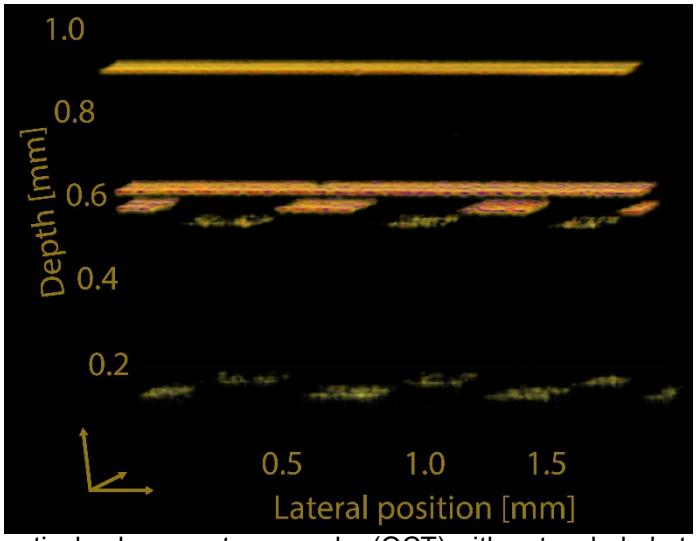
Entangled Photons for Mid-Infrared Sensing - Quantum Futur Award 2019 for Aron Vanselow



Aron Vanselow receives the second prize of the Quantum Futur Award 2019, sponsored by Ministry of Science and Education for his master thesis at Humboldt University Berlin.

It has long been anticipated that entangled photons hold the promise to drive a paradigm shift in imaging and sensing. Real-world implementations, however, have lagged behind their classical counterparts, because of low efficiency, loss and decoherence.

Aron Vanselow's thesis, carried out in the junior research group "Nonlinear Quantum Optics", led by Dr. Sven Ramelow, who is a member of **IRIS Adlershof**, presents the first experimental demonstration of mid-infrared frequency-domain optical coherence tomography (OCT) with entangled photons. OCT is an important depth-imaging method in biomedical diagnostics as well as non-destructive testing allowing for 3D microscopy. OCT in the mid-IR range enables looking inside strongly scattering media, where commercial systems which are all at shorter wavelengths don't work.

The proof-of-principle setup developed by Aron Vanselow, Sven Ramelow and their colleagues is powered by quantum entanglement generated in a patented new crystal. Importantly, the reached performances are already comparable to the best conventional techniques while exposing the sample to 8 orders of magnitude less optical power. At the same time the technological overhead is drastically reduced compared with classical techniques using only compact and cost-effective components.

With the thesis demonstrating fast 2D and 3D imaging of highly scattering real-world samples (ceramics, paint layers) with 20 µm lateral and 10 µm depth resolution it has immediate relevance for applications in non-destructive testing such as quality control of coating thicknesses, cultural heritage conservation and microfluidics.

Mid-infrared Frequency-domain Optical Coherence Tomography with Undetected Photons

A. Vanselow, P. Kaufmann, I. Zorin, B. Heise, H. Chrzanowski, and S. Ramelow
Quantum Information & Measurement V, T5A.86

Ultra-broadband SPDC for spectrally far separated photon pairs

A. Vanselow, P. Kaufmann, H. M. Chrzanowski, and S. Ramelow
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