



## Research Highlights

*Nature Nanotechnology*

Published online: 27 June 2008 | doi:10.1038/nano.2008.209

**Subject Category:** [Surface patterning and imaging](#)

### Magnetic microscopy: Diamond with a spin

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#### **Diamond tips with single nitrogen vacancies might enable scanning probe microscopes to detect single spins**

Scanning probe microscopes with ultrasharp magnetized tips are widely used for visualizing localized magnetic fields at the surfaces of materials and devices being developed for applications in data storage and spintronics. The ultimate goal in this field is to be able to study magnetic nanostructures down to the level of single atoms. Chris Degen of IBM's Almaden Research Center has now proposed building a scanning 'single spin detector' by using a diamond probe with a single nitrogen vacancy as the magnetic sensor.

Using defects in diamond to detect extremely small magnetic fields may seem counterintuitive. However, exposure of the nanoscale nitrogen vacancy defect to magnetic fields causes a well-defined shift in the electron spin resonance frequency – the frequency at which the nitrogen vacancy absorbs the most microwave radiation. This shift can be used to determine the magnitude of the field being monitored with great accuracy.

Degen's calculations indicate that this device should have atomic spatial resolution and the ability to measure single magnetic atoms even at room temperature, which is not possible with other scanning techniques.

## Reference

1. Degen, C. L. Scanning magnetic field microscope with a diamond single-spin sensor. *Appl. Phys. Lett.* **92**, 243111 (2008). | [Article](#) |

**Nature Nanotechnology** ISSN 1748-3387 EISSN 1748-3395

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