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Tensor renormalization group study of (1+1)-dimensional O(3) nonlinear sigma model w/ and w/o finite chemical potential

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We study the (1+1)-dimensional O(3) nonlinear sigma model using the tensor renormalization group method. At zero density we investigate the von Neumann and R\'enyi types of entanglement entropies. The central charge is determined from the asymptotic scaling properties of the entropies. We examine the consistency between two entropies. In the finite density region, where this model suffers from the sign problem, we investigate the properties of the quantum phase transition. We determine the transition point μ_c and the critical exponent ν from the μ dependence of the number density in the thermodynamic limit. The dynamical critical exponent z is also extracted from the scaling behavior of the temporal correlation length as a function of μ.

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