STUDENT PROJECTS
AT
RESEARCH TEAM OF BIOELECTRODYNAMICS

Research team of Bioelectrodynamics
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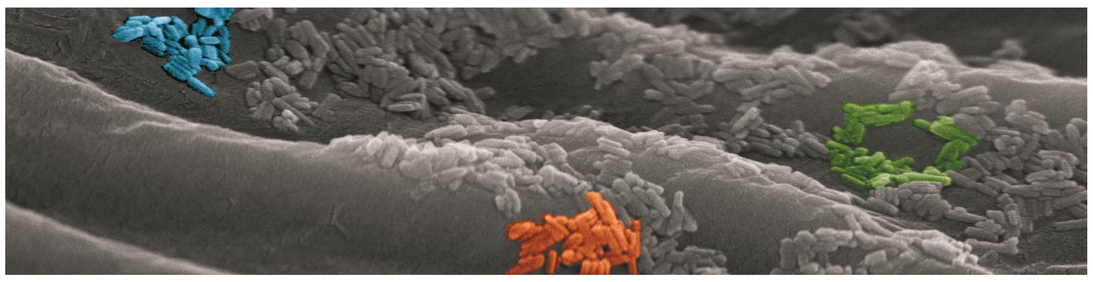
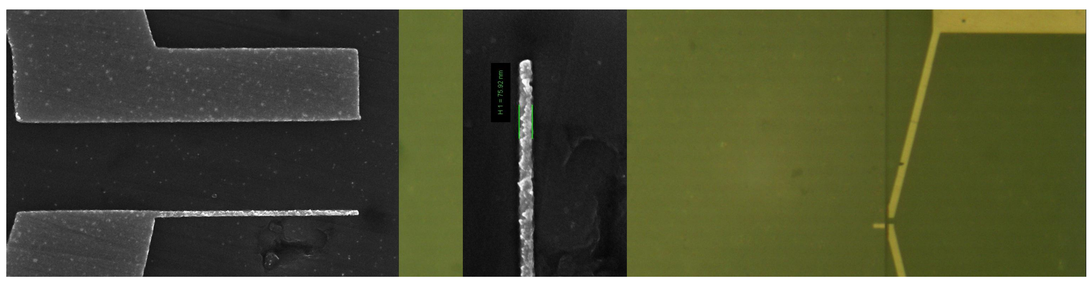
The research team of Bioelectrodynamics (coherence.ufe.cz) at the Institute of Photonics and Electronics, AS CR, currently offers positions on projects listed below. Each topic is designed as a doctoral project, but it may be modified for semestral, bachelor or master thesis. Projects are carried out in cooperation with the Faculty of Electrical Engineering, Czech Technical University in Prague but not limited to this institution if the candidate already has formal supervisor from any other university. Applicants should have appropriate background in at least two of following disciplines: math, physics, biology, chemistry, and electrical engineering. Knowledge of Czech language is not needed. Interested candidates should contact Dr. Michal Cifra (cifra@ufe.cz, www.ufe.cz/~cifra/).



Fractal analysis of bio-photon emission

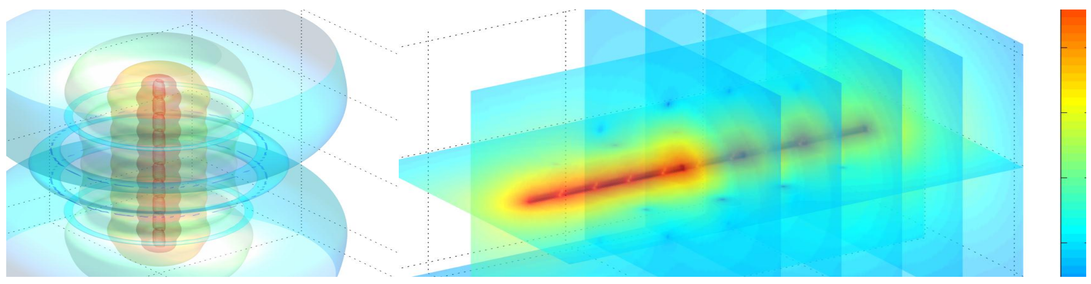
Optical ultra-weak photon emission is a universal phenomenon in metabolically active biological systems. The aim of the project is to analyze statistical properties of this emission using fractal analysis. You will perform experimental work using our darkroom with photomultiplier, analyze data obtained, and discuss possible role of the photon emission in bio-communication and other physiological processes.



