

QSM - Quantum Scanning Microscope

Magnetic fields made visible at the nanoscale.

Quantum Scanning Microscope

The QSM is a next-generation scanning probe microscope based on novel diamond sensor technology. It provides quantitative data of magnetic fields with unmatched spatial resolution and sensitivity by exploiting quantum sensing principles. Our instrument is based on a proven, low-drift design and we combine crucial hardware features such as closed-loop scanning and high efficiency optics with an intuitive user interface. The result is a simple to use high performance instrument capable of imaging phenomena at sizes and scales previously inaccessible in a compact system working at ambient conditions.

Applications

Magnetic Imaging

Showcase for the QSM is measuring the stray field of an anti-ferromagnet, which emanates from the unmatched spins of a single atomic layer. It is sensitive enough to image domain boundaries and can provide quantitative information about the boundaries, such as which type.

Current Imaging

The QSM can also image the magnetic fields generated by small currents. Not only can it trace paths, for example for failure analysis, it can also provide current density information, a key parameter for thermal management.

Waveform Reconstruction

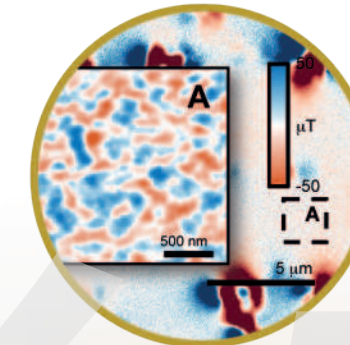
The QSM not only allows mapping continuous signals in real space, but also the reconstruction of arbitrary waveforms in the time domain, as well as determining arrival times.

More Modes

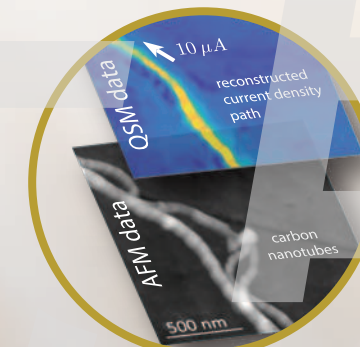
We can make the NV center susceptible to more parameters such as electric fields, temperature or conductor proximity in the software. Contact us to discuss your specific applications and how we can help you solve specific problems.

