Beyza Sütlüoğlu Ege (Bilkent University, Türkiye)

Title: Non-Hermitian optomechanical cooling and squeezing under synthetic gauge field control

Abstract: We theoretically study optomechanical cooling and squeezing in a non-Hermitian ternary coupled system composed of an optical cavity and two mechanical resonators. The couplings among the cavity and mechanical resonators form a closed-contour interaction accompanied by a Peierls phase. We illustrate a parameter regime where mechanical resonators can be individually cooled. Additionally, amplitude modulation is imposed over the cavity-pumping laser to achieve mechanical squeezing. As the so-called exceptional point singularity approaches in the parameter space, we observe an enhancement of optomechanical cooling and squeezing. This can be controlled by the closed-loop phase that acts as a synthetic gauge field. By adjusting the global phase, specific mechanical resonator can be targeted for cooling and mechanical squeezing. We use Floquet formalism to analyze the system's behavior. Due to the potential instability to be caused by modulation, we investigate the system's stability and the mechanical sector's root loci under a realistic range of parameters.