



Colloquium Notice

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*Hamiltonian dynamics of optomechanical interaction
mediated by mechanically induced symmetry
breaking*

Cavity optomechanics typically relies on mechanical modulation of optical frequencies to couple optical and mechanical degrees of freedom. Here we study a different mechanism, based on mechanically induced symmetry breaking that couples otherwise independent optical modes. Systems with this type of interaction exhibit non-trivial Hamiltonian dynamics even in the absence of external drive and dissipation, in contrast to standard models where the absence of pumping leads only to a trivial equilibrium shift. This dynamics is marked by a bifurcation: above a critical photon number the trivial equilibrium becomes unstable. In the stable regime, optical and mechanical degrees of freedom share a common spectrum and undergo amplitude-modulated oscillations. Beyond the bifurcation, their behavior diverges: the mechanical oscillator settles into periodic motion at its natural frequency, while the optical modes oscillate at much higher frequencies determined by the mechanical amplitude, with adiabatic modulation. Such adiabatic behavior is interrupted by sudden jumps reminiscent of Landau-Zener transitions in a quantum two-level system. This symmetry-breaking-mediated interaction provides an alternative route for controlling energy exchange between optical and mechanical subsystems, and establishes symmetry breaking as a principle for engineering optomechanical interactions in degenerate cavities.

Monday

October 27, 2025

Starts at 12:15 PM

Coffee at 12:00 PM

Physics Conference Room, SB B326

This talk is accessible via [Zoom](#) or use

meeting ID 829 2687 2594 and **passcode 866995** to join