S2 : **Marco Aprili** (LPS-Orsay)

« Boson induced Fermion blockade and bunching »

How a bosonic mode can affect electron tunneling ? Tunneling is a Poissonian process but in presence of a bosonic mode (phonon, photon, magnon, vibron…), it is allowed only when the energy of the electron is sufficient to excite at least a single boson, this is called the Franck-Condon blockade as for voltage bias lower that the energy of the mode, current can't flow or it's strongly suppressed depending on the coupling strength with the mode. I will present two experiments on which this physics appears a very different length scales. I will show first that electron tunneling into a single atom can excite vibronic modes. These modes have a feed-back on the tunneling statistics resulting in electron bunching. To measure this vibronic induced correlations between tunneling events, we built up a low temperature Scanning Tunneling Microscope (STM) that can not only measure the average tunneling current as commercial STM do, but also the current fluctuations. We call this new instrument the shot-noise STM. We perform the experiment in isolated Fe impurities in Bi_2Se_3 where the electron-phonon coupling is particularly strong. Then, I will discuss a very similar situation in which a superconducting micro-wave resonator is coupled to a planar tunnel junction. Here the strong coupling regime is reached by using an high impedance superconducting resonator made on granular aluminium. Down to the quantum limit, tunneling is assisted by absorption of single or multiple photons. This provides an excellent photon to electron converter. Can this device becomes a single microwave photon detector ?