Polarized Fractional Quantum Hall States at 1/3 and 5/2 Filling: a Density-Matrix Renormalization Group Calculation

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DONNA SHENG, Department of Physics and Astronomy, California State University, Northridge, California 91330, USA, F. DUNCAN M. HALDANE, Department of Physics, Princeton University, Princeton, NJ 08544 — In this talk, the density-matrix renormalization group method is employed to investigate the fractional quantum Hall effect (FQHE) at filling numbers $\nu = 1/3$ and $5/2$. We present benchmark results for both filling numbers for larger system sizes to show the accuracy as well as the capacity of our numerical algorithm. Furthermore, we demonstrate that by keeping a large number of states, one can also obtain reliable entanglement spectrum at $\nu = 5/2$, which characterizes the topological properties of FQHE states. Based on a finite-size scaling analysis, we also confirm that the entanglement gap defined by Li and Haldane for $\nu = 5/2$ state with Coulomb interaction remains finite in the thermodynamic limit.