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Lattice construction of pseudopotential Hamiltonians for Fractional Chern Insulators CHING HUA LEE, XIAO-LIANG QI, Stanford Univ — Fractional Chern insulators (FCIs) are new realizations of fractional quantum Hall states in lattice systems without orbital magnetic field. These states can be mapped onto conventional fractional quantum Hall states through the Wannier state representation (WSR) (Phys. Rev. Lett. 107, 126803 (2011)). In this talk, I shall show how the WSR can be used to construct FCIs pseudopotential Hamiltonians that are interaction Hamiltonians with certain ideal model wavefunctions as exact ground states. These pseudopotential Hamiltonians can be approximated by short-ranged interactions in FCIs, with the range minimized by an optimal gauge choice for the Wannier states. I will illustrate this lattice construction by showing the explicit form of the lowest pseudopotential for a few commonly used FCI models like the lattice Dirac model and the checkerboard model with Chern number C=1, and the d-wave model and triangular lattice model with C=2. The proposed pseudopotential Hamiltonians have the 1/3 Laughlin state as their ground-state when C=1, and a topological nematic (330) state as their groundstate when C=2. The proposed states can be verified by future numerical works, and in particular provide a model Hamiltonian for topological nematic states that have not yet been realized numerically.

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