UNIVERSITÄT DUISBURG ESSEN

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Entangled Pauli Principles

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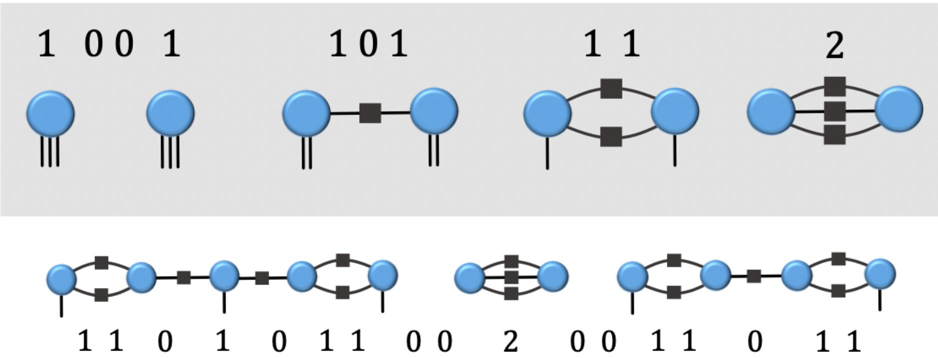

A major challenge in the study of strongly correlated electron systems is to establish a firm link between microscopic models and effective field theory. Quite often, this step involves a leap of faith, and/or extensive numerical studies. For fractional quantum Hall model wave functions, there exists – in some cases – a scheme to infer the long distance physics of a state that is both compelling and simple, and leaves very little room for ambiguity. This scheme involves a local parent Hamiltonian for the state, which unambiguously defines a “zero mode space” of elementary excitations, and what’s known as a “generalized Pauli principle”. The latter efficiently organizes the zero mode space through one-dimensional patterns satisfying local rules and effectively functions as the “DNA” of the topological phase.

Where this works, universal properties of the state emerge from counting exercises in terms of these patterns, which efficiently and unambiguously encode the edge conformal field theory and related topological data. This includes a natural scheme to infer braiding statistics directly, for both Abelian and non-Abelian states. The strong link between microscopics and effective theory brought about by the existence of a particular type of parent Hamiltonian, one which enforces a Pauli-like in its zero modes, is thus far limited to a subset of the myriad phases possible in the fractional quantum Hall regime. I will report on recent progress on extending this paradigm into new terrain where it previously did not, or did not fully apply, including most composite fermion states and their “parton” generalizations, leading to “entangled” Pauli-like principles. I will argue that these examples suggest the beginnings of a new “Hamiltonian building” framework that capitalizes on the matrix product form of fractional quantum Hall trial states, rather than their analytic first quantized form.