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Spin Measurement in Quantum Electro-Mechanical Systems
DIAN WAHYU UTAMI, Physics Department, McGill University, Montreal, QC H3A 2T8, Canada, JASON TWAMLEY, Centre for Quantum Computer Technology, Macquarie University, Sydney, New South Wales 2109, Australia, HSI-SHENG GOAN, Department of Physics, National Taiwan University, Taipei 106, Taiwan, ROC, GERARD J. MILBURN, Centre for Quantum Computer Technology, The University of Queensland, St Lucia, QLD 4072, Australia — Interests in spin measurement in solid state nanostructure has been growing in the last few years. The measurement of spin is particularly important in the realization of spin based solid state quantum computer proposals. Here we present our study on spin detection via a quantum electromechanical shuttle system using the example of an endohedral N@C60 that is placed in a magnetic gradient generated by a nearby nanomagnet. Using quantum optics methods, the currents across the system are found to be different for each of the different spin orientations. This is due to the different directional forces produced as a result of the interaction between each of the spin orientation to the magnetic gradient. The resulting force affects the steady state position of the island and thus modifies the system's conductance. We investigate the feasibility of the application of the system as a single spin measurement by looking at the current noise spectral density and investigating the measurement time required to distinguish the two currents for each of the spin states.

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