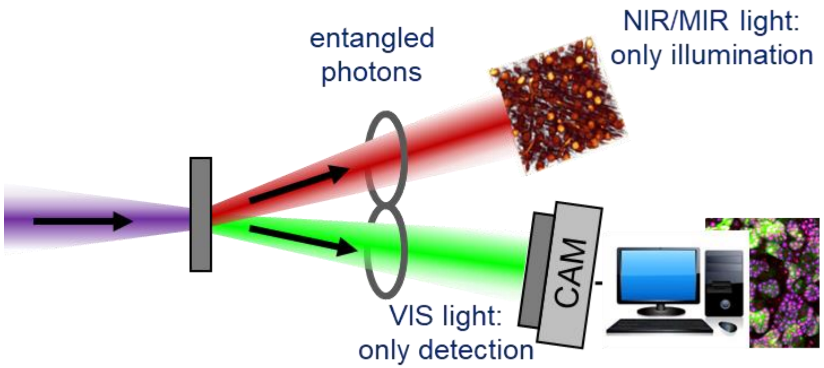
Diplomarbeit / Masterarbeit

Quantum Imaging with Non-Detected Light and Wavefront Shaping



Quantum Imaging. Red: NIR light illuminates the sample, but remains undetected. Green: The VIS light recorded by the camera never interacts with the sample but can reconstruct the image of the sample.

Motivation

Quantum physical effects can lead to entirely new possibilities in microscopic imaging. The nonlinear process of spontaneous parametric down-conversion converts a pump photon into a signal and an idler photon of different wavelengths, e.g. visible (VIS) and near-infrared (NIR). Whereas the NIR light is illuminating the sample to be imaged, the VIS light gets detected by a camera.
Even though the NIR light is not detected, the image can be reconstructed from the VIS light on the camera.
Within this work a nonlinear interferometer will be realized and investigated for imaging of microscopic samples. A spatial light modulator will be implemented to introduce a helical point-spread function in order to achieve a depth resolution.

The aim is to achieve a label-free, contrast-based 3D microscopic imaging in the near-infrared spectral range with high quantum efficiency without having to use special infrared components.

Tasks

- setup of a nonlinear interferometer and a spatial light modulator
- implementation of a microscopic depth measurement using a helical point spread function
- programming image and signal processing routines
- investigations of measurement uncertainty, demonstration measurements

Keywords

Quantum Imaging, nonlinear interferometer, wavefront shaping, microscopy

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