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State Counting for Excited Bands of the Fractional Quantum Hall Effect: Exclusion Rules for Bound Excitons[1] AJIT COIMBATORE BALRAM, Pennsylvania State University, ARKADIUSZ WÓJS, Institute of Physics, Wroclaw University of Technology, JAINENDRA JAIN, Pennsylvania State University — Exact diagonalization studies have revealed that the energy spectrum of interacting electrons in the lowest Landau level splits, non-perturbatively, into bands. The theory of nearly free composite fermions (CFs) has been shown to be valid for the lowest band, and thus to capture the low temperature physics, but it over-predicts the number of states for the excited bands. We explain the state counting of higher bands in terms of composite fermions with an infinitely strong short range interaction between a CF particle and a CF hole. This interaction, the form of which we derive from the microscopic CF theory, eliminates configurations containing certain tightly bound CF excitons. With this modification, the CF theory reproduces, for all well-defined excited bands, an exact counting for $\nu > 1/3$, and an almost exact counting for $\nu \leq 1/3$. The resulting insight clarifies that the corrections to the nearly free CF theory are not thermodynamically significant at sufficiently low temperatures, thus providing a microscopic explanation for why it has proved successful for the analysis of the various properties of the CF Fermi sea.

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