Exact Parent Hamiltonians for the Fractional Quantum Hall State in an Optical Lattice ELIOT KAPIT, ERICH MUELLER, Cornell University — We construct lattice Hamiltonians for which the $\nu = 1/m$ Laughlin state is an exact eigenstate. These Hamiltonians (both bosonic and fermionic versions) contain longer-range hopping terms, but the only interparticle interaction is a hard-core repulsion. Under many circumstances, these Hamiltonians are well approximated by ones with only nearest and next-nearest neighbor hoppings, and could be realized with ultracold atoms. Beyond this, we argue that variations of these fractional quantum Hall states can be observed near the Mott Lobes in a rotating optical lattice when the density of excess particles or holes is commensurate with the magnetic flux. We discuss the detection of these states.

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