Valley-spin qubit in a carbon nanotube

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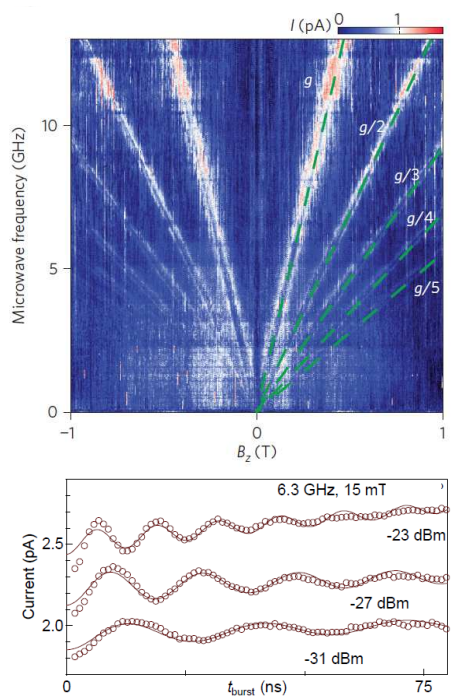
Compared with spin qubits realized in III-V materials, carbon nanotubes are a particularly attractive host material, because of the much lower concentration of nuclear spins. In this work, we realize a nanotube qubit in a double quantum dot. The qubit is encoded in two valley-spin states, with coherent manipulation via electrically driven spin resonance (EDSR) mediated by a bend in the nanotube. Readout is performed by measuring the current in Pauli blockade. We also find a spin-orbit coupling in multiple devices that is an order of magnitude larger than previously measured. This work is enabled by a novel fabrication technique with a controlled transfer of individual ultra-clean nanotubes by stamping [1] [2] [3].



[1] F. Pei, E.A. Laird, G.A. Steele & L.P. Kouwenhoven, Nat. Nanotechnol. **7**, 630-634 (2012)
[2] E.A. Laird, F. Pei & L.P. Kouwenhoven, Arxiv 1210.3085 (2012)
[3] G.A. Steele, F. Pei, E.A. Laird, J.M. Jol, H.B. Meerwaldt & L.P. Kouwenhoven, Nat. Commun. **4**, 1573 (2013)