Coherent nanodevices as detectors of structured solid-state noise sources

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Coherent nanodevices are inevitably exposed to fluctuations due to the solid-state environment. Well studied examples are charged impurities and stray flux tubes which are sources of telegraphic noise in a wide class of metallic devices. Large amplitude low-frequency (mostly 1/f) noise, ubiquitous in amorphous materials, is also routinely measured in single-electron-tunneling devices. Recent experiments on Josephson qubits indicated that charged impurities may also be responsible for noise exhibiting an ohmic power spectrum at GHz-frequencies. In this talk we will illustrate how solid state nanodevices may be used to infer characteristic features of the noise sources underlying the resulting relaxation and dephasing processes. Typical signature of the presence of low frequency noise components is a non-exponential suppression of coherent oscillations, observed when repeated measurements are performed. Single-shot measurement schemes or dynamical decoupling protocols inevitably suffer from the presence of fluctuations active during time evolution. We propose a characterisation of the effects of bistable coherent impurities in solid state nanodevices and present an alternative perspective considering qubits as a measurement devices for the noise sources. Expected effects on complex multi-qubit architectures will be pointed out.