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Entanglement entropy of quantum Hall systems in torus and spherical geometry

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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. The DMRG method is then applied to these 1D models and the entanglement entropy S of topologically ordered states is calculated at fractional fillings $1/m$ of the Landau level. We also study 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.