Manipulation of electron orbitals in hard-wall InAs/InP nanowire quantum dots

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On finite-bias transport data and determination of the electron filling

The electron filling *N* of the InAs/InP NW QDs was determined by means of finite-bias transport spectroscopy. While the use of a charge detector is highly advisable to determine the filling of few-electron systems obtained by electrostatic gating, InAs/InP QDs in NWs typically display a very reproducible behavior, due to their very strong and controlled confinement potential, so that finite bias spectroscopy can be used to reasonably identify the absolute electron filling of the dot. The figure reports a typical 4.2K bias spectroscopy scan, obtained on one of the studied dots. The absence of any hint of further conduction modes at high source-drain bias (up to 50 mV) as well as at high temperature (up to about 80K) indicate that insulating region on the left side of the dot constitute a very good candidate configuration for electron filling *N*=0. Shell filling structures and even-odd sequences at increasingly large gate potentials further support this working hypothesis. Equivalent measurements were performed on all the devices used for this work. Clear *N*=0 regions as well as even-odd sequences and shell structures were routinely observed, as typically obtained on the tightly-confined QDs based on InAs/InP NW technology [19-21].