THE UNIVERSITY OF CHICAGO

COMPUTATIONAL AND APPLIED MATHEMATICS STUDENT SEMINAR

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Classification of interacting Floquet phases with $U(1)$ symmetry in two dimensions

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ABSTRACT

Consider a two dimensional lattice of interacting bosons and fermions evolving under a time-periodic (Floquet) Hamiltonian with $U(1)$ symmetry. We derive a complete classification of the phases realizable in these systems. According to our classification, there is a one-to-one correspondence between these Floquet phases with $U(1)$ symmetry and rational functions $\pi(z) = a(z)/b(z)$ where $a(z)$ and $b(z)$ are polynomials obeying certain conditions and z is a formal parameter. The physical meaning of $\pi(z)$ involves the stroboscopic *edge* dynamics of the corresponding Floquet system: $\pi(z) = \frac{p}{q} \cdot \tilde{\pi}(z)$ where $\frac{p}{q}$ is a rational number which characterizes the flow of quantum information at the edge during each driving period, and $\tilde{\pi}(z)$ is a rational function which characterizes the flow of $U(1)$ charge at the edge. We also show that $\tilde{\pi}(z)$ is directly related to the time-averaged $U(1)$ current that flows in a particular geometry. This non-quantized $U(1)$ current is a generalization of the quantized current and quantized magnetization density found in previous studies of non-interacting fermionic Floquet phases.