# Dynamics of Quantum Noise in a Tunnel Junction under ac Excitation

J. Gabelli [1], B. Reulet [1]

[1]Laboratoire de Physique des Solides, UMR8502, bâtiment 510, Université Paris-Sud, 91405 ORSAY Cedex, France

In the same way as the complex ac conductance $G(\omega_0)$ of a system measures the dynamical response of the *average* current to a small voltage excitation at frequency $\omega_0$, we investigate the dynamical response of current *fluctuations*, that we name *noise susceptibility*. It measures the in-phase and out-of-phase oscillations at frequency $\omega_0$ of the current noise spectral density $S_2(\omega)$ measured at frequency $\omega$. We present the first measurement of the noise susceptibility, in a tunnel junction in the quantum regime $\hbar\omega \sim \hbar\omega_0 \gg k_B T$ ($\omega/2\pi \sim 6\,$GHz and $T \sim 35\,$mK). We observe that the noise responds in phase with the excitation, but not adiabatically. The results are in very good, quantitative agreement with our prediction based on a new current-current correlator that we calculate for a coherent conductor at arbitrary frequencies in the scattering matrix formalism. We also show that the noise susceptibility is a central concept in the understanding of environmental effects on quantum transport. In particular, we reformulate the Dynamical Coulomb Blockade in terms of the noise susceptibility at $\omega_0 = \omega$ providing a natural extension to existing results.