electro-weak phase transition and quark-gluon plasma. Thermal field theory is the extension of quantum field theory to a non-zero temperature environment and is achieved by modifying the propagators in loop integrations represented by Feynman diagrams. The Python program pySecDec numerically calculates dimensionally-regularized loop integrals in quantum field theory using the sector decomposition approach. It is shown how pySecDec can be applied to thermal field theory numerical calculations using modifications within the Matsubara formalism. Using the formulated algorithm, a 2-point correlation function (such as those occurring in QCD correlation functions) at finite temperature can be numerically calculated for a variety of spacetime dimensions.

Author: LI, Siyuan (University of Saskatchewan)

Co-authors: Dr STEELE, Tom; Dr HARNETT, Derek

Presenter: LI, Siyuan (University of Saskatchewan)

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