Transport properties of single-wall metallic carbon nanotubes weakly coupled to ferromagnetic leads

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Using the real-time diagrammatic technique and taking into account both the sequential and cotunneling processes, we analyze the transport properties of single-wall metallic carbon nanotubes coupled to ferromagnetic leads in the full range of parameters. In particular, considering the two different shell filling schemes of the nanotubes, we discuss the behavior of the differential conductance, tunnel magnetoresistance and the shot noise. We show that in the Coulomb diamonds corresponding to even occupations, the shot noise becomes super-Poissonian due to bunching of fast tunneling processes resulting from the dynamical channel blockade, whereas in the other diamonds the noise is roughly Poissonian, in agreement with recent experiments. The tunnel magnetoresistance is very sensitive to the number of electrons in the nanotube and exhibits a distinctively different behavior depending on the shell filling sequence of the nanotube. Furthermore, the TMR also strongly depends on the spin state of the nanotube. When the ground state of the nanotube is a triplet, the TMR becomes much enhanced as compared to the situation where the ground state is a singlet.

9.7 cm

13.4 cm

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