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Entanglement Entropy and Topological Order in Resonating Valence-Bond Quantum Spin Liquids JULIA WILDEBOER, National High Magnetic Field Laboratory, ALEXANDER SEIDEL, Washington University in St. Louis, ROGER MELKO, University of Waterloo, PI — On the triangular and kagome lattices, short-ranged resonating valence bond (RVB) wave functions can be sampled without the sign problem using a recently-developed Pfaffian Monte Carlo scheme [1]. In this talk [2], we present a study of the Renyi entanglement entropy in these wave functions using a replica-trick method [3]. Using various spatial bipartitions, including the Levin-Wen construction, our finite-size scaled Renyi entropy gives a topological contribution consistent with $\gamma = ln(2)$, as expected for a gapped Z_2 quantum spin liquid. We prove that the mutual statistics are consistent with the toric code anyon model and rule out any other quasiparticle statistics such as the double semion model.
[1] J. Wildeboer and A. Seidel, PRL **109**, 147208 (2012).
[2] J. Wildeboer, A. Seidel, and R. G. Melko, submitted to PRL.
[3] M. B. Hastings, I. Gonzalez, A. B. Kallin, and R. G. Melko, PRL **104**, 157201 (2010).

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