Diamond magnetometry

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Nitrogen vacancy (NV) centers in diamond constitute a quantum system with defined spin states and which exhibits relatively long coherence times. These properties enable the realization of sensitive magnetic sensors. In addition, the location of this system, within a lattice, enables an operation in a large range of temperatures from liquid He to high above room temperature.

In this talk we will present the physical principles of the NV center. We will describe preliminary measurements done at BGU of a random field by a magnetic sensor based on ensemble of NV centers in diamonds. Our magnetometer exhibits ~100 μm^3 spatial resolution and <1μT sensitivity. Time permitting we will also present an experiment now underway to image high Tc superconducting vortices.

The ultimate goal of our research is to better understand the "atomic physics" of the NV center, its quantum numbers, and its light-matter interaction. On the applicative side, we aim to generate a chip scale magnetometer. According to theoretical predictions, such a device will have a sensitivity < 1pT and a spatial resolution < $1 \mu m^3$. These properties will enable the mapping of miniature biological and solid state samples, e.g neurons and superconductors. The latter two will again contribute to both fundamental science as well as present day applications.