

ABSTRACT:

In this work, fundamental results on carrier statistics in a carbon nanotube treated as a one-dimensional material are presented. Also the effect of degeneracy on the capacitance of the carbon nanotube channel in a carbon nanotube field effect transistor is discussed. A quantum capacitance as well as a classical capacitance is revealed. Furthermore it is shown that for low gate voltage, the total capacitance is equivalent to the classical capacitance but for high gate voltage it is equivalent to the quantum capacitance. We predict that in the nondegenerate regime, the total capacitance is equivalent to the classical capacitance and that the quantum capacitance can be neglected, whereas only quantum capacitance needs to be taken into account in the calculation of the total capacitance in the degenerate regime.