



**UNIVERSITÄT
BIELEFELD**

Fakultät für Physik

Michael Mandl

Universität Graz

Kernels and Integration Cycles in Complex Langevin Simulations

Many physical systems of interest, e.g., Quantum Chromodynamics at nonzero baryon density or real-time quantum field theory, suffer from the infamous sign problem, rendering conventional lattice approaches based on importance sampling inapplicable. One method aimed at by-passing this issue is the complex Langevin approach, which is based on a stochastic evolution of the (complexified) degrees of freedom. This stochastic evolution, however, sometimes converges to an equilibrium distribution that produces incorrect results for physical observables. This wrong convergence can - in principle - be cured by the introduction of a so-called kernel into the complex Langevin equations, such that the conventional correctness criteria are satisfied.

However, as I demonstrate in this talk, the resulting observables might nonetheless be incorrect due to contributions from unwanted so-called integration cycles, which are certain integration paths in complexified field space, that might be sampled in a simulation. In particular, I elaborate on the relation between the kernel and the relevant integration cycles and how one may obtain correct results in simple toy models.

Thursday, 16 January 2025

14:15

D6-135