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Complex Langevin Simulations: Reliability and applications to full QCD at non-zero density

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M. Scherzer, E. Seiler, D. Sexty and I.-O. Stamatescu Complex Langevin (Equation) is a well defined method providing a general instrument for ab initio, approximation free studies of realistic lattice models even for complex action. The latter include full QCD at finite density and CLE appears as the only method presently applied in this context. The complexification of the variable space required by a complex action introduces, however, special conditions to be satisfied in order to ensure correct convergence. Analyzing these conditions led to the development of procedures and criteria which allow to control the simulations and define physical reliability regions. We here develop one essential condition directly related to the correctness proof to a general criterion applicable on-line also to QCD and discuss its relation to other criteria. We also present full QCD CLE results for the transition from the confinement to the deconfined phase for $0 \leq \mu/T_c(\mu = 0) \leq 5$ and for observables vs μ at high temperature.

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