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**Ground states at the filling factors  $\nu = 7/3$  and  $8/3$  in the second Landau level** TORU ITO, NAOKAZU SHIBATA, Department of Physics, Tohoku University, KENTARO NOMURA, Institute for Material Research, Tohoku University, DEPARTMENT OF PHYSICS, TOHOKU UNIVERSITY TEAM — The Laughlin state successfully describe the fractional quantum Hall state at  $\nu = 1/3$  in the lowest Landau level. However, it is known that the Laughlin wavefunction has little overlap with the ground state wavefunction at  $\nu = 7/3$  in the second Landau level. The ground states at  $\nu = 7/3$  and  $8/3$  are still unknown. To determine the ground states at these fillings, we use the exact diagonalization method and density-matrix renormalization group (DMRG) method. We calculate overlaps between the ground state and the trial wavefunctions, the ground state energies, and the ground-state pair-correlation functions. We find that the ground state wavefunction at  $\nu = 8/3$  have very high overlap between the parafermion state, and the ground state energy of the parafermion state is lower than that of the Laughlin state. Further, the short-range structures of pair-correlation functions are significantly different from that of the Laughlin state. From these results, we consider that the parafermion state is a strong candidate of the ground state at  $\nu = 7/3$  and  $\nu = 8/3$ .

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