This thesis is concerned with the interplay between electrical current and vibrational and plasmonic excitations. The development of nano-scale devices for electronics relies on the ability to identify individual atoms and molecules as well as their geometry and electronic structure. In this thesis we show how measuring the noise can give information about the quantum nature of the device and relate the high frequency noise to light-emission. A first principle method is presented for calculating the light-emission and is utilized to calculate the light-emission from two STM experiments: An adatom on a Ag(111)surface and a C60 molecule on a Cu(111) surface. The calculated photon yield is found to agree with experiments for photons with energies below the applied bias (\(h \omega < eV\)). Inelastic electron tunneling spectroscopy (IETS) serves as a powerful tool for non-destructive characterization. A new fast method for calculating the energy dependent IETS signal is presented, and applied to a one-level model revealing how a symmetric system can give rise to peak-dip features in the IETS. The new method is used to explain the IETS signal obtained for a 1,4-benzene-dithiol(BDT) molecule in a symmetric gold junction as a function of gate voltage. Gating molecules in 3D metal junctions is difficult due to screening effects. On the other hand, graphene devices are routinely gated. Thus, we study the IETS signal from gated graphene nano ribbons (GNR). We study pristine GNRs with both zigzag and armchair chirality, and related the IETS signal to the phononic band structure. For the spin-polarized zigzag GNRs the role of the spin-polarization is investigated, revealing IETS as an indirect measurement of spin-polarization. Further, the role of impurities is explored, revealing the possibility of detecting defects in the hydrogen passivisation by IETS. Lastly a preliminary study of the heating due to the electrical current is described, investigating the effect of the deterministic current-induced forces, treated within the framework of the semi-classical generalized Langevin equation (SGLE). For a pristine zigzag ribbon the deterministic current-induced forces is seen to give rise to runaway modes. For an armchair ribbon with partly dehydrogenated edges the deterministic current-induced forces is seen to break the symmetry and increase the excess heating.

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