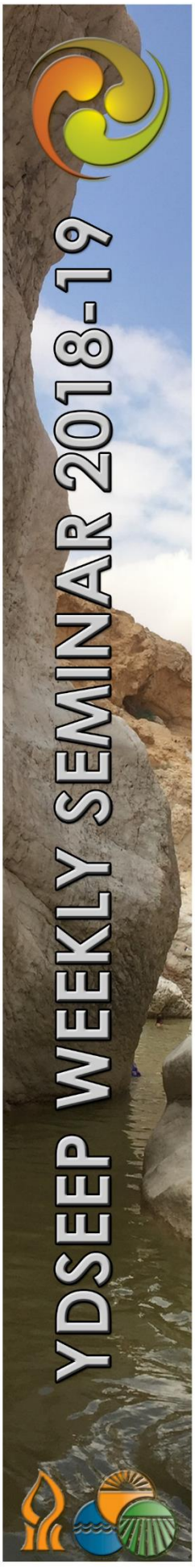

Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
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The Chiral Induced Spin Selectivity Effect (CISS)

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Abstract

Living organisms rely on chiral molecules, such as nucleic acids and proteins. A chiral molecule is not superimposable on its mirror image, also known as its enantiomer, just like our right hand cannot be superimposed on our left hand. Organisms contain only one enantiomeric form of a molecule, a selectivity that has prevailed through evolution. We claim that the chiral induced spin selectivity (CISS) effect can explain why enantiomeric purity might provide an advantage in biology. CISS is an electronic phenomenon in which electron transmission through chiral molecules depends on the direction of the electron spin, a quantum mechanical property associated with its magnetic moment. Thus charge displacement and transmission in chiral molecules generates a spin-polarized electron distribution. This effect; enhance electron transfer in proteins, enable Nano metric charge separation, and explain biorecognition.

From the implicational point, by utilizing the CISS effect we demonstrated a magnet less spin based Nano magnetic optical and electrical memory. To further enhance efficiency, we also investigated the interface between superconducting thin films and the magnetic layers improving and simplifying superconducting spintronic devices. The presented technology has the potential to overcome the limitations of other magnetic-based memory technologies to allow fabricating inexpensive, high-density universal and embedded memory-on-chip devices.

Lastly, using magnetic ferromagnetic surfaces we have shown a simple generic way to separate between two enantiomers. Achieving enantiopurity is of great importance to many industrial fields. This enantiospecific interaction is controlled by surface magnetization and the chirality of oligopeptides, oligonucleotides, and amino acids.

In my talk I will present the CISS effect and its importance, both for applications and basic science. I will also point to open questions regarding the CISS.

Biography

Professor Yossi Paltiel is the chair of the Applied Physics Department, the Hebrew University of Jerusalem Israel. Prof. Paltiel has worked for both high-tech industry groups and in the academic world. Since July 2009, He is the leading the Quantum Nano Engineering group. Paltiel's group's goal is to establish a way to incorporate quantum mechanics into room temperature "classical" computation and reading schemes. This will provide quantum coherence control at nanometer scale distances, while maintaining the physical characteristics of currently available computer input-output devices. Professor Paltiel has published more than 100 papers in leading journals as well as issued 13 patents. He is also the co- founder of two startup companies named Valentes NanoTech and Kiralis.

Date & Location:

Tuesday, January 8, 2019, 11:00
Lecture room, Physics Building (ground floor)