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Definitions of entanglement entropy of spin systems in the valence-bond basis[1] YU-CHENG LIN, Applied Physics, National Chengchi University, ANDERS SANDVIK, Physics, Boston University — The valence-bond structure of spin-1/2 Heisenberg antiferromagnets is closely related to quantum entanglement. We investigate definitions of entanglement entropy based on individual valence bonds connecting two subsystems, as well as shared loops of the transposition graph (overlap) of two valence-bond states [1]. We reformulate a previously used definition based on valance bonds in the wave function as a true ground state expectation value, and find that its scaling for the Heisenberg chain agrees with an exact result. The loop-based entanglement entropy of the two-dimensional Heisenberg model is shown to satisfy the area law (with an additive logarithmic correction), unlike single-bond definitions (which exhibit multiplicative logarithmic corrections).

[1] Y.-C. Lin and A.W. Sandvik, arXiv:1005.0821.

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