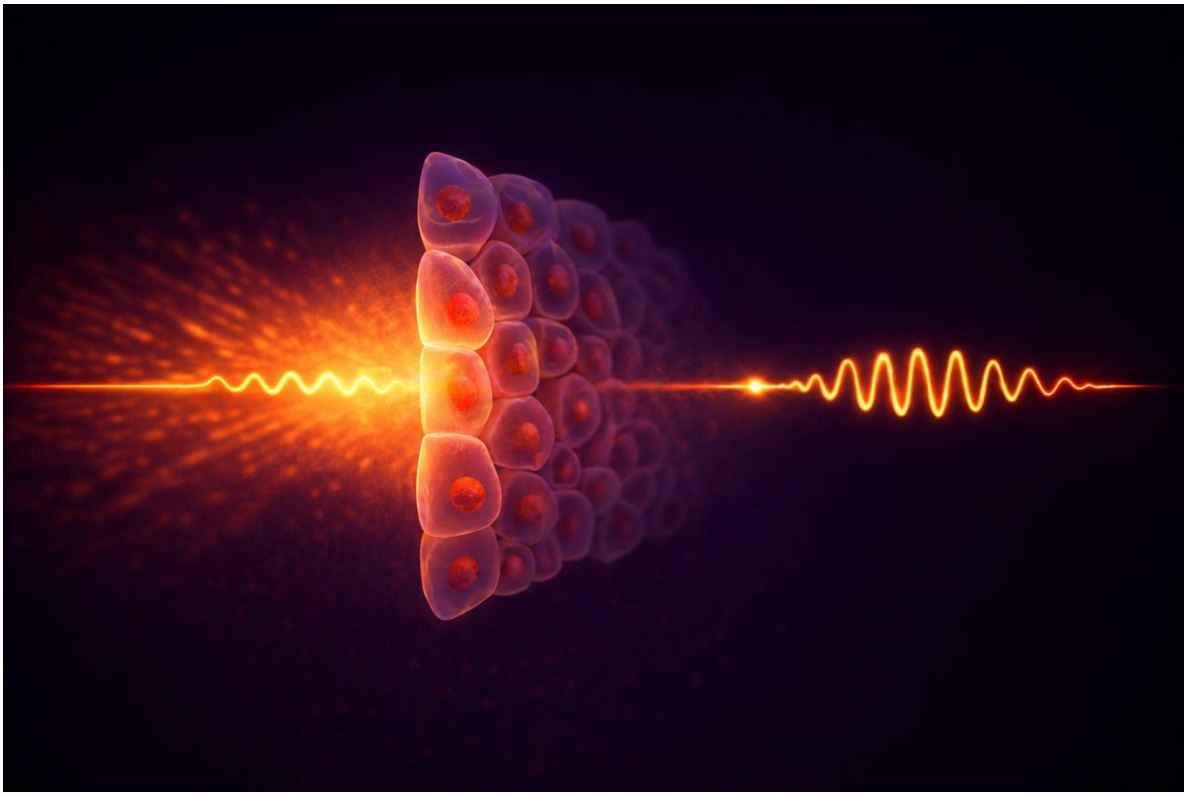
MSc Thesis at the Laboratory of Lightwave Metrology, Prof. Ioachim Pupeza

Field-Resolved Mid-Infrared Spectroscopy of Biological Samples



Mid-infrared molecular spectroscopy provides quantitative and specific fingerprints of complex biological samples, with high promise for applications in biology and medicine [1]. However, exploiting this potential remains challenging due to the molecular complexity and strong absorption of biological samples. Field-resolved mid-infrared spectroscopy directly measures the electric-field oscillations of ultrabroadband pulses, offering high sensitivity and a linear response over several orders of magnitude.

In this project, you will work with a prototype field-resolved spectroscopy system based on a Kerr-lens mode-locked femtosecond laser driving ultrabroadband mid-infrared generation. You will contribute to further developing this platform and exploring its potential for quantitative molecular analysis of complex biological samples, such as tissue specimens.

The project offers opportunities in experimental development, optimization of measurement techniques, and spectroscopic investigations of biologically relevant samples. We aim to tailor the thesis to your interests and strengths while keeping it aligned with our ongoing research. The project is closely connected to our collaborative work in biology and medicine and aims to advance the capabilities of vibrational spectroscopy and its applications to complex biological systems.

[1] I. Pupeza et al., “Field-resolved infrared spectroscopy of biological systems,” Nature 577, 52 (2020)

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