replacing MAR16-2015-002017. Abstract Submitt

for the MAR16 Meeting of
The American Physical Society

Zero modes, bosonization, and topological quantum order: The Laughlin state in second quantization[1] TAHEREH MAZAHERI, Department of Physics, Washington University, St. Louis, MO 63160, USA, GERARDO ORTIZ, Department of Physics, Indiana University, Bloomington, IN 47405, USA, ZOHAR NUSSINOV, ALEXANDER SEIDEL, Department of Physics, Washington University, St. Louis, MO 63160, USA — We introduce a "second-quantized" representation of the ring of symmetric functions to further develop a purely second-quantized approach to the study of zero modes of frustration-free Haldane-pseudopotential–type Hamiltonians, which in particular stabilize Laughlin ground states. We present three applications of this formalism. We start demonstrating how to systematically construct all zero modes of Laughlin-type parent Hamiltonians in a framework that is free of first-quantized polynomial wave functions, and show that they are in one-to-one correspondence with dominance patterns. Second, as a by-product, we make contact with the bosonization method, and obtain an alternative proof for the equivalence between bosonic and fermionic Fock spaces. Finally, we explicitly derive the second-quantized version of Read's nonlocal order parameter for the Laughlin state, extending an earlier description by Stone.

[1]his work has been supported by the National Science Foundation under NSF Grant No. DMR-1206781 (AS) and under NSF Grant No. DMR-1106293 (ZN).

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Date submitted: 05 Nov 2015 Electronic form version 1.4