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Tensor renormalization group and the volume independence in 2D U(N) and SU(N) gauge theories

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The tensor renormalization group method is a promising approach to lattice field theories, which is free from the sign problem unlike standard Monte Carlo methods. In this work, we apply the method to two dimensional U(N) and SU(N) gauge theories, where we propose a practical strategy to restrict the number of representations in the character expansion when constructing the fundamental tensor. Using this, we investigate the behaviour of singular values in the large-N limit and propose a novel interpretation of the Eguchi-Kawai reduction in the context of TRG. Additionally, with the presence of a theta term, we find a new type of volume independence in the strong-coupling phase, which goes beyond the Eguchi-Kawai reduction.

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