Measuring current fluctuations and Hanbury Brown and Twiss cross correlations in nanophysics

In the past decade, the measurement of the spectral density of current fluctuations - noise - has become an accepted diagnosis of transport in nanocircuits. I review situations where noise cross correlations at zero frequencies can provide useful information about the transport properties of a nanocircuit. An example is the signature of quasiparticle charges in the fractional quantum Hall effect, other one is the signature of effective charges in the carbon nanotubes, both of which are the result of the collective excitations in this correlated electron system. Noise is also useful for performing a test of entanglement (quantum mechanical non-locality) in nanocircuitry. Sometimes finite frequency noise cross correlations are desperately needed for these diagnoses. I the nexamine several theoretical models where the noise source is coupled to a measuring device, with either capacitiveoupling or with inductive coupling, allowing a "direct" measurement of noise.