Selected Applications - Nanopositioners

Mechanically Controlled Multi-Contact Break Juncions

In this application, small tips made from either glass or graphite were used to locally deform a silicon membrane, creating break junctions in a very controlled fashion. The tips with a typical radius between 50 and 200 microns were precisely controlled using attocube’s nanopositioning technology. The approach of locally creating and controlling individual break junctions can be used to study the influence of optical excitations on the conductance of individual molecules and for controllable metallic single-electron transistors.


3D g-Factor Mapping of Single Quantum Dots

A xyz linear positioning stack combined with a rotator was used in a novel fiber-based confocal microscope, dedicated for the investigation of certain nanostructures such as InGaAs quantum dots (QDs) using magneto-photoluminescence (PL). The specific arrangement of positioners enabled scientists in this experiment to tilt and rotate samples at low temperature with respect to a magnetic field of up to 10 T while maintaining focus on a single QD.


Dissipation In Optomechanical Resonators

The acoustic dissipation of microresonators was analyzed via a cryogenic interferometry setup. Hereby, a continuous flow 4He cryostat was utilized as sample chamber, which in turn was equipped with a stack of attocube’s ANPxyz51 positioners for the alignment of the sample with respect to an optical fiber. The fiber was part of a homodyne interferometer, allowing high signal-to-noise measurements of the eigenmodes of the resonator while keeping disturbances due to radiation pressure and optical fluctuations at a minimum.

G.D. Cole; M. Aspelmeyer, Univ. of Vienna; Austria.

Magnetic Resonance Imaging of Nanoscale Tobacco Mosaic Virus at 300 mK

attocube’s ANPxyz51 positioners were used in an MRFM setup with the task to precisely and reliably position a magnetic tip and a copper nanowire to close proximity of an ultra-sensitive cantilever. The MRFM setup was applied to investigate and reconstruct the ‘Y spin distribution of Tobacco Mosaic Virus particles, representing a 100-fold improvement in volume resolution over conventional MRI.


Lensless Imaging with X-Ray Waveguides

In order to implement holographic hard X-ray imaging at the nanoscale, quasi-spherical reference waves exiting a hard X-ray waveguide (bonded Silicon waveguides with channel dimensions in the range of a few 10 nm) were used to yield a magnified hologram of the sample. Several linear positioners, goniometers, and rotators were applied for precision alignment of the waveguide with respect to the sample, which was mounted on a high-precision tomographic rotation stage.


Scanning Microwave Impedance Microscopy at 4K and 9T

A set of linear positioners and scanners was implemented into a microwave impedance microscope located inside a liquid helium flow cryostat equipped with a 9 T superconducting magnet. The 1 GHz microwave signal was guided to the cantilever probe, which detected the dielectric constant and conductivity contrast of the sample during scanning. The system is a versatile tool for fundamental research on complex materials and phase transitions under various conditions.


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