Mesoscopic thermodynamics in nanostructures

Klaus Ensslin
ETH Zurich, Switzerland

The second law of thermodynamics is one of the pillars of our understanding in modern physics. For nanostructures individual charge carriers may violate this law, while averages over many charging events agree with predictions for macroscopic systems. As nanostructures contain fewer and fewer carriers, fluctuations become ever more important and their understanding is at the heart of mesoscopic thermodynamics. In this talk I will show results on time-resovled single electron transport through semiconductor and graphene quantum devices. This technique allows to measure directional transport at zero applied bias and enables the test of fluctuation theorems that connect measured quantities in non-equilibrium situation to well-known equilibrium quantities. This work was done in collaboration with A. Hofmann, V. Maisi, C. Roessler, B. Kueng, and T. Ihn.