Quantum Hall States and Entanglement Entropy

Naokazu Shibata

Department of Physics, Tohoku University, Aoba, Aoba-ku, Sendai, 980-8578 JAPAN

Entanglement entropy of two-dimensional (2D) electron systems in magnetic field is studied by the density matrix renormalization group (DMRG) method. Many body interacting systems on torus and spherical geometries are mapped onto 1D models by using guiding center X, and angular momentum m, respectively[1]. We apply the standard DMRG method to the effective 1D models with long-range interaction and calculate the entanglement entropy S of 2D topologically ordered states at fractional fillings $1/m$ of the Landau level. We also study 2D bilayer systems, whose degrees of freedom are described by charges and pseudospins. The entanglement entropy S and the coefficient c in area law $S = cL - \gamma + O(1/L) + ...$ are analyzed for various sizes of the system in torus and spherical geometries.

References

[1] N. Shibata, J. Phys. A **36** (2003) R381; N. Shibata and D. Yoshioka, Phys. Rev. Lett. **86** (2001) 5755.