Sensing with Quantum Spins

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Abstract:

Sensing applications in quantum technology hold great promise, often requiring precise control over the coherence of constituent particles within the system. The negatively charged nitrogen-vacancy center in diamond exhibits a triplet spin with remarkably long coherence times even at room temperature. With this advantageous property and convenient optical readout through simple electronic transitions, the NV center has emerged as an artificial atom in solid-state form factor, finding applications in sensing and qubit encoding. However, the presence of many-body coherence, while offering opportunities for enhanced sensitivities, also poses challenges in measurement interpretation. This presentation explores the utilization of an ensemble of NV centers in a nano-diamond for various sensing applications. Additionally, we investigate controlling collective spin relaxation dynamics and discuss potential strategies for sensing applications utilizing many-body coherence in diamond nanoparticles.