

Hybrid approach to room temperature quantum devices

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Quantum theory provides a coherent picture of the physical processes at the microscopic scale. Two major ideas of quantum mechanics govern their operation. The first is the quantized behavior of physical properties like energy and momentum. The second is the duality of wave and particle. While the first basic idea is being widely used in everyday technology, coherent wave properties are not frequently used in real world devices.

For a long time, it was believed that going to a condensed phase while retaining useful quantum behavior would be difficult if not impossible. This has now been disproved in both synthetic and biological systems. Nitrogen vacancy centers in Diamond and quantum dots are a prominent example of such an 'atom like' system in a solid. Photosynthetic pigments have shown how coherence can be maintained over hundreds of atoms in a system with low symmetry.

Our aim is to realize a nano tool box that can be used to create the quantum material that can be used to understand where quantum coherence coexists with noise. This understanding will lead to the realization of what we call the quantum machine. We use bottom up approach using organic molecules and nanocrystals hybrid layers, coupled to top down classical semiconductor devices. In my talk, I will present the nano tool box and show studies of charge transfer, spin transfer and energy transfer in the hybrid layers as well as collective transfer phenomena. These enable to realization of room temperature operating quantum electro-optical devices.

Biography

Yossi Paltiel has completed his Ph.D. in the Physics Department at the Weizmann Institute of Science, Rehovot, Israel. Following his Ph.D., he served as the head of the electro optical division in several startups. He had also a tenured position at Soreq National Laboratory, Israel working on semiconductor quantum devices. Since July 2009, he is leading the Applied Physics Department, Quantum Nano-Engineering group at the Hebrew University, and received a tenured position in January, 2013. Yossi Paltiel has published more than 60 papers and has 9 patents and patent applications. Since 2009, the group gave 22 invited talks.

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