

RESEARCH FACILITIES

Our unique research equipment allows us to carry out high level scientific investigations in the fields of optical signal detection, laser absorption spectroscopy, electronics for optoelectronic devices, and fibre and THz technologies. These instruments are also used in the training of students in the Optoelectronics and Security System specialties.

The research equipment located in our Research Facilities includes:

- Equipment for analysing fibre optics, including: fibre welding machine, optical spectrum analyser, fibre optic reflectometer, optical power meters
- Ground radar
- Laboratory for characterizing optoelectronic imaging devices
- Infrared camera
- Portable set for testing infrared cameras
- Ultra-fast camera for observation of very fast phenomena
- Thermal desorption spectrometer with adapters working in the range of 0.06-3 THz
- Grid spectrometer
- Programmable pulse generator
- Vacuum pumping stand
- Explosive materials sensor
- Gas reference generator

- Sets of infrared radiation sources using cascade lasers and a tunable OPO laser system,
- Conditioning devices and analysers of photodetector signals, e.g. low noise preamplifiers; synchronous integrators and phase sensitive amplifiers; spectrum analysers; low-noise current-voltage biasing source; function generators, generators of time delays, and digital signals

Selected scientific research and teaching laboratories:

- Test stand for determination of the spectral characteristics of optical materials, infrared sources, and infrared detectors
- Test stand for evaluating thermal cameras, visible light cameras, night vision devices, and laser rangefinders
- Test stand for microscopic thermal imaging
- Test stand for non-destructive testing using optical lock-in thermography
- Mobile laboratory for infrared and spectroradiometric measurements
- Test stand for IR equipment testing in climate chambers

RESEARCH GROUPS

- Quantum Electronics Group
- Detection of Optical Signals Group
- Security Systems Group

Optoelectronic Systems Division

Chief

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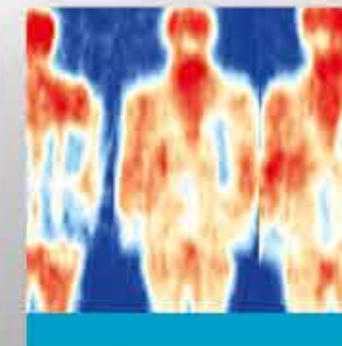
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Optoelectronic Systems Division

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The research and development activities in the Optoelectronic Systems Division focus on applications of new optoelectronic detection systems, fibre and terahertz (THz) technologies in medicine, environment monitoring, and critical infrastructure protection.

RESEARCH

- Design of low-noise, highly responsive photoreceivers working in the extreme ultraviolet to long-wavelength infrared radiation range
- Construction and investigation of devices for vapour preconcentration and thermal decomposition of explosive materials
- Design of free space optical transceivers that operate in the longer infrared wavelengths
- Investigation of ultrasensitive optoelectronic sensors for dangerous gases
- Development of air sampling units for breath analyses of people, using laser absorption spectroscopy
- Design of special current drivers for semiconductor lasers used in laser absorption spectroscopy or free space optic setups
- Development of fibre sensors for electronic protection of large objects
- Design, consulting, and commissioning of electronic protection systems for critical infrastructures
- Measurement methods and systems for investigating thermal imaging cameras, TV cameras, night vision devices, laser devices, and multisensor observation devices
- Measurement of the spectral signatures of dangerous materials

(explosive materials, drugs) and characterization of composite materials using THz spectroscopy

- Investigations of integrated radar-camera systems for airport and seaport security

ONGOING PROJECTS

Projects Funded by the European Union (EU):

- A low cost and fully passive THz inspection system based on nanotechnology for security applications

Projects Funded by the Ministry of Science and Higher Education:

- A low cost and fully passive THz inspection system based on nanotechnology for security applications

European Defence Agency Project:

- A THz imaging platform for remote detection of improvised explosive devices

Development Projects:

- Development of modular multisensor systems for ground protection of critical infrastructure
- Integrated and multisensor system for monitoring and protection of seaports
- Integrated laser photography system for monitoring open space and preventing terrorist threats
- THz detection system of hazardous materials carried on-body

- Free space optical communication system operating in the wavelength range of 8-18 μm
- Development of optoelectronic sensors of vapours from explosive materials
- Development of optoelectronic sensors of nitrogen dioxide
- Improvement of the border clearance process using biometric devices for self-control and to control transport across the external border of the EU
- Development of an energy-saving kit for mobile biometric and document control systems using acoustic and facial imaging
- Mobile border control using biometric techniques adapted to the requirements and recommendations of the EU
- Fibre link integrity monitoring to protect against unauthorized access to confidential information
- Implementation of a multipixel THz radiation detector that uses a selective MOS transistor and its applications in biology, medicine, and security systems
- The development of an environment for implementing the concept of Smart Borders
- Active sub-THz 3D scanner for anti-terrorism applications
- THz radiation detectors prepared using field effect transistors for use in wireless communications

Key Projects:

- PROTEUS - Integrated mobile system for counter-terrorism and rescue operations
- Composite system of passive and active protection of critical infrastructure

Applied Research Projects:

- SENSORMED - An optoelectronic system of sensors for detecting disease markers

- New generation IR emitters and detectors for use in devices detecting trace amounts of gases

Own Research Projects:

- Capability analysis of hazardous material detection based on tunable laser spectroscopic methods with quantum cascade lasers
- Analysis of the driving signals and cooling units for quantum cascade lasers
- Study of the concentration and decomposition processes of explosives vapours using optoelectronic sensors

ACHIEVEMENTS

The most important achievements of the Optoelectronic Systems Division include:

- Development of optical sensors for trace detection of explosive materials
- Commercialization of a fibre system for perimetric protection of special objects
- Fibre optic sensor for protection of museum collections
- Single-photon sensor to protect and monitor the integrity of the fibre-optic link
- Integrated platform radar-camera for protection of military facilities
- Integrated maritime port security system
- Protection system against pirate ship attacks



Development and testing of terahertz sensor for explosives detection



QCL laser controller



Nitrogen dioxide optoelectronic sensor



Dangerous material detector