Institut für Angewandte Physik

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RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITÄT BONN

COLLOQUIUM „OPTICS AND CONDENSED MATTER“

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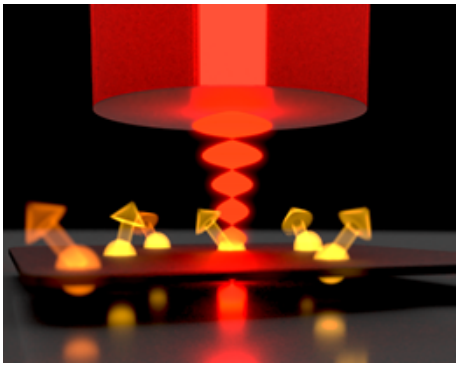
Optically addressable spin qubits and their photonic interfacing

Optically addressable spins in the solid state are promising candidates for realizations of quantum networks and quantum computing nodes.

As one material platform, we study color centers in diamond, such as the tin-vacancy (SnV) center, which offers advantageous optical coherence properties. We observe long-term spectral stability and Fourier-limited emission linewidths of individual emitters. We investigate their spin degree of freedom and demonstrate coherent manipulation of the centers’ electron spin [1]. We furthermore identify strongly coupled neighboring nuclear spins and achieve nuclear spin state preparation and coherent control [2]. Finally, we integrate a thin diamond membrane into a microcavity for efficient spin-photon interfacing and observe Purcell-enhanced emission and cooperative coupling [3]. Together, these steps combine the key requirements for an efficient spin-photon interface as required for quantum network applications.

A complementary platform is rare earth ion-based materials. I will report investigations of molecular rare-earth-complexes with promising coherence properties for quantum applications [4], a first demonstration of optically detected nuclear magnetic resonance in molecules [5], and efforts to study single ions coupled to a cavity as qubits [6,7].



References

[1] Karapatzakis et al., Phys Rev X 14, 031036 (2024)
[2] Resch et al., arxiv:2509.03354 (2025)
[3] Pallmann et al., Phys Rev X 14, 041055 (2024)
[4] Serrano et al., Nature 603, 241 (2022)
[5] Vasilenko et al., arxiv:2509.01467 (2025)
[6] Eichhorn et al., Nanophotonics 14, 1817 (2025)
[7] Deshmukh et al., Optica 10, 1339 (2023)

November 18th, starting with discussion at 17:00 h, talk at 17:15 h, live IAP lecture hall or via Zoom
https://uni-bonn.zoom.us/j/98441612025?pwd=a01SSjlkY1Q3SDFhL09JQk1qc1V6dz09
Meeting-ID: 984 4161 2025
Kenncode: 294164