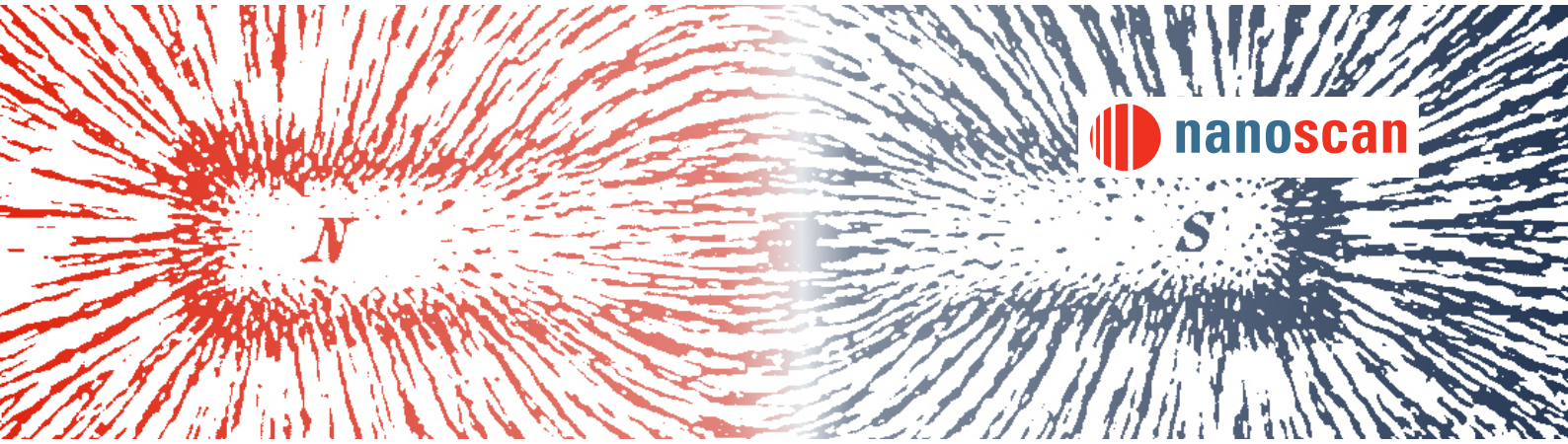
Magnetometry of single magnetic nanostructures



VLS^{80} - The tool for magnetic force microscopy

Variable field Magnetic Force Microscopy (MFM) can give valuable insights into the magnetization reversal of single magnetic nanostructures. The NanoScan VLS^{80} offers an out-of-plane magnetic field option with fields up to ± 550 mT.

The excellent stability of vacuum MFM enables the user to measure the frequency shift of the MFM tip positioned above a single nanostructure during magnetic field sweeps without any significant tip drift.

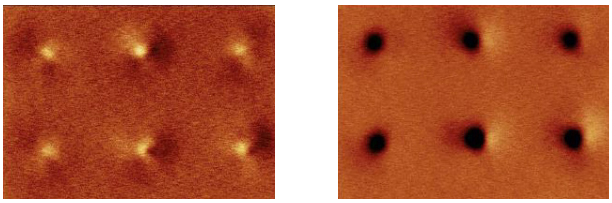
IONTOF

Heisenbergstraße 15
48149 Münster
Germany

Phone +49 251 1622-100
Email sales@iontof.com
Internet www.iontof.com

MFM Magnetometry of a single Co nanosphere

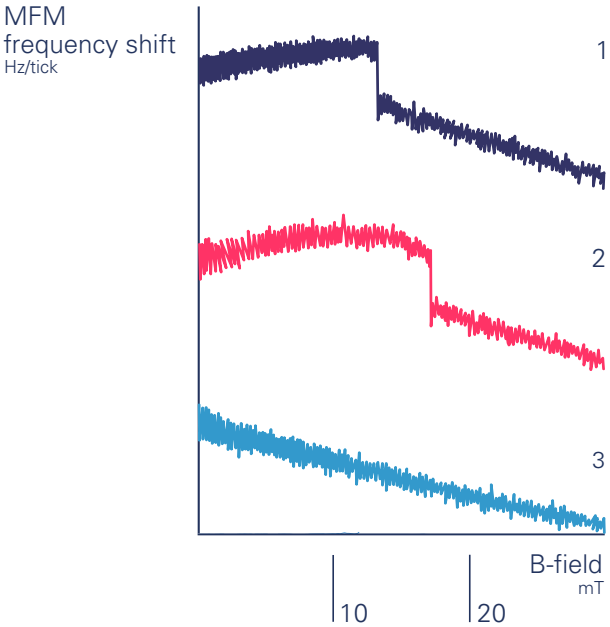
Here we demonstrate magnetic force microscopy (MFM) measurements of cobalt nanospheres with 50 nm diameter at two different external magnetic field values.
It can be demonstrated that the magnetisation of the Co nanospheres switches between the two fields.



7 mT 20 mT

Magnetic force microscopy of 50 nm cobalt nanospheres at two distinct field values, before and after the flip of the magnetisation of the Co sphere cores.
The image size is 7 x 5 μm^2.

The frequency shift of the MFM cantilever positioned above the centre of a single cobalt nanosphere with a radius of 150 nm is measured during a magnetic field sweep.
The application of the magnetic field by a permanent magnet, which does not introduce thermal heat into the vacuum chamber, and the excellent stability of the VLS80 enable the user to perform the measurement without any significant tip drift. The magnetic field can be varied from -550 to +550 mT with a step size smaller than 60 µT.
The example shows the frequency shift as a function of the external magnetic field. At the beginning, the sphere was saturated in a negative field of -500 mT. Then the field was swept from 0 to 30 mT (trace 1) and twice from 0 to -30 mT (traces 2 and 3).



Trace 1 shows a core flip in a positive field of 13 mT. Trace 2 shows the core flip at negative field of -17 mT. The last sweep (trace 3) shows only linear decrease of the signal without any abrupt changes as the vortex core was already flipped in the previous sweep.

We acknowledge CEITEC Nano Research Infrastructure supported by MEYS CR (LM2018110)

Cover page image adapted from:
Newton Henry Black [Public domain]
https://commons.wikimedia.org/wiki/File:Magnet0873.png