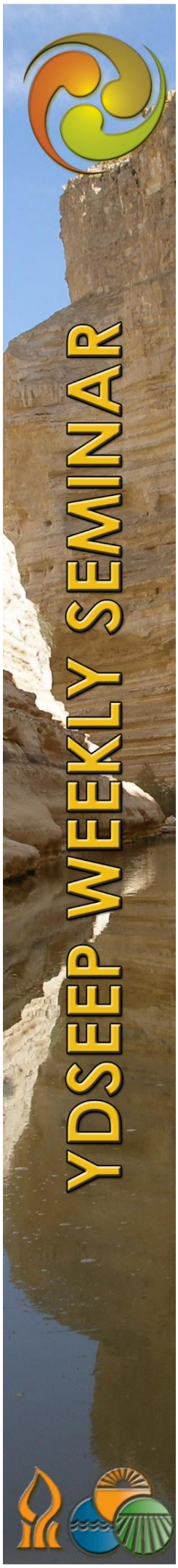

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Probing bulk materials properties and the electrode-electrolyte interface with high sensitivity solid state NMR spectroscopy

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Abstract

The development of high energy, long lifetime energy storage systems based on rechargeable batteries relies on our ability to control charge storage and degradation processes in the bulk of the electrode materials and at the electrode-electrolyte interface. In recent years, NMR spectroscopy has been increasingly used for probing the electrochemical processes in the bulk of the active materials, providing important insights into the charge storage mechanisms. However, the crucial processes governing electrochemical performance occurring at the interface of the active materials with the electrolyte are much harder to study as they often involve thin, heterogeneous and disordered surface layers. To probe these processes with NMR, isotope enrichment is required along with high magnetic fields and long acquisition times. These requirements limit the systems and processes that can be studied with NMR.

I will describe how we can overcome these limitations by the use of Dynamic Nuclear Polarization (DNP). In DNP, the large electron spin polarization is utilized to boost the sensitivity of NMR spectroscopy. This approach results in high sensitivity to the surface and enables us to efficiently detect the electrode interface without the need for isotope enrichment. Furthermore, I'll present a new route for sensitivity enhancement in the bulk of materials, utilizing paramagnetic metal ion dopants, which opens the way for sensitive characterization of structure and composition of functional materials at natural isotopic abundance.

Date & Location:

Tuesday, May 8, 2018, 11:00

Lecture room, Physics Building (ground floor)