Spin-photon interface of SiV^- center in nanometer-sized diamond host

Prof.
Alexander Kubanek

University Ulm, Ulm, Germany
E-mail: alexander.kubanek@uni-ulm.de

Implementing efficient, highly controllable light-matter interfaces is essential to realizing the goal of solid-state quantum networks. The negatively charged silicon-vacancy (SiV^-) center in diamond is a promising candidate for such interfaces due to favorable optical properties and long coherence times at low temperatures. Creating optical links between remote SiV centers via photon-mediated spin-spin entanglement is an outstanding challenge. An efficient link could be realized by Purcell-enhanced optical transitions by means of optical resonators. The integration of the diamond host into the mode of an optical resonator is demanding and requires, e.g., absence of scattering and optimized coupling. Therefore small dimensions are favorable. However, the resulting proximity of the quantum emitter to the surface of the host matrix typically degrades the optical and coherence properties.

In this talk I will present our work on how to obtain single SiV^- centers per one nanodiamond with ideal optical properties. I will discuss the integration of SiV centers into photonic structures and analyze the achieved coupling efficiency. Furthermore, I will discuss the integration of diamond membranes into fiber-based optical resonators without changing the properties of the cavity. We used the coupled system to extract the absorption cross section of SiV^- centers.

References

[1] U. Jantzen et. al., New Journal of Physics (2016)

[2] S. Häußler et. al., New Journal of Physics (2017)

[3] S. Häußler et. al., Phys. Rev. B 99, 165310 (2019)

[4] L. J. Rogers, et al., Phys. Rev. Applied 11, 024073 (2019)