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Quantum sensing by NV centers in diamond semiconductor

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Abstract

The NV center in diamond has been attracting attention from the viewpoint of the application of ultrasensitive sensors and quantum information devices. In the NV center, the spin of the single NV center can be observed at room temperature despite the spin in the solid. In addition, it has the longest Hahn-echo electron spin coherence time (2.4 ms) and imhomogeneous electron spin dephasing time (1.5 ms) among room-temperature solid state systems [1]. We consider that the elongation of coherence times in n-type semiconductor diamond paves the way to the development and application of diamond-based quantum-information, sensing, and spintronics devices.
The dynamic range is also important from the viewpoint of the application. Conventional sensors have difficulty simultaneously achieving high sensitivity and a large range. On the other hand, we have demonstrated to widen the dynamic range while maintaining sensitivity, which can be applied to the NV center [2]. In addition, we will also show our recent research on low-frequency quantum sensing.

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[1] E. D. Herbschleb, et al., Nature Communications, 10, 3766 (2019).
[2] E. D. Herbschleb et al., Nature Communications, 12, 306 (2021).