

STRUCTURE OF THE IOE

LASER TECHNOLOGY DIVISION

Solid State Lasers Group
Fibre Lasers Group
Laser Optics Group
Laser Applications Group
Laser-Matter Interaction Group

OPTOELECTRONIC TECHNOLOGIES DIVISION

Optical Technologies Group
Laser Teledetection Group
Laser Nanotechnologies Group
Optical Spectroscopy Group
Biochemistry Group

OPTOELECTRONIC SYSTEMS DIVISION

Quantum Electronics Group
Optical Signals Detection Group
Security Systems Group

INFRARED TECHNOLOGY AND THERMOVISION DIVISION

Infrared and Thermovision Group

BIOMEDICAL ENGINEERING CENTRE

ACCREDITED TESTING LABORATORY

Laser Metrology Group

Institute of Optoelectronics

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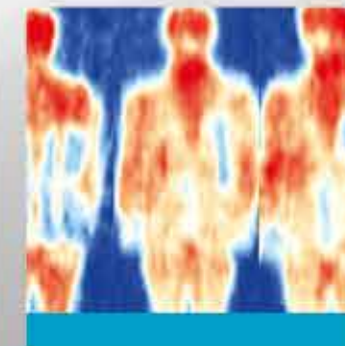
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Military
University
of Technology

Institute
of Optoelectronics **ioe**



Institute of Optoelectronics

The Institute of Optoelectronics (IOE) carries out scientific research and educational programmes in the fields of optoelectronics and photonic technologies. The principal mission of the IOE is research and development related to defence and security needs defined by the Ministry of National Defence (MoD). The IOE activities include basic scientific investigations, research & development of laboratory models, technology demonstrations and testing prototypes of optical and optoelectronic systems. Institute runs Bachelor programme in field of Space and Satellite Engineering, and Master and Doctoral programmes filed of Electronics. The Council of the Institute is authorized to award doctoral and habilitated doctor degrees in the field of electronics.

RESEARCH

The main areas of research carried out at the IOE are laser physics, photonics, optics, optoelectronics, spectroscopy, thermovision, optical signal detection, and the interaction of laser radiation with matter. The IOE conducts scientific research in the following areas:

- Solid-state and fibre lasers
- Laser-driven X-ray and EUV sources
- High-power laser systems
- Laser optics and electronics
- Laser-matter interactions and laser-assisted material processing
- Optical materials and technologies
- Optoelectronic technologies
- Optical signal detection
- Optical spectroscopy in the EUV-UV-VIS-IR-THz range, Raman and fluorescence spectroscopy
- Optical and optoelectronic metrology
- THz physics and technology
- LIDAR technologies
- Infrared technology and thermal imaging
- Laser rangefinders
- Fibre-optic technologies for critical infrastructure protection and security
- Optoelectronic systems for defence and security
- Nanotechnologies and plasmonics
- Biotechnology, biochemistry, and biomedical engineering

DEVELOPED DEVICES, SYSTEMS, AND TECHNOLOGIES

The research projects carried out at the IOE have resulted in the development of various devices and systems, which have repeatedly received awards at international fairs and exhibitions. Many of them have been commercialized. The following were developed at the IOE in the last couple years:

- "Poprad" self-propelled anti-aircraft weapon
- ZSU-23-4MO "Biata" anti-aircraft artillery and missile system
- Thermal weapon sights for small arms
- Biological weapon detection system
- Systems for spectral characterization of hazardous materials in the THz range
- Optoelectronic systems for fire protection and explosion suppression
- Universal test sets for examination of night vision devices
- Two-colour scattering LIDAR
- Scattering LIDAR for underwater object detection
- Fluorescence LIDAR
- High peak power Er:YAG, Tm:YLF, Cr:ZnSe, Ho:YAG, Ho:YLF, Tm fiber lasers
- High peak power, eye-safe, Er fibre laser transmitters
- Mid-Infrared SuperContinuum Fiber Laser Sources
- Optoelectronic CEAS systems for trace gas detection
- Laser vehicle speedometer system
- Laser photography system based on a range-gated imaging system

DOMESTIC AND INTERNATIONAL COLLABORATIONS

For years now, the IOE has been engaged in various collaborations with leading research centres in the fields of optoelectronics and photonics in Poland, Europe, North America and Asia. The cooperation is mainly based on joint research programs, as well as the exchange of staff and students. In addition, the IOE works closely with industry to commercialize devices, systems, and technologies developed at the IOE. The IOE actively participates in European Union (EU), European Defence Agency (EDA), and North Atlantic Treaty Organization (NATO) programmes.

