Naren Manjunath

Title: Fractional disclination charge and discrete shift in the Hofstadter butterfly

Abstract: In the presence of crystalline symmetries, topological phases of matter acquire a host of invariants leading to non-trivial quantized responses. Here we study a particular invariant, the discrete shift S, for the square lattice Hofstadter model of free fermions. S is associated with a Z_M classification in the presence of M-fold rotational symmetry and charge conservation. S gives quantized contributions to (i) the fractional charge bound to a lattice disclination, and (ii) the angular momentum of the ground state with an additional, symmetrically inserted magnetic flux. S forms its own ‘Hofstadter butterfly’, which we numerically compute, refining the usual phase diagram of the Hofstadter model. We propose an empirical formula for S in terms of density and flux per plaquette for the Hofstadter bands, and we derive a number of general constraints. In particular, we show that bands with the same Chern number may have different values of S, although odd and even Chern number bands always have half-integer and integer values of S respectively.

Reference: https://arxiv.org/pdf/2204.05320.pdf