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Gaussian states for the variational study of (1+1)-dimensional lattice gauge models

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Gaussian states, meaning states whose density matrix can be expressed as a Gaussian function in the creation and annihilation operators, are widely used in various areas to describe fermionic as well as bosonic systems. However, in cases where both bosons and fermions are present, they cannot describe any correlations between the two species beyond mean-field. This renders them at first glance unsuitable for the description of lattice field theories with gauge and matter degrees of freedom.

In this talk, we show how to derive a set of unitary transformations for (1+1)-dimensional gauge models which allow us to disentangle the relevant degrees of freedom. The resulting formulation can be addressed with a Gaussian variational ansatz which makes it possible to numerically investigate static and dynamical aspects of string breaking in Abelian and non-Abelian gauge models. We show that the approach captures the relevant features and reliably describes the static properties as well as the out-of-equilibrium dynamics of the phenomenon. Benchmarking our results against those obtained from Tensor Network simulations, we observe excellent agreement although the number of variational parameters in the Gaussian ansatz is much smaller.

Primary authors: Prof. DEMLER, Eugene (Harvard University); Prof. CIRAC, J.Ignacio (Max Planck Institute of Quantum Optics); Dr BANULS, Mari Carmen (Max Planck Institute of Quantum Optics); SALA, Pablo (Technical University of Munich); Dr KUEHN, Stefan (Perimeter Institute for Theoretical Physics); Prof. SHI, Tao (Chinese Academy of Sciences)

Presenter: Dr KUEHN, Stefan (Perimeter Institute for Theoretical Physics)

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