The Nobel price winning invention of the Scanning Tunneling Microscope by Binnig and Rohrer in 1981 has triggered a completely new branch in science and engineering called Scanning Probe Microscopy. In the last decades the scanning probe microscope (SPM) has become an indispensable tool in scientific research, such as for instance the Magnetic Force Microscope in magnetic recording research.

Imaging of magnetic domain patterns is of vital importance in high density magnetic data storage research. High resolution images give us information about media noise, details on track edge writing and overwrite behaviour for instance.

The bitlength in modern recording media is much shorter than the wavelength of visible light, so imaging techniques such as Kerr-microscopy cannot be used. Fortunately, in the early 1990ies a new method was discovered, Magnetic Force Microscopy.

In a Magnetic Force Microscope (MFM) a magnetic tip is used to probe the magnetic stray field above the sample surface. The magnetic tip is mounted on a small cantilever that translates the force into a deflection which can be measured. The microscope can sense the deflection of the cantilever, resulting in a force image (static mode) or the resonance frequency change of the cantilever which will result in a force gradient image. The sample is scanned under the tip which results in a mapping of the magnetic forces or force gradients above the surface.
The fact that no sample preparation is necessary and that a lateral resolution below 50 nm can be reached make it a powerful tool for investigation of submicron magnetisation patterns. Since it is possible to apply external magnetic fields during the measurement, the field dependence of domain structures and magnetic reversal processes can be observed. Methods to separate topography and magnetic features allow pure magnetic images to be achieved. Topographic and magnetic details from the same scan can be related to each other.

Within the TST Group we operate two Magnetic Force Microscopes, and one STM/AFM (See Microscopes, on the left menu).

Learn more about MFM and other scanning probe techniques:

- Steffen Porthun's [invited review paper](#) on MFM
- Leon Abelmann's [book chapter](#) on MFM
- [Digital Instruments application notes](#)
- [NTMDT Learning center on SPM techniques](#)