

Abstract for an Invited Paper
for the MAR09 Meeting of
The American Physical Society

Density Matrix Renormalization Group Studies of Incompressible Fractional Quantum Hall States¹

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In this talk I introduce a powerful technique, the density-matrix renormalization group (DMRG), for studying ground and excited state properties of incompressible FQH states on the sphere. This method not only reproduces the numerical results obtained earlier in the exact diagonalization studies, but we are able to extend our understanding of the ground-state and low-lying excited state properties of these FQH states to substantially larger system sizes. We address a very important open problem in fractional quantum Hall physics, namely, if the half-filled second Landau level state can exhibit non-Abelian statistics. By studying large systems on the sphere, and extrapolating to the thermodynamic limit, we determine that the ground state for this filling fraction is fully polarized for shifts corresponding to both the Moore-Read Pfaffian state and its particle-hole conjugate (anti-Pfaffian). This result is found to be robust against small variations of the interaction, strongly supporting the argument favoring a non-Abelian state. We further extend the application of this technique to identify other incompressible Hall states in the second Landau level.

¹Work done in collaboration with S. Das Sarma, C. Nayak, E. Rezayi, and K. Yang. (Phys. Rev. Lett. **100**, 166803 (2008), and arXiv:0804.4502)