Solid State Institute
המכון למצב מוצק

TECHNION
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סמינר

Towards Experimental Implementation of Quantum Gate Operations in a ^{28}Si:P Sample

Yaron Artzi

M.Sc. Student of Professors Yosi Avron and Aharon Blank

Physics and Chemistry Departments
Technion

Abstract

Quantum information theory predicts a major speedup in several important processing tasks, which makes it a subject of great interest. However, the search for a physical system in which such quantum information processing algorithms can be successfully executed, is still underway. One possible implementation of a quantum information processing unit may be achieved by directly addressing electron spins in a solid-state sample, using methods of induction detected pulsed electron spin resonance (ESR). En-route towards experimental implementation of unitary operations (quantum logic gates) on electron spin states, employing methods of pulsed ESR, the detection sensitivity that is available in state-of-the-art ESR systems has to be improved significantly. We present experimental results that were recorded in our ultra-sensitive induction-detection ESR setup, with a sample of phosphorus doped isotopically pure silicon crystal (^{28} Si:P), showing such an improvement in detection sensitivity. We estimate that the number of electron spins required for a detectable signal in our new setup is only ~ 10^4 spins/√Hz (meaning ~100 spins in a few hours of averaging time), which is 5 orders of magnitudes lower than in the most sensitive commercial ESR setup. This high sensitivity was achieved thanks to the development of an ultra-miniature micrometer-sized microwave resonator that was operated at 34 GHz at cryogenic temperatures in conjunction with a unique cryogenically cooled low noise amplifier.

ההרצאה תתקיים ביום רביעי, ה-23.12.15 בשעה 12:30

בבניין המכון למצב מוצק, בחדר הסמינרים

The lecture will take place on Wednesday, 23.12.15 at 12:30

at the Solid State Institute, seminar room

Organizer: Associate Professor Oren Cohen