Usikov Institute of Radiophysics and Electronics (IRE), Kharkiv

Technical Area: Physics; Sensors
Keywords: microwave science and engineering

General Information
The Institute of Radiophysics and Electronics (IRE) was established in 1955 as a spin-off of the Kharkov Institute of Physics and Technology as a primary research institution in microwave science and engineering in Ukraine. The main objective of the newly founded Institute was research and development in the wide frequency range of electromagnetic wave spectrum, with a special emphasis on the millimeter (mm) and sub-millimeter (sub-mm) waves.

The structure of the Institute includes 19 departments (650 people, 220 of which are scientists), a Special Design Bureau (SKTB), and a Pilot Production facility for experimental and prototyping production of microwave and mm-wave devices. The facility works with IRE researchers on application development projects, but maintains certain independence within the Institute.

Institute’s Focus
Over the years, IRE has gained a status of a well-known scientific center having developed significant core competencies and expertise in:
- vacuum electronics
- quasi-optical mm/sub-mm functional devices, units and high frequency circuits
- innovative radar equipment design
- microwave studies in solid-state physics and biophysics
- radio wave propagation
- advanced mathematical modeling.

Valuable Technology Offerings
Tangible outputs include mm-wave klystrons, magnetrons, klynotrons, and otron (generators of diffraction radiation), as well as systems for high temperature plasma diagnostics, masers for radio astronomy, Doppler, noise and other radars, polarimeters, high-temperature sensors, super-compact testing ranges, and so on.

Concurrently with traditional fields of study, new areas of research were explored to include subsurface radiolocation (Ultra Wide Band / Short Pulse (UWB/SP) Radiolocation), optics of periodic media, Earth remote sensing from air- and space-born carriers, acoustic monitoring of sea bottom, use of microwave electronics for biomedical applications, etc.

Scientific Cooperation and Technology Transfer
IRE maintains active collaboration with a number of research institutions both in and outside of Ukraine. Close ties remain with the National Scientific Center “Kharkov Physical-Technical institute” (e.g., joint research on electronic-optical modules for vacuum systems), one of the founders of Scientific and Industrial Concern NAUKA, a project management organization facilitating technology transfer and commercialization through a number of programs, such as the bi-lateral Russian-Ukrainian Science and Technology Program “Nanophysics and Nanoelectronics”.

International cooperation includes joint research projects under European Union’s Framework programs. For example, IRE’s Modeling of Optoelectronic Components and Antennas group participates in two Networks of Excellence, Micro-Scale to Nano-Scale Photonic Structures for Optical Communications and Antenna Center of Excellence. Over 20 projects were funded by INTAS and STCU. Noteworthy is cooperation with the International Research Centre for Telecommunications and Radar, Delft University of Technology, the Netherlands, the International Center for Theoretical Physics in Trieste, Italy, and, especially, the Institute of Bio-and Nanosystems (IBN) of the Research Centre Jülich, Germany, where IRE scientists participate in the studies of transport and noise properties in advanced materials and heterostructures for the design of ultra low noise oscillators and sensors.

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FOCUS AND EXPERTISE
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PARTNERSHIP OPPORTUNITIES
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The Usikov Institute of Radiophysics and Electronics of NAS of Ukraine (IRE) is proud to present a brief inventory of the results of research and development effort that has for years been pursued and led to the tangible achievements in the following areas:

- Developing novel, highly efficient methods for resolving diffraction problems;
- Exploring fundamental properties of solids and bioobjects;
- Research on nanotechnology, superconductivity and radar effects;
- Creating operational laboratory prototypes of radar systems to keep close watch on the territories or sites where protected objects are located;
- Detecting masked or hidden objects on a human body;
- Searching for survivors under the rubble of ruined buildings;
- Handling the subsurface probing issues, namely, searching for underground service lines, voids, oil slicks; supervising the integrity and migration of oil and gas pipelines;
- Locating tunnels or holes dug out under the ground, etc (these operations are being carried out within the framework of the NASU innovation projects);
- All-weather monitoring of the state of buildings and engineering structures;
- Developing the collision-avoidance systems for moving objects;
- Devising the technique for radar monitoring from aerospace carriers, which are aimed at forecasting and monitoring the floodings and inundations emergency situations, particularly, forest fires; monitoring the state of vegetation and forest tracts;
- Studying soil erosion processes, water surface purity and surfactant-contaminated zones resulting from the impact of anthropogenic nature.

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a) Millimeter wave semiconductor radar.
b) Alt Laser 10-100-VS Laser Complex.
c) Millimeter Waveband Cryomagnetic Radiospectroscopy Complex "Buran".
d) Two-frequency radiospectrometer-relaxometer.