Resonant time-symmetry breaking in coupled oscillators

Mark Dykman

Michigan State University, Michigan State University, 567 Wilson Rd., East Lansing, USA

A periodically driven system has discrete time-translation symmetry with the period of the driving. Its quantum dynamics is described in terms of the Floquet states. A driven nonlinear oscillator allows one to see peculiar features of tunneling and dissipation in the Floquet world. Generally, if a system is in a Floquet state, its dynamical variables oscillate with the period of the driving. However, the discrete time-translation symmetry can be broken, the "time crystal" effect. Nonlinear oscillators, including nanomechanical systems and modes in electromagnetic cavities, can be used to study this effect. We will discuss the quantum phase transition to the broken-symmetry state in systems of coupled oscillators. The transitions occur due to a comparatively weak resonant driving. We will show that heating is exponentially suppressed, no many-body localization is required for this suppression. Time permitting, we will discuss frustration and a transition to a topologically nontrivial period-3 state.