

MAR17-2016-020511

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

Rigidity and Criticality in Discrete Time Crystals

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Despite being forbidden in equilibrium, spontaneous breaking of time translation symmetry can occur in periodically driven, Floquet systems with discrete time-translation symmetry. The period of the resulting discrete time crystal (DTC) is quantized to an integer multiple of the drive period, arising from a combination of collective synchronization and many body localization. In this talk, I will describe a simple model for a one dimensional discrete time crystal which explicitly reveals the rigidity of the emergent oscillations as the drive is varied. I will analyze the properties of the dynamical phase transition where the time crystal melts into a trivial Floquet insulator. Effects of long-range interactions and pre-thermalization will be considered in the context of recent DTC realizations in trapped ions and solid-state spins.