Symmetry protected fractional Chern insulators and fractional topological insulators

YUAN-MING LU, Department of Physics, University of California at Berkeley, Berkeley, CA 94720, USA, YING RAN, Department of Physics, Boston College, Chestnut Hill, Massachusetts 02467, USA — We construct fully symmetric wavefunctions for the spin-polarized fractional Chern insulators (FCI) and time-reversal-invariant fractional topological insulators (FTI) using the parton approach. We show that the lattice symmetry gives rise to many different FCI and FTI phases even with the same filling fraction $\nu$ (and the same quantized Hall conductance $\sigma_{xy}$ in FCI case). They have different symmetry-protected topological orders, which are characterized by different projective symmetry groups. We mainly focus on FCI phases with which are realized in a partially filled band with Chern number one and filling fraction $\nu = 1/m$. Examples of FCI/FTI wavefunctions on honeycomb lattice and checkerboard lattice are explicitly given. Possible non-Abelian FCI phases which may be realized in a partially filled band with Chern number two are discussed. Generic FTI wavefunctions preserving all lattice symmetries in the absence of spin conservation are also presented for filling fraction $\nu = 2/m$. 

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