

Path Integration in Statistical Field Theory: from Quantum Mechanics to Interacting Fermion Systems

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We begin with a short introduction to statistical field theory at finite temperature and density. We proceed to express expectation values of observables (energies, masses, condensates) and thermodynamic potentials in terms of functional integrals. These formal integrals are then approximated by a discretisation of space on a finite (hypercubic) lattice. The resulting high-dimensional integrals can be estimated with stochastic means. We discuss Monte-Carlo algorithms for systems of interacting relativistic fermions. They describe Dirac materials with linear dispersion relation and at the same time model certain low-energy properties of strong interaction. If time admits we also comment on recent simulations of supersymmetric field theories.

A. Wipf, *Statistical Approach to Quantum Field Theory*,
(Lecture Notes in Physics 864, Springer 2013)

M. Bartelmann, B. Feuerbacher, T. Krüger, D. Lüst, A. Rebhan, A. Wipf,
Theoretische Physik (Springer 2014)