Critical conductivity of strongly correlated bosons in optical lattices in an Abelian synthetic magnetic field

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Topological phase engineering of neutral bosons loaded in an optical lattice opens a new window for manipulating of transport phenomena in such systems. Exploiting the Bose Hubbard model (BHM) and using the magnetic Kubo formula proposed in Ref. [1] we show, that for different synthetic magnetic field configurations, the critical conductivity at the tip of the lobe is non-universal and depends on the energy minima of the spectrum. In the case of $1/2$ and $1/3$ flux per plaquette, our results are in good agreement with those of the previous Monte Carlo (MC) study. Moreover, we show that for half magnetic-flux through the cell the critical conductivity suddenly changes in the presence of a superlattice potential with uniaxial periodicity.

References:
[1] A.S. Sajna, T.P. Polak, R. Micnas, *Phys. Rev. A*, 89, 023631 (2014)