NAWI Graz Natural Sciences

We work for tomorrow

Master's Thesis

DEVELOPMENT OF NEXT-GENERATION UV-PHOTOACOUSTIC MICROSCOPY WITH METAOPTICAL COMPONENTS

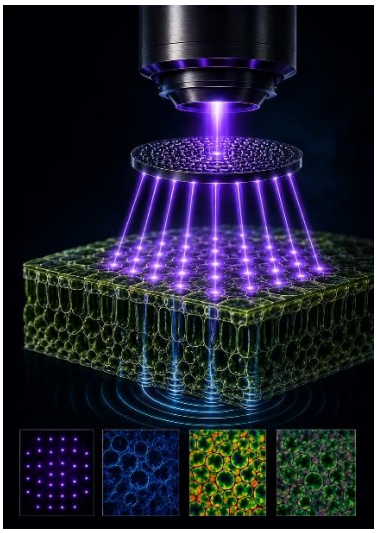
Photoacoustic Microscopy (PAM) combines optical excitation with acoustic detection, providing absorption-based image contrast at high spatial resolution and increased imaging depth in scattering biological samples. Beyond multispectral and functional imaging, UV excitation has recently emerged as a promising approach for label-free histological imaging, enabling direct visualization of DNA/RNA-rich cell nuclei without conventional staining.

However, UV-PAM faces major technological challenges, i.e., suitable optical components are limited, while tight focusing at short wavelengths provide excellent lateral resolution but results in a very short depth of focus, making volumetric imaging over extended depth ranges challenging and time-consuming.

This Master's thesis aims to explore next-generation UV-PAM concepts using advanced metaoptical components to generate structured excitation fields, enabling new approaches to high-resolution photoacoustic imaging.

The focus of this experimental Master's thesis is to:

- Optically characterize an already fabricated UV metalens array.
- Integrate and evaluate the metalens array in an existing UV-PAM setup.
- Develop a compact ultrasound detection concept compatible with the metaoptics-based excitation scheme.
- Characterize the resulting PAM system (resolution, contrast, etc.).
- Apply the developed imaging system to histopathological samples.



The thesis combines experimental physics, optics, photoacoustics, numerical simulations, metaoptics, and biomedical imaging, offering the opportunity to develop novel optical concepts for next-generation biomedical microscopy.

Interested? Contact us (ro.nuster@uni-graz.at or peter.banzer@uni-graz.at) or just drop by!