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The dark exciton as a qubit – its physical properties and its coherent control

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Abstract

The dark exciton in semiconductors is a fundamental excitation in which an electron is promoted from the valence band to the conduction band while its spin state is reversed. As such, it has a total angular momentum of 2, resulting from the electron orbital momentum and spin addition.

Since light interacts only with the electron orbital momentum, but not with its spin, this excitation is optically inactive. Therefore, the dark exciton has long life time. In quantum dots the dark exciton is confined and isolated, and as a result, the coherence time of a superposition of its two states (with spin projections of ±2 on the quantum dot symmetry axis) is long as well. Therefore, the dark exciton is an excellent matter qubit.

In my talk I will discuss optical methods and techniques for coherent writing, measuring, and controlling the state of the dark exciton. These methods were crucial for our recent work, in which we used repeated excitation of the dark exciton to demonstrate on demand generation of a cluster state of entangled photons (I. Schwartz et al., Science 354, 434, 2016).

ההרצאה תתקיים ביום רביעי, ה - 1.2.2017 בשעה 12:30
בבניין פיסיקה, לוינר, חדר סמינרים (412)
The lecture will take place on Wednesday, 1.2.2017 at 12:30
at the Physics Building, Lewiner Seminar Room (412)

Ph.D. Student of Professor David Gershoni