SINGLE ELECTRON COUNTING SPECTROSCOPY BASED ON CARBON NANOTUBE TRANSISTORS

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We carry out single-electron counting spectroscopy measurements to probe the electronic properties of semiconducting CdSe quantum dots. This measurement scheme is based on an original approach where the investigated particle is attached only to one electrode, a carbon nanotube [1] (see Fig. 1). This approach is particularly suitable for systems with a high contact resistance (up to 10^{19} Ohms). The nanotube is employed as a reservoir that supplies electrons to the particle, and as the detector for the transfer of single electrons to the particle. Counting individual electrons is achieved by measuring the conductance of the nanotube as it is ultra sensitive to the electrostatic environment. Our study shows that single-electron detection with nanotube transistors represents a powerful strategy to study the energy separation between the electronic discrete levels of highly-resistive particles. By studying electron transfer as a function of the gate voltage V_g applied on the backside of the wafer, we noticed that no electron transfer is observed for certain range of V_g. We show that the V_g gap is the result of the energy gap in the CdSe particle.

References:

[1] Andreas Gruneis, Maria J. Esplandiu, Daniel Garcia-Sanchez and Adrian Bachtold, *Nano Letters* **7** 3766 (2008).

Figure 1