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Spontaneous Particle-Hole Symmetry Breaking in the 5/2 Fractional Quantum Hall Effect KWON PARK, Korea Institute for Advanced Study, MICHAEL PETERSON, SANKAR DAS SARMA, University of Maryland — The essence of the $\nu = 5/2$ fractional quantum Hall effect is believed to be well captured by the Moore-Read Pfaffian (or anti-Pfaffian) description. However, an important mystery regarding the formation of the Pfaffian state is the role of the three-body interaction Hamiltonian H_3 that produces the Pfaffian as an exact ground state and the concomitant particle-hole symmetry breaking. We show that a two-body interaction Hamiltonian H_2 constructed via particle-hole symmetrization of H_3 produces a ground state nearly exactly approximating the Pfaffian and anti-Pfaffian states, respectively, in the spherical geometry. More importantly, the ground state energy of H_2 is shown to exhibit a "Mexican-hat" structure as a function of particle number in the vicinity of half filling for a given flux indicating spontaneous particle-hole symmetry breaking.

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