# The ANKA-IR2 Nanoscope and Micro- and Nanospectroscopy Applications

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***Abstract*—We report on a newly developed and integrated microscopy and nanoscopy station at the ANKA-IR2 beamline. We further elucidate how vibrational near-field and micro-spectroscopy can give new insights in medical applications.**

## I. Introduction And Background

A novel microscopy and nanoscopy station integrated at the ANKA-IR2 synchrotron beamline[1] (Fig. 1) combines far- and near-field spectroscopy and microscopy[1,2] with a variety of other modalities such as: Raman confocal and atomic force microscopy (AFM)[1-3,5], near-field aperture (a-SNOM)[1] and aperture-less or scattering near-field optical microscopy (s-SNOM) [1-3,6] in the IR and THz region[7].

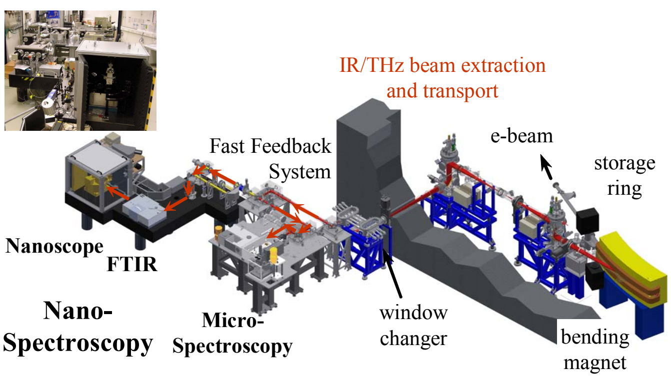


**Fig. 1:** Nano- and micro-spectroscopy stations at the ANKA-IR2 beamline (photo: view at the multi-modal microscope). They are connected via a versatile window changer and fast feedback system for the optical beam.

The multi-modal nanoscope is designed to combine a broad array of techniques to study the "same" sample at the "same" position[3,5], e.g. semiconductors[3] or graphene[5], using IR[3] and THz synchrotron radiation[4].

## II. Results

We report on near-field microscopy applications in the infrared and on the development of time-resolved detection techniques in the THz spectral range. Figure 2 shows a measurement of scattered infrared light from a sample illuminated by one of the additional offline laser sources. The optical beam was passed through the FTIR and focused on the AFM cantilever tip, which oscillates at a sub-MHz frequency *f*. The scattered light was detected with an IR detector and demodulated with a lock-in amplifier at 2*f*, a typical operating mode to record near-field images.

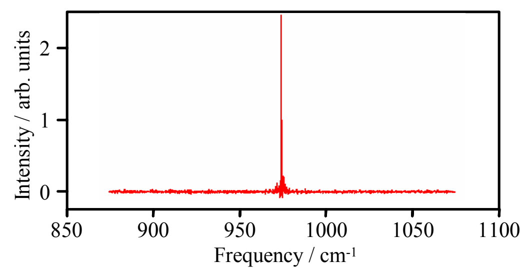


**Fig. 2:** FTIR measurement of scattered light from a sample illuminated at 975 $cm^{-1}$ (29 THz) and demodulated at 2*f* of the cantilever oscillation frequency *f*.

We further elucidate how vibrational micro-spectroscopy can give new insights in chemistry and medicine[2,6]. Introducing infrared active labels[6] into super-resolution IR s-SNOM may enable molecular tracking and distribution studies even in complex biological systems[6].

## III. Acknowledgments

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