The IOE has been involved in many research projects relevant to EU programmes, including:

- CEZAMAT- The Centre for Advanced Materials and Technologies
- OPTOLAB - upgrading of laboratory facilities at the IOE of the Military University of Technology

- InTechFun - Innovative Technologies of multi-Functional materials and structures for nanoelectronics, photonics, spintronics, and sensors
- ELI - European Light Infrastructure
- LASERLAB EUROPE II - The integrated initiative of European laser research infrastructures II
- PROTEUS - Integrated mobile system for counter-terrorism and rescue operations
- TERAEEYE - A fully passive THz inspection system based on nanotechnology for security applications
- The IOE has been involved in many research projects involving EDA programmes, including:
- TIPPSI - THz Imaging Phenomenology Platforms for Stand-off IED Detection
- RAMBO - Rapid Air-particle Monitoring against BiOlogical threats
- AMURFOCAL - Active MUltispectral Reflection Fingerprinting Of persistent ChemicAL agents
- ADHELW - Air Defence High Energy Laser Weapon
- AHEAD - Advanced Helmets and Devices for Individual Protection
- SNIPOD - SNIper Positioning and detection
- FABIOLA - Application of Extended Fluorescence Methods for Improved Detection of Biological Warfare Agents

The IOE actively participates in activities of the Polish Technology Platform for Security Systems coordinated by the Military University of Technology and is a member of the OPTYKA DYFRAKCYJNA, EULASNET, POLLASNET, and POLSKA OPTOELEKTRONIKA networks. In addition, the IOE is a member of the OPTOKLASTER - Mazovian Photonic Technology Cluster.

EDUCATION

The IOE runs Bachelor's degree (I degree) programs in Space and Satellite Engineering, Master's degree (II degree) graduate programs in Electronics and Telecommunications with specializations in Optoelectronics Systems and Lasers, and PhD (III degree) graduate programs in the field of Electronics. Employees of the IOE give lectures, classes, and lead laboratory exercises in courses run by other faculties related to optoelectronics, photonics, and materials engineering. The rich scientific experience and achievements of the IOE staff, modern equipment of the research laboratories, and expanded collaborations with Polish and foreign universities and research centres create excellent conditions for learning.

RESEARCH FACILITIES

The IOE has well-equipped laboratories with modern diagnostic devices used for spectroscopy, signal detection, recording parameters of laser radiation, and laser metrology. The IOE also has a testing laboratory equipped with devices for measuring the parameters of laser radiation. The equipment used at the IOE includes among others:

- X-ray photoelectron spectrometer (XPS)
- Atomic absorption spectrometer (AAS)
- FTIR, UV-VIS-NIR, Raman and fluorescence spectrometers
- Raman-SPM system
- Atomic force microscope (AFM)
- THz spectroscopy research standards
- Excimer lasers
- TW femtosecond laser system
- High energy laser systems
- Laser-plasma EUV, SXR radiation sources
- Strobe system for fluorescence lifetime measurements
- BIRAL systems for measurements of the distribution of diameters, the level of fluorescence, and the shape of biological aerosols
- Gas analysis systems with quantum cascade lasers
- Infrared reference sources
- Pulsed Laser Deposition (PLD) system for deposition of nanolayers
- Thin Film Technology Laboratories (PVD, CVD)
- Chemical laboratory

ACCREDITED TESTING LABORATORY

The Accredited Testing Laboratory of the IOE of the Military University of Technology functions in accordance with a quality management system, meeting the requirements of the PN-EN ISO/IEC 17025, since 1997. The management system is documented and has received a certificate (no AB 109) from the Polish Centre for Accreditation. The results of tests performed by the laboratory are recognized by the International Laboratory Accreditation Cooperation/Mutual Recognition Arrangement (ILAC/MRA). Laboratory equipment can determine correction factors and the nonlinearity of laser energy/power meters, an absorption coefficient of optical materials, the safety class of devices emitting laser radiation, and the characteristics of infrared, noctovision, and low level television devices.