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Diamond-based quantum sensors: technology and applications in physics and biology

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Abstract

Diamond has emerged as a unique material for a variety of applications, both because it is very robust and because it has defects with interesting properties. One of these defects, the nitrogen-vacancy center (NV center), has a single spin associated with it that shows quantum behavior up to room temperature. Our group is harnessing the properties of single NV centers for high resolution magnetic sensing applications.

In this talk, I will introduce the basic technology and concepts and emerging applications of diamond-based quantum sensors. I will discuss the challenges in the fabrication of high-quality diamond probes, and present some illustrative examples of applications in nanoscale imaging, including the imaging of antiferromagnetic domains and domain walls, the flow of current in graphene devices, and magnetic resonance imaging (MRI) of nuclear spins with atomic spatial resolution.
