



## KONWERSATORIUM INSTYTUTU FIZYKI UMCS

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### ***„Methods of non-linear microscopy in biology and medicine”***

Optical microscopy is one of the major methods of research of properties, quality control and diagnostics of liquid and solid media in materials physics, industrial production, chemistry, biology and medicine. Modern fluorescent, confocal and laser scanning microscopes are widely used to obtain spatial, including 3D, images of materials' and objects' structure in various domains of natural sciences, industry and medicine. Optical microscopy grows in its importance with the development of modern nanotechnology, biotechnology, methods of diagnostics and treatment of most dangerous for mankind diseases.

Along with the traditional fluorescence or Raman microscopy, optical non-linear laser microscopy has been developing intensively. With this method, the generated signal that forms the contrast mechanism of the image depends non-linearly on the excitation intensity. The non-linear optical microscopy includes Two-Photon (Multi-Photon) Fluorescence Microscopy (TPEF), the microscopy based on the Generation of the Second (Third) Harmonic (SGH, THG), the sumerized (SFG) or differential (DFG) frequencies (including resonance vibrational), as well as the four-wave-mixing microscopy including the vibrational coherent anti-Stokes Raman scattering (CARS). As all the above mentioned types of non-linear microscopy are based on various non-linear phenomena, they may bear different on principle information about the object under study and successfully complement each other. High-intensity pico- or femto- second lasers that can initiate several non-linear optical phenomena at the same time are used for simultaneous generation of several images. In case of many registration channels, images completely different in their physical nature can be formed in the microscope thus reciprocally enriching data on the object. This type of microscopy can be called the multi-channel non-linear optical microscopy. The coherent anti-Stokes Raman scattering (CARS) is a stimulated process of the Raman scattering when molecular vibrations are phased with external radiation and scatter this radiation into the anti-Stokes region.

Recently, the Joint Institute of Nuclear Research has obtained such a unique facility – a non-linear optical microscope which includes also possibility to register CARS signals which is very proper method to implement the non-invasive and high-sensitive investigations of biological objects. The first experiments on this facility are scheduled at the beginning of 2011.

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Uprzejmie zapraszam wszystkich pracowników, doktorantów i studentów Instytutu Fizyki.

Zbigniew Korczak