The Iby and Aladar Fleischman
Faculty of Engineering
Department of Materials Science and Engineering

אוניברסיטת תל-אביב
TEL AVIV UNIVERSITY

הפקולטה להנדסה
ע"ש איבי ואלדר פליישמן
המחלקה למדע והנדסה של חומרים

You are cordially invited to attend this seminar to be held on

Wednesday, April 6th, 16:00
Room 103, Engineering Class (Kitot) Building

Classical shear cracks drive the onset of frictional motion

ILYA SVETLIZKY

The Racah Institute of Physics, The Hebrew University of Jerusalem, Jerusalem, Israel.

ilya.svetlizky@mail.huji.ac.il

A dry frictional interface is composed of an ensemble of discrete contacts. Motion at each point along the interface is only initiated when contacts are broken via propagating ruptures. Characterization of the dynamic fields that drive these ruptures and how they couple to the dissipative mechanisms on the interface are therefore critical to our fundamental understanding of frictional motion and have important implications to various fields such as tribology, the fracture of weak interfaces and earthquake dynamics. We study these frictional ruptures by performing dynamic stick-slip experiments of spatially extended acrylic blocks. Their structure is revealed by simultaneous high-speed measurements (at μs time scales) of the real contact area and local strain field variations at the onset of motion. We demonstrate how brittle fracture theory provides an excellent quantitative description of these frictional ruptures. We first show that the strains surrounding propagating rupture tips are quantitatively described by classical singular solutions, originally derived to describe brittle shear cracks [1]. This theoretical framework, moreover, quantitatively predicts the lengths of spontaneously arrested ruptures [2]. We furthermore show that inclusion of non-singular terms provides a quantitative description of the measured stress-waves radiated by rapidly accelerating ruptures. This radiation has a characteristic, highly localized form and is sufficiently energetic to nucleate secondary supershear ruptures (ruptures beyond the shear wave speed)[3].

Selected Refernces:

[1] I. Svetlizky and J. Fineberg, Nature, 509 (2014) 205-8
[2] E. Bayart, I. Svetlizky and J. Fineberg, Nature Physics, 12 (2016) 166-70
[3] I. Svetlizky et.al, PNAS, 113 (2016) 542-7

Biosketch

Ilya Svetlizky is pursuing his direct-track PhD in Prof. Jay Fineberg's group at the Hebrew University of Jerusalem. His research revolves around understanding the detailed dynamical aspects of frictional instabilities and how these are related to dynamic fracture mechanics. In 2009 he completed a B.Sc. in physics at the Hebrew University. As a PhD student he won the Racah Prize for achievements in research.