Physikalisches Kolloquium
Einladung

Physics Colloquium
Invitation

Monday, 07 February 2022

ROOM CHANGE - Lecture Hall O25/H2, AND ONLINE VIA ZOOM

Starting Time: 16:15 hrs

Photoelectric Readout for Diamond Quantum Technology

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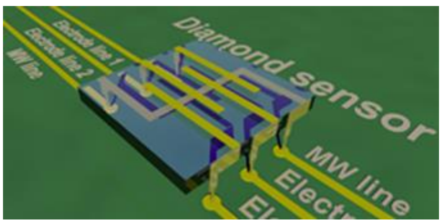
The fast development of the precise control and readout of quantum systems at the individual level promises to bring us to an era, which people usually refer to as a second quantum revolution. Quantum technologies will have a major impact on computing, communication, and sensing. Among different platforms, which are considered for the future quantum hardware, solid-state systems are expected to enable miniaturization, reliability, reduction of power consumption, large scale production and to take a lead similarly as semiconductor devices in the XX century took over vacuum tubes. Point defects in solid-state crystals can introduce discrete levels in the bandgap mimicking trapped atoms. One of the most studied solid-state hosts for single atom-like impurities is diamond. It facilitates a long coherence time of the optically addressable spin defects even at room temperature. Particularly, nitrogen-vacancy (NV) defect in diamond became a leading contender for quantum information processing, quantum sensing, and quantum metrology. The NV's spin allows for the control by microwave field and can be read out optically. However, optical detection suffers from low photon collection efficiency, due to the high refractive index of diamond. Moreover, optical readout implies a bulky photon counting system that limits the miniaturization of a device.

In this talk, I will show a scheme enabling direct on-diamond detection of the NV spin state through the collection of the charge carriers generated on the defect. This technique results from the closed cycle of NV's charge state conversion. Moreover, the process is spin-dependent which leads to the concept of photoelectric detection of magnetic resonance. The method can be extended to microwave-free magnetometry, which is especially important for biological applications. Also, photoelectric detection is capable of imaging single defects even those, which are non-luminescent.



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