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Vortex quantum dynamics of two dimensional lattice bosons NETANEL LINDNER, ASSA AUERBACH, Physics Department, Technion, Israel, DANIEL P. AROVAS, University of California at San Diego — We study hard core lattice bosons in a magnetic field near half filling[1]. The strong periodic potential scatters the vortices by units of reciprocal lattice momenta, enhancing their mobility and modifying their effective Magnus field. The bare vortex hopping rate on the dual lattice is extracted by exact diagonalizations of square clusters. We deduce quantum melting of the vortex lattice above vortex density of 6.5×10^{-3} per lattice site. The Hall conductivity, which reflects the vortex Magnus dynamics, reverses sign abruptly at half filling. The characteristic temperature scale of the Hall conductivity vanishes at the transition point. We prove that at half filling, each vortex carries a spin half quantum number ('v-spin'). Experimental implications of these results are relevant for diverse systems of current interest, e.g. cold atoms on rotating optical lattices, arrays of Josephson junctions and underdoped cuprate superconductors.

[1]See: arXiv:0810.2604

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