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, December 2nd, 16:00
Room 103, Engineering Class (Kitot) Building

Resonantly Tuned Raman Scattering in MoS2

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The systems of layered materials of transition metal dichalcogenides in general, and particularly MoS2, have attracted significant attention recently. The ability to easily obtain controlled number of layers allows for a systematic examination of the evolution of their properties with thickness.
Resonant Raman scattering has been widely used to study electronic band structures and to investigate the nature of electron-phonon interactions in semiconductors. A key issue in those studies is the role played by intermediate exciton states.
In the first part of the talk I will briefly describe a study we reported a while ago [1] on the temperature (at ambient pressure) and pressure (at ambient temperature) dependence of Raman spectra of a single crystal of 2H-MoS2, as the exciton energies are tuned into resonance with the energy of the excitation laser at EL=1.96 eV. The separate contributions of temperature and pressure in shifting the excitons are oppositely signed (~-0.06 vs. ~+0.12). The question arises as to whether the calculations that take into account both effects can be adequately reproduced in the experiment. I will address this issue by presenting our recent study [2], where we explored the combined effect of T-P in the range of 6 to 300 K and up to 6 GPa.
In the third part of the talk I will discuss our recent study [3] where we explored the higher order phononic transitions in MoS2 for thickness down to the single layer. Our systematic study clarifies the nature and simplifies the representation of ~80 multiphonon resonant, low temperature Raman transitions of 2H-MoS2. The analysis consists of a comprehensive symmetry assignment from which we extract a complete set of allowed transitions at the M and K Brillouin edges.
In the last part the talk I will refer to our unpublished work on the system of Inorganic Fullerenes (IF), where we argue for correspondence between the structural properties and the measured resonant Raman response.

References

[1] T. Livneh and E. Sterer "Resonant Raman scattering at exciton states tuned by pressure and temperature in 2H-MoS2 " Phys. Rev. B 81, 195209 (2010).
[2] T. Livneh, J.S. Reparaz, and A.R. Goñi "The combined temperature and high pressure effects on the resonant Raman scattering in 2H-MoS2 ",In preparation
[3] T. Livneh and J.E. Spanier "A comprehensive multiphonon spectral analysis in MoS2", 2D Materials, 2, 035003(2015)

Biosketch

Dr. Tsachi Livneh is a senior researcher in the Physics department at the Nuclear Research Center, Negev (NRCN), combining optical spectroscopy and materials research. He conducted his doctoral research in Prof. Micha Asscher's laboratory at the Hebrew University, Jerusalem, exploring the photochemistry on well defined metal surfaces; In 2004 he spent a Sabbatical year at the University of California Santa Barbara (UCSB) with Prof. Martin Moskovits, exploring polarized Raman from single semiconductive nanowires. In 2011 he spent a short Sabbatical leave at the Drexel university in Philadelphia with Prof. Jonathan Spanier expanding his Raman scattering exploration of the layered dichalcogenide MoS2, down to a single layer level.