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Quantum bits utilizing the quantum dot confined bright and dark excitons

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Abstract

The building block for quantum information processing (QIP) is a reliable physical two-level system or a quantum bit (qubit). Semiconductor quantum dots confine charge carriers into a three dimensional nanometer scale region, thus acting in many ways as isolated 'artificial atoms' and are a source of quantum light, as they can generate single photons and entangled photons on demand. Semiconductor quantum dots are also compatible with modern microelectronics and optoelectronics, which makes them particularly attractive as solid state qubits and interface for light qubits. In order to prepare, control, and measure the quantum states of matter qubits, one or two auxiliary levels, which are optically connected to the qubit levels are typically used. These auxiliary levels form a so called lambda-system or a pi-system with respect to the two level system that forms the matter qubit. A lambda-system is more common between the two, and has been studied extensively in the past.

In my talk I will present methods for controlling a qubit using a pi-system. I will demonstrate experimentally and discuss theoretically the differences between a lambda and a pi-system, realized on the quantum dot confined bright exciton qubit. Then, I will focus on the dark exciton as a spin qubit, which forms a pi-system with its biexciton auxiliary levels. In particular, I will present new data demonstrating control of the dark exciton eigenstates using externally applied magnetic field, and control of its coherent precession frequency by resonant optical radiation (the AC Stark effect).

ההרצאה תתקיים ביום רביעי, ה-13.7.16 בשעה 12:30

בבניין המכון למצב מוצק, בחדר הסמינרים

The lecture will take place on Wednesday, 13.7.16 at 12:30

at the Solid State Institute, seminar room

Ph.D. Student of Professor Gad Bahir
and Professor David Gershoni