Applications

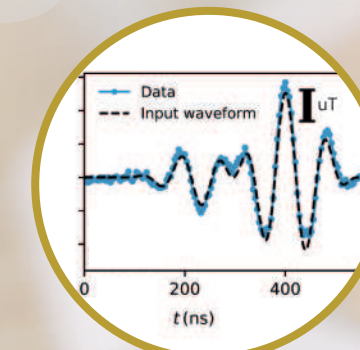
Imaging magnetic domains



Current path sensing

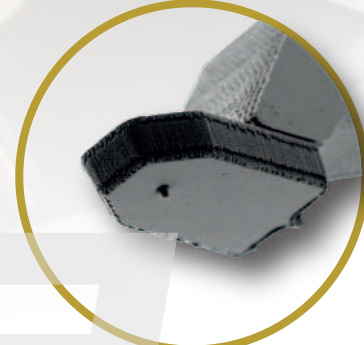


Time-resolved sensing



QSM system

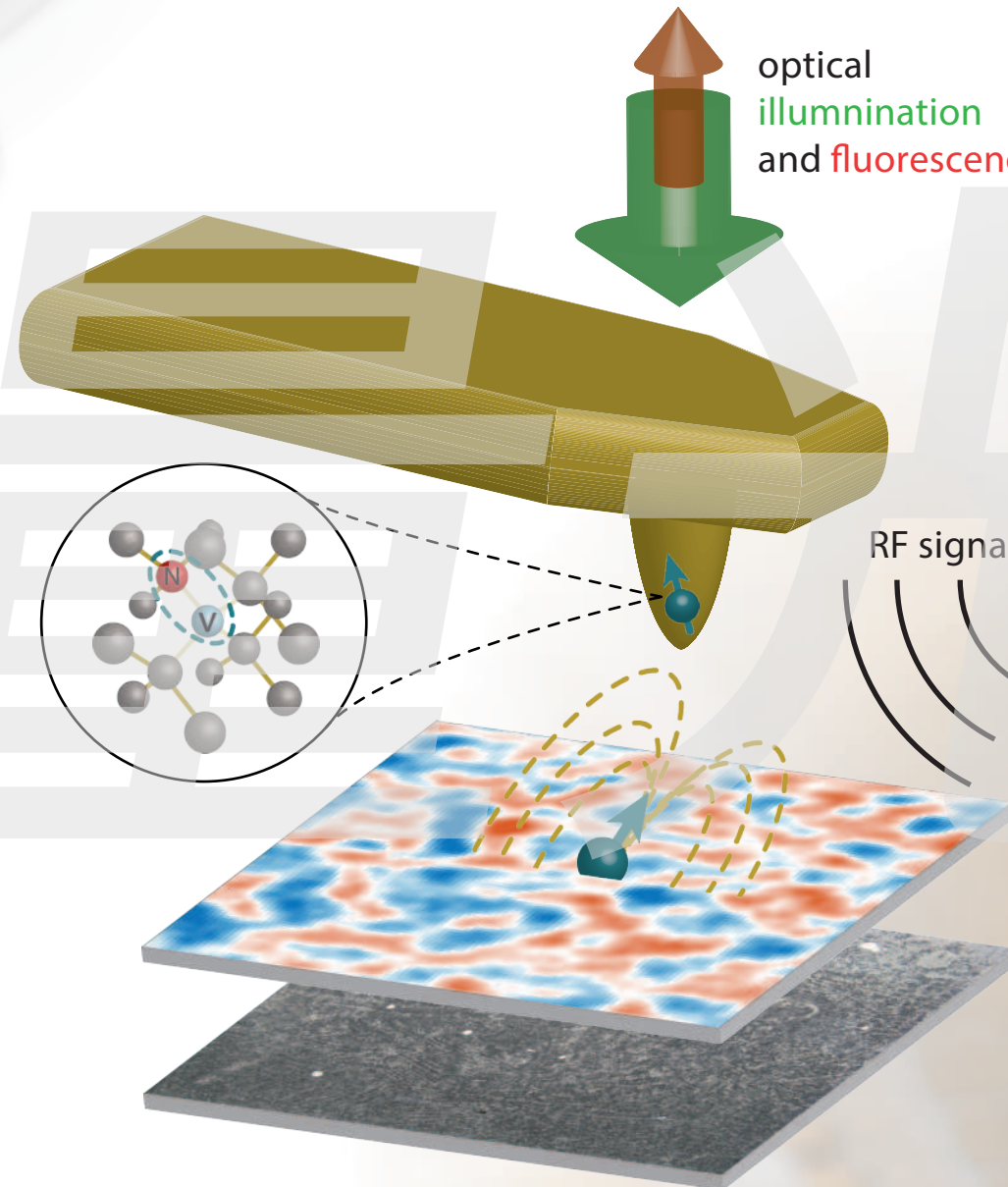
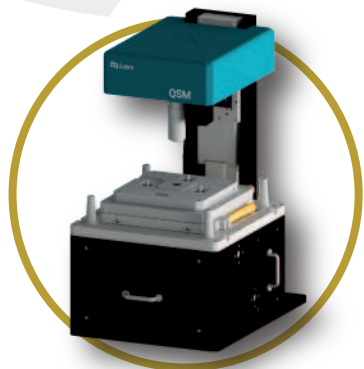
Quantum sensor tip



Quantum control console



QSM



How it works

The key component of the QSM is a so called nitrogen vacancy (NV) center in diamond, which acts as an atomic size magnetic field sensor.

The NV center has a magnetic orientation which is susceptible to the local magnetic field. The larger this field, the more energy is required to change the orientation.

We probe this energy by illuminating the NV with microwaves and monitoring its fluorescence. When the energies of the NV and microwave match, the orientation changes and the fluorescence decreases, yielding a quantitative measurement of the local magnetic field.

