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Finite-size scaling of Polyakov's loop in the 2D Abelian Higgs model

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Starting with the 2D Abelian Higgs model with the quartic self-coupling taken infinitely large we study the finite-size scaling of the Polyakov loop. We find an exponential decay for large temporal extents which is dictated by the energy gap between the ground states of a system with the Polyakov loop inserted, and one without. We study this system using the tensor renormalization group, and we take the continuous-time limit to obtain a quantum Hamiltonian where gauge invariance has been maintained exactly. Comparing with numerical results from the density matrix renormalization group we find universal features of the finite-size scaling of the energy gap survive this continuous-time limit. We propose an optical-lattice ladder to quantum simulate this model, and observe the universal features of the energy gap scaling.

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