Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Ultraclean single, double, and triple carbon nanotube quantum dots with recessed Re bottom gates[1] MINKYUNG JUNG, JENS SCHINDELE, STEFAN NAU, MARKUS WEISS, ANDREAS BAUMGARTNER, CHRISTIAN SCHOENENBERGER, Department of Physics, University of Basel — Ultraclean carbon nanotubes (CNTs) that are free from disorder provide a promising platform to manipulate single electron or hole spins for quantum information. Here, we demonstrate that ultraclean single, double, and triple quantum dots (QDs) can be formed reliably in a CNT by a straightforward fabrication technique. The QDs are electrostatically defined in the CNT by closely spaced metallic bottom gates deposited in trenches in Silicon dioxide by sputter deposition of Re. The carbon nanotubes are then grown by chemical vapor deposition (CVD) across the trenches and contacted using conventional electron beam lithography. The devices exhibit reproducibly the characteristics of ultraclean QDs behavior even after the subsequent electron beam lithography and chemical processing steps. We demonstrate the high quality using CNT devices with two narrow bottom gates and one global back gate. Tunable by the gate voltages, the device can be operated in four different regimes: i) fully p-type with ballistic transport between the outermost contacts (over a length of 700 nm), ii) clean n-type single QD behavior where a QD can be induced by either the left or the right bottom gate, iii) n-type double QD and iv) triple bipolar QD where the middle QD has opposite doping (p-type).

[1]Research at Basel is supported by the NCCR-Nano, NCCR-QIST, ERC project QUEST, and FP7 project SE2ND.

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Date submitted: 13 Nov 2013 Electronic form version 1.4