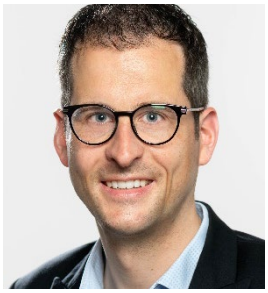
Universität Münster

Aktuelle Fragen der Nanophysik

Montag, 30.06.2025 um 15:15 Uhr
R87, Wilhelm-Klemm-Str. 10

How to bring quantum sensors to applications? Unconventional solutions to real-world problems



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Diamond quantum sensors for magnetic fields have transformed several areas of science, most prominently magnetic resonance and magnetic field imaging at the micro- and nanoscale. However, these breakthroughs have largely remained limited to specialized laboratories. I will present two lines of research of our laboratory to change this state of affairs and significantly simplify the use of diamond quantum sensors.

One direction concerns scanning probe imaging, where we have developed a simplified approach to scanning probe positioning. While conventional setups image magnetic fields by scanning a nanofabricated diamond tip hosting a single NV center across a sample, we developed a setup where we can scan an extended (10 µm to mm) bulk diamond in 10 nm-scale proximity of a sample, using interferometric alignment to maintain the sensor perfectly parallel to the sample. Beyond a technical simplification, this approach opens the door to massively parallel scanning probe microscopy using multiple NV centers, as well as to novel plasmonic near-field microscopes.

Another direction concerns the electric readout of large ensembles of NV center spins, as they might find application in large-scale commercial devices like gyroscopes or magnetic field sensors. Here, we have shown in recent research that readout in a microwave cavity is remarkably competitive with more established optical readout for large ensembles, and provides a straightforward all-electric way to integrate diamond spin sensors into microfabricated circuits.