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## Phase structure analysis of 2d CP(1) model with $\theta$ term by tensor network renormalization

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We analyze the phase structure of 2d CP(1) model with  $\theta$  term by using the tensor renormalization group method. We propose a new tensor network representation for the model using the quadrature scheme and confirm that its accuracy is improved compared to the previous one. For the coarse-graining algorithm, we employ not only the conventional one but also the bond-weighted one in order to further improve the accuracy. As a probe to study the phase structure we adopt the central charge and find that  $c = 1$  for  $\beta > 0.55$  at  $\theta = \pi$ . This result indicates the BKT transition, which is consistent with the Halden conjecture.

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