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Lattice real-time simulations with machine learned optimal kernels

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Direct simulations of real-time dynamics of strongly correlated quantum fields are affected by the NP-hard sign sign-problem, which requires system-specific solution strategies [1].

Here we present novel results on the real-time dynamics of scalar field theory in 1+1d based on our recently developed machine-learning assisted kernelled complex Langevin approach [2]. By using simple field independent kernels and an improved optimization functional [3] we manage to extend the validity of the simulations to a real-time extent twice the current community benchmark (which was based on contour deformations). Due to the favourable numerical cost of our CL approach we are able to avoid discretisation artefacts that plagues previous simulations.

[1] M. Troyer, U.-J. Wiese Phys.Rev.Lett. 94 (2005) 170201 (cond-mat/0408370)
[2] D. Alvestad, R. Larsen, A. Rothkopf, JHEP 04 (2023) 057 (2211.15625)
[3] D. Alvestad, A. Rothkopf, N. Lampl, D. Sexty (in preparation)

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Algorithms and Artificial Intelligence

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