School of Nano Science

IPM Condensed Matter and Statistical Physics Group

Weekly Seminar

Parallel Quantum Circuit in a Tunnel Junction

Invited Speaker:

Dr. Omid Faizy

CEMES-CNRS, France

Abstract:

The spectrum of 1-state and 2-states per line quantum buses is used to determine the effective $V_{ab}(N)$ electronic coupling between emitter and receiver states through the bus as a function of the number N of parallel lines in the bus. When the calculation of $V_{ab}(N)$ is spectrally difficult, an Heisenberg-Rabi time dependent quantum exchange process can be triggered through the bus by preparing a specific initial non-stationary state and identifying a target state to capture the effective oscillation frequency $\Omega_{ab}(N)$ between those. For $\Omega_{ab}(N)$ (for $V_{ab}(N)$), two different regimes are observed as a function of N: linear and $\sqrt{N}$ more moderate increases. This state preparation was replaced by electronically coupling the quantum bus to two semi-infinite electrodes. The native quantum transduction process at work in this tunnel junction is not faithfully following the $\Omega_{ab}(N)$ variations with N. Due to normalisation to unity of the electronic transparency of the quantum bus and to the low pass filter character of the transduction, large $\Omega_{ab}(N)$ cannot be followed by the tunnel junction. At low coupling and when N is small enough not to compensate the small through line coupling, an N^2 power law is preserved for $\Omega_{ab}(N)$. The limitations of the quantum transduction in a tunnel junction is pointing how the broadly used concept of electrical contact between a metallic nanopad and a molecular wire can be better described as a quantum transduction process.

Wednesday, 8 Ordibehesht 95 (27 April, 2016), 2-3 pm

Farmaniyeh seminar room