Scanning Gate Microscopy and Vortex Imaging

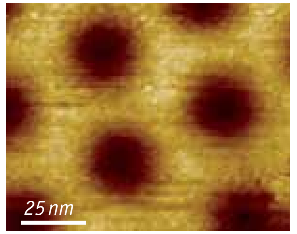
selected applications for cryogenic tuning fork based microscopy

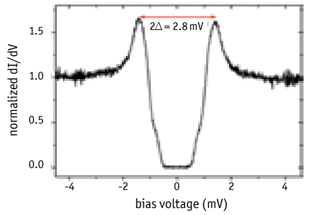
Scanning Gate Microscopy at 300 mK

In this measurement, an attoAFM III was operated inside an attoLIQUID3000 cryostat at 300 mK in scanning gate microscopy mode (SGM) - investigating the trajectory and interaction of edge channels of a split-gate quantum point contact (QPC) device in the Quantum Hall (QH) regime. By scanning the SGM tip over the surface of the QPC at constant height and by simultaneously measuring and plotting the source-drain current, conductance maps were obtained. The image to the left is an example of such a conductance map depicting the characteristic branched-flow of electrons at zero magnetic field, which in turn shows electron interference fringes and the actual electron path. T = 400 mK, 2DEG density n_{2D} = 3.37 x 10^{11} cm^{-2}.

(Data and images were generously provided by S. Heun et al., NEST, CNR-INFM and Scuola Normale Superiore, Pisa, Italy.)

Scanning Tunneling Spectroscopy on $NbSe_2$ at 315 mK





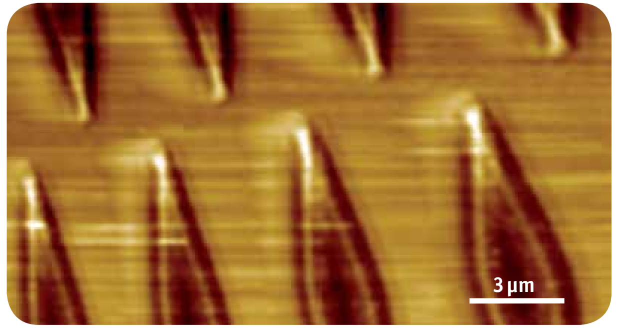
In this application, the attoAFM/STM was used to conduct scanning tunneling spectroscopy (STS) measurements and vortex imaging on $NbSe_2$ at a temperature of 315 mK and a magnetic field of 1 T. A cut Platinum/Iridium tip was mounted onto the microscope's tuning fork sensor, allowing both shear force AFM and STM measurements. The image (left) was recorded at a bias voltage of 1.4 mV, corresponding to the superconducting coherence peak energy. The coherence peaks are suppressed inside the vortex cores, leading to the observed contrast. The spacing between the vortex cores is in excellent agreement with the expected value for a magnetic field of 1 T. The image to the right shows a dI/dV spectrum of $NbSe_2$ revealing a local superconducting gap with 2Δ equal to 2.8 mV.

(attocube application labs, 2009).

Scanning Near-Field Optical Microscopy

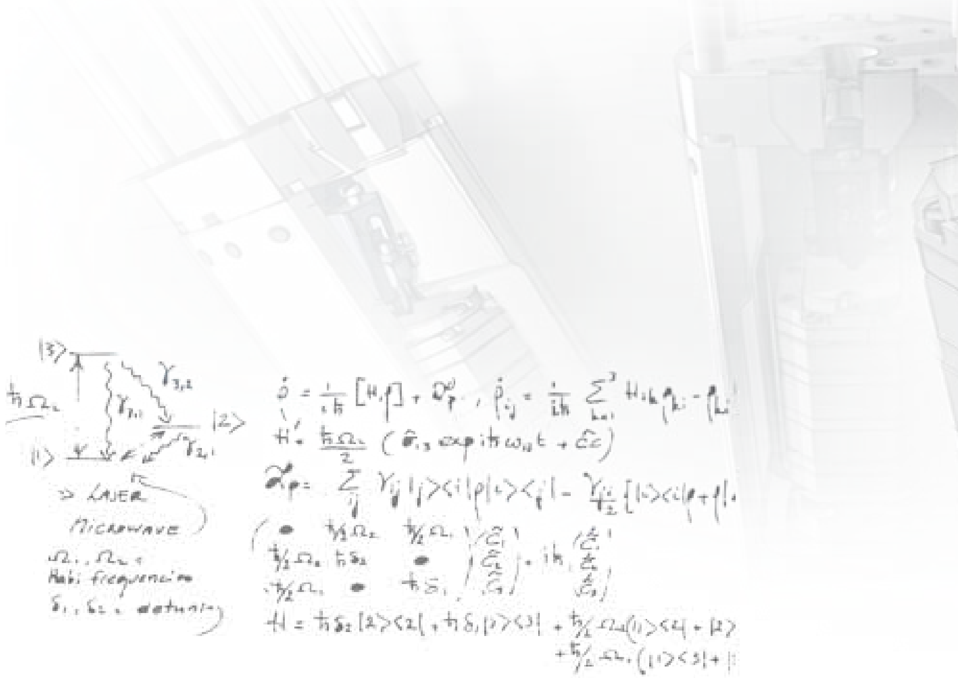
selected applications for cryogenic tuning fork based microscopy

SNOM Imaging at 4 K and 8 T



Optical near-field measurement in transmission mode using the attoSNOM at 4 K and 8 Tesla. Sample: Vanadium rhomb-structure on a glass substrate with a thickness of 10 nm and a periodicity of 5 µm. A pronounced near field enhancement is clearly visible at the tip of the rhombs.

(attocube application labs, 2007).



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