Bar-Ilan University
אוניברסיטת בר-אילן

Faculty of Exact Sciences
Department of Chemistry

הפקולטה למדעים מדויקים
המחלקה לכימיה

S P E C I A L S E M I N A R

Sunday, 12/01/2020, 10:30 am

Building 211, seminar room

SPEAKER:

Dr. Ido Hadar

Department of Chemistry,
Northwestern University

TOPIC:

Novel Semiconductors for Electro-Optical Applications – Solar-Cells, Detectors and Light Emission

Abstract:

Semiconductor materials are the building blocks of most modern technologies and specifically all sorts of electro-optical applications. In this field, there is a constant search for the 'next-generation' materials that will lead to improved, simpler, and cheaper devices and in some cases, to entirely new applications. In my talk, I will present three examples of electro-optical materials I have studied during the recent years – simple and stable absorbers for photovoltaic devices, novel semiconductors for hard radiation detection, and soft-semiconductors with unique light-emitting properties.

In the first case, I will present our research on selenium based solar cells. Selenium is the world's 'oldest' semiconductor and its photovoltaic properties were discovered about 150 years ago. In our study, we examined how selenium can be utilized as a modern thin-film solar cell, we indicated the primary considerations for its processing, and proposed a path for future improvements of these devices by alloying selenium to reduce its bandgap energy.

For the application of hard radiation detection, we have studied various metal halide perovskites and related compounds. Detecting high energy radiation such as gamma-

rays and alpha particles with low interaction cross-section and dose is a challenging task that requires semiconductors with exceptionally low defect levels and dark currents. We showed that metal halide perovskites could achieve such requirements with a fairly simple process and with proper device structure, can detect gamma and alpha radiation at room temperature. I will also present our current research, focusing on developing sensitive X-ray detectors based on these compounds.

Finally, I will discuss some unique optical properties of low-dimensional metal halide perovskites that arise from their soft lattice and specifically our study of white-light-emitting compounds. These compounds efficiently emit photons at a broad energy spectrum, enabling their utilization for solid-state lightening and color conversion applications. Our research in this field is focused on developing novel and efficient white-light-emitting compounds as well as understanding the fundamental properties of this process.