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Towards sampling complex actions

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For many physical systems, the computation of observables amounts to solving an integral over a strongly oscillating complex-valued function. This so-called sign problem renders the numerical evaluation of these integrals a hard computational problem. Complex Langevin dynamics is one numerical method for tackling the sign problem. In this talk, I introduce a generalized framework for this method, providing explicit access to problems hindering a general applicability of complex Langevin dynamics.

One of the key problems of complex Langevin dynamics is a potential convergence to unphysical solutions. Starting from first principles, I establish constraints on sampling processes facilitating a sampling of the physically correct solutions. The constraints are built on firm grounds by techniques of Markov chain Monte Carlo methods which warrant, as opposed to complex Langevin dynamics, explicit control of the underlying sampling process.

The approach opens up a perspective for tackling the sign problem by means of taylor-made sampling schemes.

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