Particle Theory Seminar

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"Perturbation Theory Without Diagrams"

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Abstract:

Higher-order perturbative calculations in Quantum (Field) Theory suffer from the factorial increase of the number of individual diagrams. Here I describe an approach which evaluates the total contribution numerically for finite temperature from the cumulant expansion of the corresponding observable followed by an extrapolation to zero temperature. This method (originally proposed by Bogolyubov and Plechko) is applied to the calculation of higher-order terms for the ground-state energy of the polaron. Using state-of-the-art multidimensional integration routines two new coefficients are obtained corresponding to a 4- and 5-loop calculation. Several analytical and numerical procedures have been implemented which were crucial for obtaining reliable results.