MECHANICAL ENGINEERING SEMINAR

Monday, June 30, 2025 at 14:30, D. Dan and Betty Kahn Building, Room 217

Metamaterials driven by broken symmetries

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Hosted by Prof. Alon Wolf

Wave manipulation is a long-standing challenge in both science and engineering. I will present two different approaches developed in my group that share one feature: both are driven by broken symmetries.

First, I will introduce our approach for breaking Hermitian symmetry, which enables degenerate states called exceptional points and leads to anomalous wave propagation. The conventional route to access these features is to generate and balance material gain and loss. I will show how the unique nature of elastodynamics can be harnessed to reproduce non-Hermitian phenomena such as negative refraction and frozen modes using only conservative elastic layers, eliminating the need for active components.

In the second part, I will show how breaking spatial symmetry in piezoelectric media at the mesoscale generates metamaterial property not found in nature. I term it the *electromomentum coupling*, since it couples the macroscopic linear momentum density with the electric field. I will then show how our approach also applies to heat conduction, revealing unprecedented thermal bianisotropic terms. Our results open avenues to detect, generate, and transport elastic, electromagnetic and thermal signals in efficient ways.

Seminars Coordinator: Assoc. Prof. Shmuel Gal.