Noise conductance of carbon nanotube transistors

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— We report on radio-frequency transmission and noise measurements of high-transconductance carbon nanotube transistors. Gate capacitance $C_g$, drain conductance $g_d$, transconductance $g_m$ and current-noise data are analyzed with a ballistic 1-dimensional nano-transistor model where the nanotube channel is described by a quantum capacitance $C_q$. Current is thermally activated with a transconductance controlled by a bias-dependent electronic temperature. Shot-noise is a thermal noise with a noise conductance $g_n$ different from the drain conductance $g_d$. The 1-dimensional model gives a simple formula $g_n - g_d = g_m(C_q/2C_g)$ which is verified in the nanotube transistor. Finally we estimate the charge resolution of nanotube devices for applications as fast single-shot electron detectors.

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