

## *NanoIR as a New Tool for Spectroscopic Imaging in Biomedical Studies*

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Laboratory of Spectroscopic Imaging for Radiobiology, Therapy and of Complex Systems Research at the Institute of Nuclear Physics, Polish Academy of Sciences in Kraków was founded in order to apply physical methods in eradication cancer and other pathologies studies.

We have developed and applied infrared nano-spectroscopy (nanoIR) to explore the detailed composition of chromosomes. NanoIR2 system, which we have in our laboratory, permits to image local IR absorption with nanometer resolution achieved by mapping local thermal dilatation using an AFM tip. The integrity of chromatin structure is essential for every process occurring within eukaryotic nuclei [1, 2]. For example, tightly packed, methylated DNA forms heterochromatin, which is transcriptionally inactive, but indispensable for the maintenance of structural integrity [3, 4]. However, lightly packed unmethylated euchromatin contains most genetic information [3, 4]. NanoIR coupled with the Principal Component Analysis (PCA) has confirmed that chromosome areas containing euchromatin and/or heterochromatin are distinguishable based on differences in degree of methylation. Heterochromatin has significantly more methylated sites than euchromatin as previously described [3,4]. We will present the new, robust and reproducible approach for detection of DNA methylation sites in human chromosomes providing the location of the heterochromatin–euchromatin boundaries at a spatial resolution below 100 nm. Given the importance of DNA methylation in the development of nearly all types of cancer [5] there is potential of nanoIR approach [6] to be used as an early screening tool for malignancy.

Additionally, we will present the application of other nanospectroscopic techniques (TERS, SERS) to investigate Pt-103 interactions with DNA.

The laboratory of spectroscopic imaging has been co-funded by the Malopolska Regional Operational Program Measure 5.1 Krakow Metropolitan Area as an important hub of the European Research Area for 2007-2013.

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