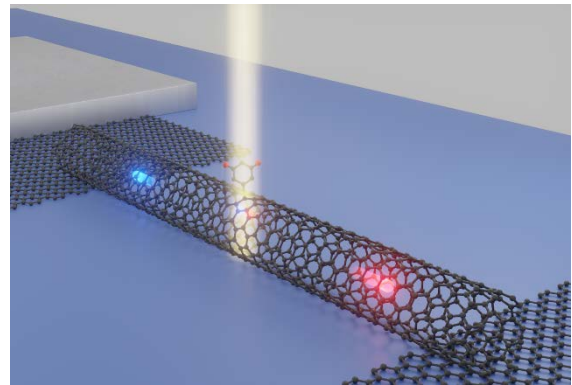


Master Thesis

Photodetection with Defects in Carbon Nanotubes

Motivation: Low-dimensional materials and molecular nanostructures such as graphene and carbon nanotubes have fascinating properties and are of general interest to science and technology. Recently, carbon nanotubes with engineered molecular defects have emerged as very promising structures for optoelectronic applications and quantum communication.



Aim: In this master thesis, the goal is to study defects in carbon nanotubes by using scanning photocurrent spectromicroscopy. The defects of interest are photoactive in the telecom optical wavelength band¹⁻² and suitable for building quantum circuits. From this photodetection study, we will better understand the process of light absorption, exciton formation, and charge generation in carbon nanotubes with tailored defects.

Task: You will learn and use instruments and methods for the assembling, characterization, and simulation of quantum devices; read literature; analyze and present your data; and carry out scientific writing. You will use nanofabrication technology (electron-beam lithography, reactive ion etching, metallization, dielectrophoresis), small-signal electrical characterization methods (charge transport, lock-in technique), optical spectroscopy (Raman, photocurrent), and perform light-field simulations (transfer-matrix method).

Interested?: Highly motivated candidates can send their application (CV, full academic transcript, BSc thesis) to krupke@kit.edu. Knowledge in quantum mechanics, semiconductor physics, or optics is beneficial. Python and Jupyter Notebook skills are expected. English C1 level is required. The workplace is at the Institute of Nanotechnology near Karlsruhe, info at www.int.kit.edu/krupke-group. For TU Darmstadt students, the work counts as an internal master thesis. Thesis guidelines at bit.ly/3nir67A

[1] X. He et al., Nature Materials 17, 633 (2018). [2] M. Gaulke et al., ACS Nano 14, 2709 (2020).