Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Renyi entropy of gapless spin liquids TARUN GROVER, YI ZHANG, ASHVIN VISHWANATH, UC Berkeley — Spin liquids are exotic quantum states that do not break any symmetry. Though much is known about gapped spin-liquids, critical spin-liquids with strongly interacting gapless excitations in two and three spatial dimensions are less understood. Candidate ground state wave-functions for such states however can be constructed using the Gutzwiller projection method. We use bipartite entanglement entropy, in particular the Renyi entropy S_2 to investigate the quantum structure of these wave-functions. Using the Variational Monte-Carlo technique, we calculate the Renyi entropy of a critical spin liquid - the projected Fermi sea state on the triangular lattice. We find a violation of the boundary law, with S_2 enhanced by a logarithmic factor, an unusual result for a bosonic wave-function reflecting the presence of emergent spinons that form a Fermi surface. The Renyi entropy for algebraic spin liquids is found to obey the area law, consistent with the presence of emergent Dirac fermions in the system. Projection is found to completely alter the entanglement properties of nested Fermi surface states. These results show that the Renyi entropy calculations could serve as a diagnostic for gapless fractionalized phases.

Tarun Grover
UC Berkeley

Date submitted: 19 Nov 2010

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