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Quantum Geometry of the "Fuzzy-Lattice" Hubbard Model and the Fractional Chern Insulator[1] SAGAR VIJAY, F.D.M. HALDANE, Princeton University — Recent studies of interacting particles on tight-binding lattices with broken time-reversal symmetry reveal "zero-field" fractional quantum Hall (FQH) phases (fractional Chern insulators, FCI). In a partially-filled Landau level, the non-commutative guiding-centers are the residual degrees of freedom, requiring a "quantum geometry" Hilbert-space description (a real-space Schrödinger description can only apply in the "classical geometry" of unprojected coordinates). The continuum description does not apply on a lattice, where we describe emergence of the FCI from a non-commutative quantum lattice geometry. We define a "fuzzy lattice" by projecting a one-particle bandstructure (with more than one orbital per unit cell) into a single band, and then renormalize the orbital on each site to unit weight. The resulting overcomplete basis of local states is analogous to a basis of more than one coherent state per flux quantum in a Landau level. The overlap matrix characterizes "quantum geometry" on the "fuzzy lattice", defining a "quantum distance" measure and Berry fluxes through elementary lattice triangles. We study quantum geometry at transitions between topologically-distinct instances of a fuzzy lattice, as well as N-body states with local Hubbard interactions.

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