

# Tensor renormalization group approach to four-dimensional complex $\phi^4$ theory at finite density

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Tensor network is an attractive approach to field theory with negative sign problem. The complex  $\phi^4$  theory at finite density is a test bed for numerical algorithms to verify their effectiveness.

The model shows a characteristic feature called the Silver Blaze phenomenon associated with the sign problem in the large volume limit at low temperature. We analyze the four-dimensional model employing the anisotropic tensor renormalization group algorithm. We find a clear signal of the Silver Blaze phenomenon on a large volume of  $V=1024^4$ , which implies that the tensor network approach is effective even for four-dimensional field theory beyond two dimensions.

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