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Entanglement Entropy and Entanglement Spectrum for Two-Dimensional Classical Spin Configuration HIROAKI MATSUEDA, Sendai National College of Technology — In quantum spin chains at criticality, two types of scaling for the entanglement entropy exist: one comes from conformal field theory (CFT), and the other is for entanglement support of matrix product state (MPS) approximation. On the other hand, quantum spin-chain models can be mapped onto two-dimensional (2D) classical ones. Motivated by the scaling and the mapping, we introduce new entanglement entropy for 2D classical spin configuration as well as entanglement spectrum, and examine their basic properties in the Ising and the three-state Potts models on the square lattice. They are defined by the singular values of the reduced density matrix for a Monte Carlo snapshot. We find scaling relations of the entropy analogous to the CFT and the MPS results. At criticality, the spin configuration is fractal, and various sizes of ordered clusters coexist. Then, the original snapshot can be decomposed into a set of images, and they have different length scales, respectively. This is the origin of the scaling. Based on these observations as well as calculation of the entanglement spectrum, we conclude that the amount of information of only one snapshot at criticality is equal to that of 1D quantum critical systems.

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