

Concepts of the effective electromagnetic functional influence on biological structures.

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The results of interdisciplinary research-consulting group activity, set up in Hydrophysical Research Centre on the Physics Faculty (M.V. Lomonosov Moscow State University) in the field of the microwave interaction with condensed medium and biological objects are presented in the report.

Quasioptical coherent microwave radiation sources with wide range frequency tuning, for directed electromagnetic energy transmission based on interaction of rotating electron beams with electrodynamic structures fields, which are much greater than wavelength, matching output resonator window with radiative antenna, etc. are the most critical results for the construction of the effective NLW systems.

Carried out research permitted to:

- create a number of experimental models of industrial quasioptical devices with capacities ~ 1kW in continuous operation regime $\lambda \sim 3$ mm, 8 mm, with frequency tuning ~ 20 %.
- create compact gyro-devices on permanent magnets with the same parameters, operating at high (up to 10) harmonics.

expected results in this direction includes:

- creation of a unique electron-electrodynamic systems of concordance and electromagnetic beam control.
- advancement of developed sources into THz spectral region on the basis of compact relativistic sources and new types of quasi-optical electrodynamic structures
- estimation of the “exotic” physical mechanisms realization when creating NLW
- spectral-energy boundaries analysis of self-focusing effect in atmosphere
- modernization of created and traditional microwave sources with the purpose of: frequency tuning region widening, use non-magnetic (except for focusing – accompaniment of cathode beams) systems with rectilinear electronic flows, realization of oscillating modes with efficiency ~ (75-80) %.

Millimeter wave radiation sources were used for carrying out biomedical research, which main results are:

- revealing of long-living (during several days) aqueous medium states changed both from point of view of physicochemical properties and biological activity.

- modification processes analysis of condensed medium properties at the expense of it's molecular structure reorganization – resonant action effects leading to biological effects not concerned with pronounced thermal action.

Expected results by given direction:

- determination of action specificity of millimetric range electromagnetic radiation as the most perspective for the aims of NLW on human organism water structures
 - o cell membrane, hydration shells
 - o multi-layer cells of organism, first of all multi-layer skin tissues
 - o integrated reaction of organism taking into account it's water structure peculiarities
- detailed analysis of functional striking factor of electromagnetic radiation in various spectral ranges
- elaboration of methods of long conservation of electromagnetic radiation functional action effect (memory effect) on biological objects
- research of spectral-energy characteristics of various human organs and tissues

Objectivisation of biological action results of electromagnetic radiation is proposed to be conduct at several levels: beginning from elementary and unicellular algae up to higher plants, using them as elegant biosensors.

Ten-year experience of interdisciplinary group, which joined efforts of scientists from MSU, specialists of leading scientific-industrial associations, institutes of Russian Federation Academy of Sciences demonstrated the possibilities of International University/Industry Research Collaboration in dual-technology programmes and lays good basis for organization of complex research on the NLW issues.