Design of integrated circuits for measurement of electromagnetic activity of living cells

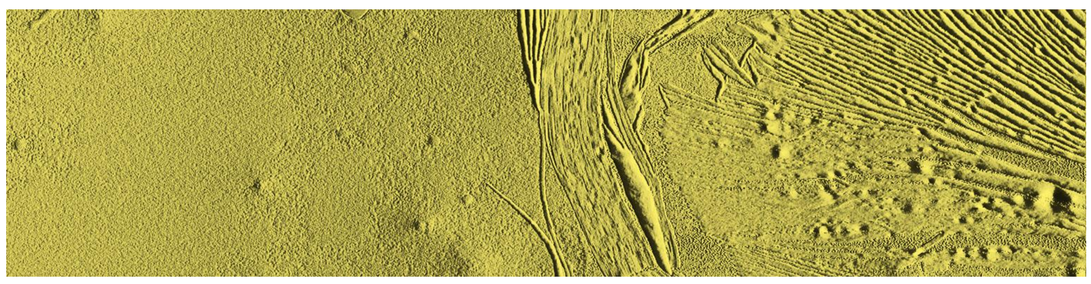
Electromagnetic activity of living cells remains opened question for several decades. Your task will be design of integrated sensor with preamplifier for detection of cellular electromagnetic emission in the vicinity of the cell. This part of the measurement system is crucial for achievement of desired power and spatial resolution. The frequency range of interest spans from kHz up to GHz region. You will therefore face a number of technical challenges. Solid background in numerical modeling and good knowledge of engineering software (MatLab, Comsol, etc.) is required.

Join our team!



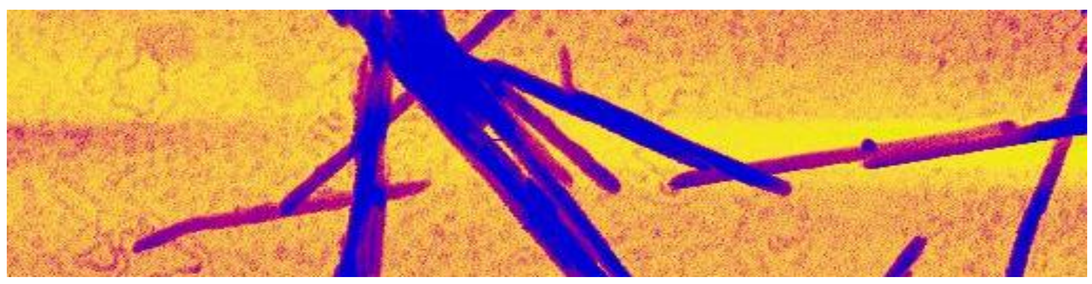
Modeling of biophysical processes generating electromagnetic field on supramolecular level

Nanoelectromechanic properties of supramolecular structures make them good candidates for generation of electromagnetic field. However, biophysical processes underlying this mechanism are not satisfactorily understood. The aim of this project is to develop models of supposed processes and discuss their feasibility *in vivo*.



Nano-characterization of bio-materials with attention to electromechanical properties

Electromechanical properties of proteins, supramolecular structures, etc. are in the focus of contemporary research, because electro-mechanical coupling seems to play important role in biological functionality of these structures. During work on this project you will gain experience with atomic force microscopy (AFM) and other up-to-date material characterization methods, carry out simulations and perform image/signal analysis. The object of interest will be particularly microtubules, significant part of cytoskeleton.



Microwave spectroscopy of biomolecular nanostructures

Biomolecular nanostructures, such as membranes and cytoskeletal polymers, are theoretically predicted to have electromagnetically active vibration modes in the upper microwave region of several tens of GHz. Your task will be to design the measurement sensor for microwave spectroscopy of liquid samples containing biomolecular structures of interest. Sensor will be based on modified planar transmission line and connected to network analyzer. Background in electrodynamics or microwave engineering is required.