Room temperature optically detected magnetic resonance of single spins in GaN

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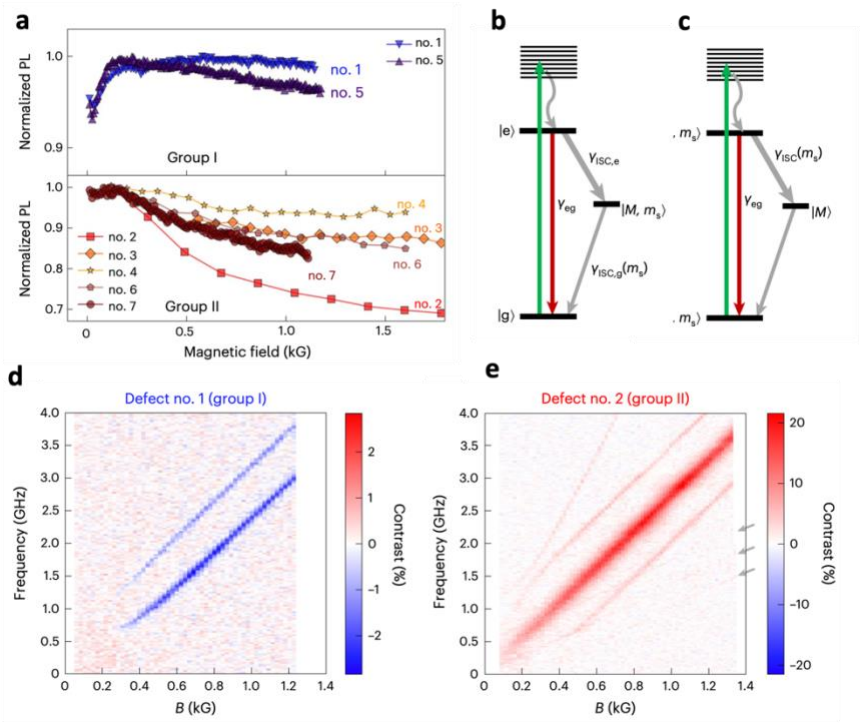
High contrast optically detected magnetic resonance (ODMR) is a valuable property for reading out the spin of isolated defect color centers at room temperature. Spin-active single defect centers have been studied in wide bandgap materials including diamond, SiC, and hBN; each with associated advantages for applications. We report the discovery of ODMR in two distinct species of bright, isolated defect centers hosted in GaN [1]. In one group, we find negative ODMR of a few percent associated with a metastable electronic state, whereas in the other, we find positive ODMR of up to 30% associated with the ground and optically excited electronic states. We examine the spin symmetry axis of each defect species and we establish coherent control over a single defect's ground-state spin. Given the maturity of the semiconductor host, these results are promising for scalable and integrated quantum sensing applications.



(**a**) PL as a function of magnetic field along the GaN c-axis. Two distinct defect groups are evident from the behavior. The inferred level structure of group-I defects (**b**) and group-II defects (**c**). The ODMR spectra of group-I defects (**d**) and group-II defects (**e**). Figure modified from Ref [1].

[1] J. Luo, Y. Geng, F. Rana, and G. D. Fuchs, "Room temperature optically detected magnetic resonance of single spins in GaN," *Nat. Maters* **23**, 512 (2024).