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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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