MECHANICAL ENGINEERING SEMINAR

Monday, Nov 23 2026 at 14:30, D. Dan & Betty Kahn Building, Auditorium 1

Mechanical Screening in Solids: A Geometric Framework from Metamaterials to Disordered Matter

Michael Moshe, Ph.D.
Associate Professor of Physics
Racah Institute of Physics, The Hebrew University, Jerusalem
Email: Michael.Moshe@mail.huji.ac.il

Hosted by: Associate Professor. Gal Shmuel

In this talk I will introduce a simple geometric formulation of solid-like materials with internal stress-relaxation mechanisms, including mechanical metamaterials, glassy solids, granular matter, and epithelial tissues. These internal rearrangements can be understood within a unified geometric framework of mechanical screening, in which they act as singular sources of curvature. Borrowing concepts from electrostatic screening, the resulting continuum theory generalizes classical elasticity by introducing new screening moduli that describe the coupling between external deformations and internal rearrangements. Unlike its electrostatic counterpart, mechanical screening exhibits a richer phenomenology even in the linear regime, with multiple distinct screening behaviors and qualitatively new mechanical responses. I will demonstrate how this framework captures a broad range of physical systems, from holes in metamaterials to localized plastic rearrangements in amorphous solids and T1 transitions in epithelial tissues. Particular attention will be given to disordered granular solids, which lack a conventional continuum description. Experiments reveal mechanical responses that lie outside the scope of classical mechanics yet are quantitatively captured by an odd-screening theory, a non-conservative extension of mechanical screening that does not derive from an elastic energy. Finally, I will discuss how mechanical screening extends to three-dimensional solids and may provide a natural framework for understanding a new hexatic-like state of 3D matter.

Short Bio:

Michael Moshe is a theoretical physicist at the Racah Institute of Physics, The Hebrew University of Jerusalem. His research explores the interplay between geometry and mechanics in soft, disordered, and living matter. He develops continuum theories that connect microscopic interactions with emergent macroscopic behavior, with particular emphasis on geometric frustration, mechanical screening, growth, defects, and shape formation. His work combines methods from differential geometry, continuum mechanics, statistical physics, field theory, and elasticity theory to study a broad range of systems, including thin elastic sheets, self-assembled materials, granular matter, amorphous solids, cellular tissues, and biological materials. A central theme of his research is the development of geometric and field-theoretic frameworks that reveal universal principles governing the mechanics of complex materials. Michael received his Ph.D. in Physics from The Hebrew University of Jerusalem in 2016. He subsequently held postdoctoral positions at Syracuse University (2016) and at Harvard University (2017-2018). In 2018, he returned to The Hebrew University of Jerusalem, where he established his independent research program at the Racah Institute of Physics.

Seminars Coordinator: Prof. Sefi Givli