天津大学 Tianjin University

机械工程学院 School of Mechanical Engineering

International Lecture on "Mechanics and Physics of Advanced Materials and Structures" Lecture 39

Presentation Title: ***Feedback-based phononic networks imitating quantum tunneling***

Speaker: ***Lea Sirota***

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Abstract

The striking analogy between the electronic band structure of solids and the frequency dispersion of classical systems inspired the idea of mimicking quantum effects on classical platforms. For example, a great deal of attention was devoted to mimicking quantum topological phenomena, exploiting the band structure properties to achieve unique functionalities such as beam-like narrow waves, which are immune to backscattering from corners and structural defects. However, entire class of quantum phenomena related to tunneling remains significantly underexplored for classical waveguiding. This includes Klein tunneling of particles through potential barriers of arbitrary heights and widths, tunneling of particles across the event horizon of black holes, tunneling in superconducting systems, and more. The common property of these effects is an unusual and counterintuitive ability of the particles to cross gaps, barriers, or interfaces, despite this crossing being seemingly forbidden by energy considerations. In the talk we will see classical-mechanical analogy of several such effects, including tunneling through the event horizon, and a tunneling-like effect in non-Hermitian systems, which turn out to require structural couplings that violate the rules of classical dynamics. We will see how these couplings can be precisely realized using feedback control in active phononic networks in real-time.

Short CV

Lea Sirota is an Assistant Professor and the head of the Active Wave Control research group at the School of Mechanical Engineering, Tel Aviv University, since July 2020. She received her BSc degree in Mechanical Engineering and her PhD degree (direct track), both at the Technion – Israel Institute of Technology, respectively in 2008 and 2016. During 2016-2018 Lea was a postdoctoral associate at the Active-Adaptive Control lab at Massachusetts Institute of Technology, and during 2019 at the Physics of Complex Systems lab at Tel Aviv University. Her research is focused at actively-controlled metastructures that realize autonomous and reprogrammable guiding of acoustic/mechanical waves. In particular, she is passionate about waveguding inspired by quantum-mechanical phenomena, real-time wave absorbers, artificial acoustic fields, and cloaking.

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