Parametric resonance in mesoscopic oscillators: connecting some dots

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Parametric resonance has been known for millennia, but mesoscopic systems, in particular nanomechanical resonators, cold atoms, and microwave cavity modes, have breathed new life into this phenomenon. They have allowed studying it not only in the classical, but also in the quantum setting. Importantly, parametric resonance is a nonequilibrium phenomenon, and mesoscopic vibrational systems have enabled using it to reveal generic features of systems away from thermal equilibrium. An important aspect that has emerged is the role of classical and quantum fluctuations, both small fluctuations and the squeezing effect, and large rare fluctuations that lead to phase slips. Related is a generic feature of quantum tunneling and the effect of underbarrier interference. Another area is many-body effects that emerge when parametric oscillators are coupled together. Such coupling can lead to a variety of effects, including phase transitions to the many-body states with broken discrete time translation symmetry, both in the coherent and dissipative regime. The talk will try to draw a connection between these phenomena.