By placing NV 10 nm below the apex of our scanning tips, we can map the local magnetic field with a lateral resolution on the order of 10-20 nm.

The QSM combines the optical read out, a low-drift atomic force microscope and an integrated microwave excitation line all into a single turnkey instrument. The intuitive software guides the user to ensure that more time is spent measuring rather than setting up.

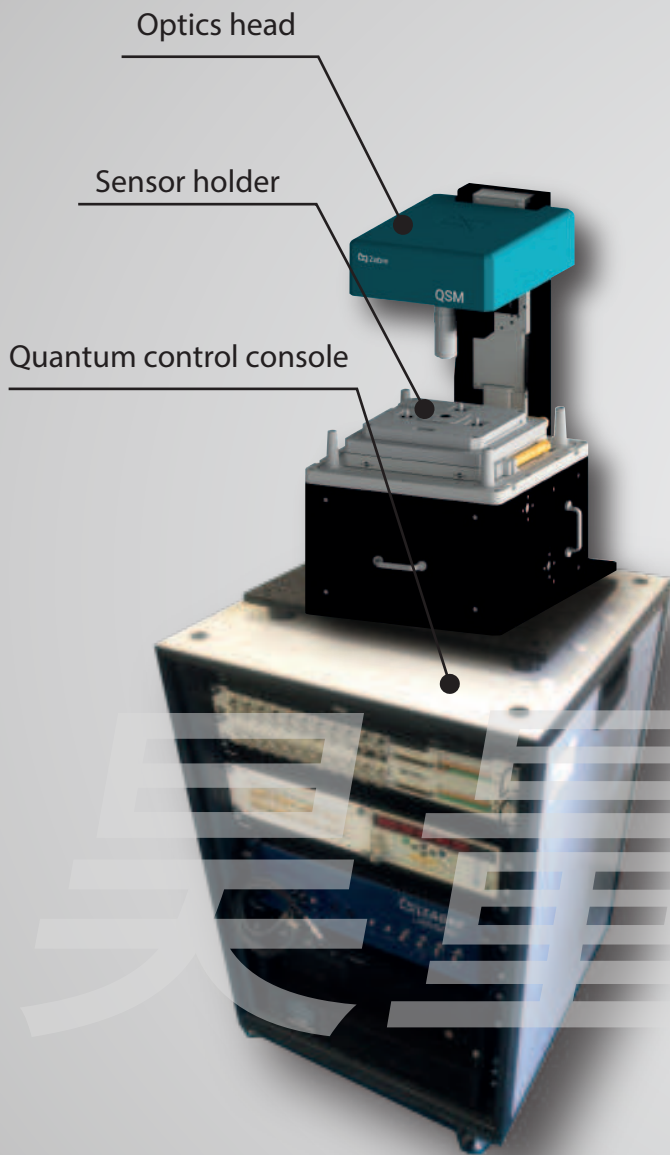
Get started in the world of quantum imaging today!

At a glance

- Turnkey instrument
- Simple tip exchange
- Magnetic field resolution better than 50 nm and 10 uT (vector)
- Equipped with quantum control console
- Low-drift scanning stage and compact optics head
- User-friendly QS3 software control

Key specifications

Scan range	90x90x15 um
Magnetic spatial resolution	30-70 nm
Magnetic sensitivity	1-10 uT/Hz ^{1/2}



The QSM system and its parts

- ▶ Scanning force microscope and controller, close-loop control
- ▶ Optics head including an excitation channel, a confocal optical detection and a CCD camera for easy navigation over the sample
- ▶ Integrated sensor holder with force-feedback and microwave connectivity
- ▶ Quantum control console including optical and microwave excitation and detection
- ▶ QS3 quantum control software package

Add on

- ▶ Time-domain measurement option providing pulsed quantum control and AC detection
- ▶ Electromagnet option providing switchable vector fields up to 80 mT

Shaping a new future for nanoscale imaging

Established in 2018, QZabre is a pioneer in NV technology. An ETH Spinoff from the Spin Physics and Imaging Group, our goal is to make scanning NV imaging as easy to use as AFM today.

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