NANOSCIENCE COLLOQUIUM

Fluctuation (noise) spectroscopy as a tool to study nano-scale objects in condensed matter

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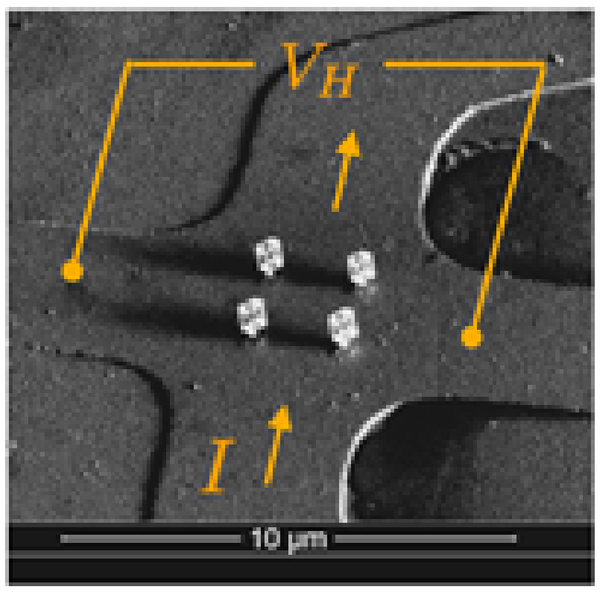
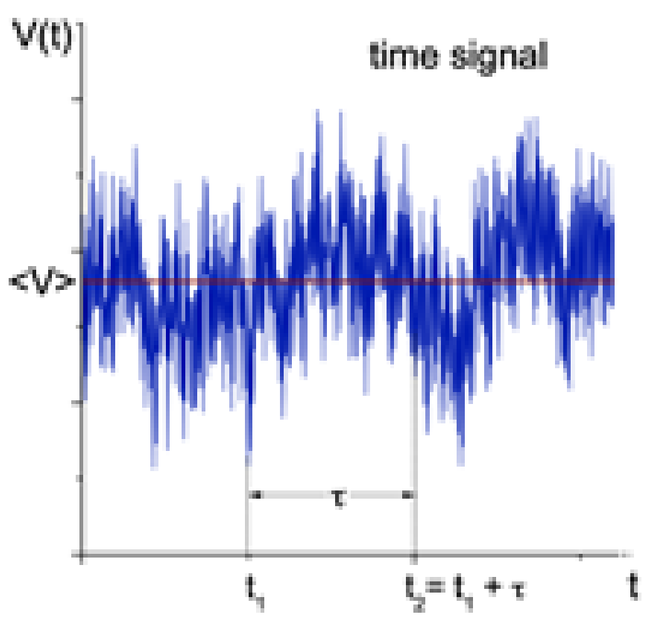
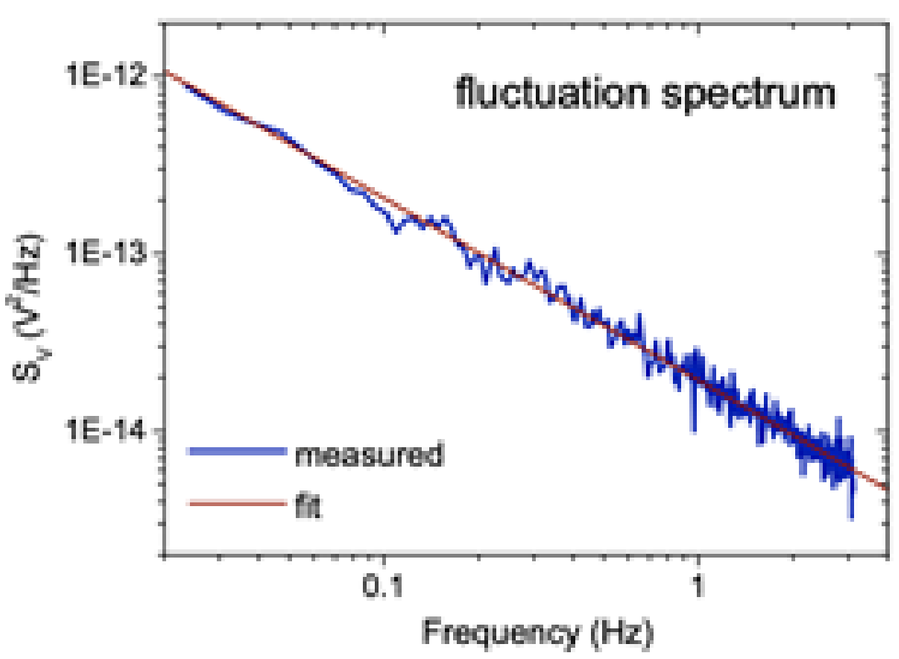
Abstract: Fluctuations (or noise) are inevitably present in any physical measurement, yet mostly aimed to be suppressed in order to increase the accuracy of the experiment. However, the fluctuations of a system (e.g. in the conductance of a sample) are related to a particular (here: current-current) correlation function and therefore provide valuable insights into the microscopic kinetics of the charge carriers, an energy-resolved information that is lost when considering only mean values.
In this talk, we will give a basic and general introduction into fluctuation processes in nature and condensed-matter systems and how to understand the ubiquitous 1/f-type noise which scales inversely with the volume of a system and therefore becomes a serious obstacle for miniaturization of electronic and magnetic devices.
We will (i) show that understanding the origin of the fluctuations in devices, as e.g. micro-Hall sensors, allows to improve their sensitivity enabling measurements of individual magnetic nanoparticles. We will then (ii) give several examples where fluctuation spectroscopy helps to delineate the low-frequency dynamics of charge carriers in strongly-correlated molecular (organic) conductors and intermetallic systems where the switching of nanoscale dielectric and ferromagnetic clusters is related to the rich physics of metal-insulator transitions.







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