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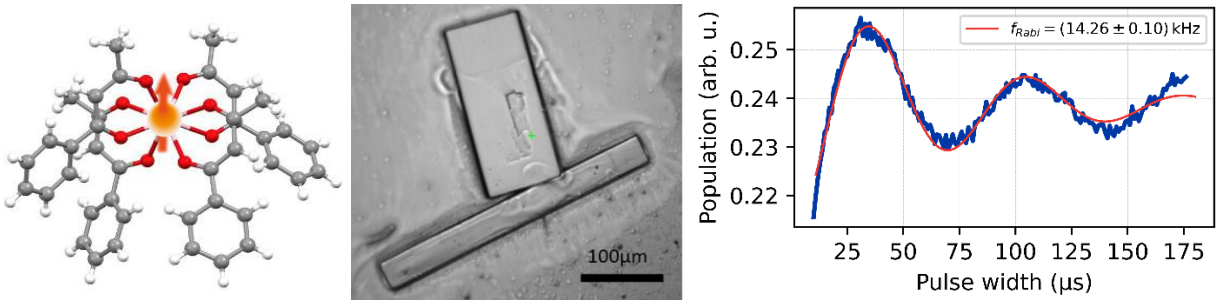
Master's Thesis:

Spectroscopic investigation of novel rare-earth-based molecular complexes for quantum information technologies

Rare-earth ions doped into solids are a promising candidate in the development of quantum technologies due to the exceptional coherence times of their optical transitions and spin states.
In the group of Prof. Hunger, we are investigating rare-earth-based organic molecular complexes for their coherence properties and developing methods for integrating these molecules into Fabry–Pérot microcavites to enhance light-matter interactions. Molecular complexes can be engineered to provide the desired optical and spin properties, and also have the ability to self-assemble into high-quality crystals.

This project will involve sample preparation of these molecular complexes into a form suitable for cavity integration and employing multiple spectroscopic techniques to determine the optical and spin properties of the samples. Typical spectroscopic methods include performing spectral-hole burning and spin-echoes.



Left: Structure of a molecular complex. Centre: Image of self-assembled molecular crystals. Right: optically detected nuclear Rabi oscillations.

You will gain hands on experience in conducting experiments in a running optics lab, with a large range of aspects to explore, including optics setups, electronics & RF, programming, data analysis, and modelling.

Further reading: Serrano, D. et al. Ultra-narrow optical linewidths in rare-earth molecular crystals. Nature 603, 241–246 (2022), DOI: 10.1038/s41586-021-04316-2.

We're looking for a creative and motivated Master's student for this project!

If you'd like to be a part of this project, send your application (or any questions), to:
Prof. David Hunger (david.hunger@kit.edu) or
Dr. Nicholas Jobbitt (nicholas.jobbitt@kit.edu).

Applications should include your curriculum vitae and academic records.