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Biomedical application of Positron Annihilation Lifetime Spectroscopy - in vitro studies of alive normal and cancer cell lines and tissues

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Abstract
Positron Annihilation Lifetime Spectroscopy (PALS) allow to examine structure of materials at nano and sub-nanometer level. This technique is based on the lifetime and production intensity of ortho-positronium atoms in free volumes of given structures. Recent studies shown it can be used for studies of biological structures [1-5] and morphometric imaging as proposed in patent [6].
Results of the first experiment with alive melanocytes and melanoma cell culture in vitro will be presented. PALS, viability and microscopic studies were performed on normal and cancer cells cultures, before and after measurement conducted in condition close to ones in human body (eg. in 37 C deg.). As a result, it was proved that PALS can be successfully used for studies of living organisms, their dynamics and its relation to the cells morphology.
Studies with human tissue will also be presented. Research were conducted on cardiac myxoma (benign hart tumour) with adipose mediastinal tissue as a control and later with myxoma cells extracted from the tissue, to compare between these two models. All these studies shown significant differences in o-Ps lifetime between normal and cancer cells.
This experiment show perspective for biomedical application of PALS technique, giving insights in determination of early and advanced stages of carcinogenesis by observing changes in biomechanical parameters between normal and tumour cells. Simultaneous investigations of PALS and PET can be performed with the Jagiellonian Positron Emission Tomograph (J-PET) [6-9] which is a multi-purpose detector used for investigations with positronium atoms in life-sciences as well as for development of medical diagnostics. J-PET is capable of imaging of properties of positronium produced inside the human body [1, 10].

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