The division laboratories are also equipped with original section-made test equipment and test stands, including:

- Scanning imaging system for laser surface cleaning
- Dual-channel pulse Nd:YAG laser (2 J) for laser interference micromachining studies
- EUV radiation laser-plasma source for polymer micro-treatment
- EUV microscope with a laser-plasma radiation source
- System for material testing using Laser Induced Breakdown Spectroscopy (LIBS)

RESEARCH GROUPS

- Solid State Lasers Group
- Fibre Laser Group
- Laser Optics Group
- Laser Applications Group
- Interaction of Laser Radiation with Matter Group

Laser Technology Division

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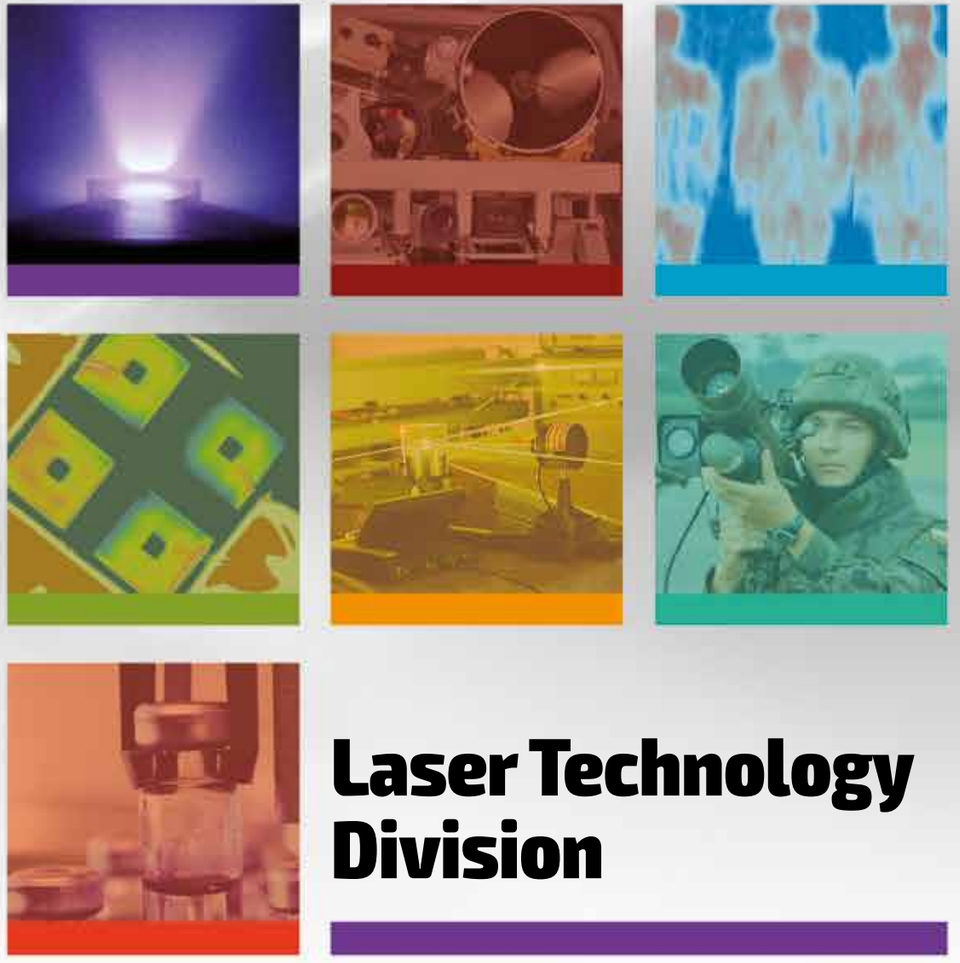

Laser Technology Division

Laser Technology Division

The Laser Technology Division conducts fundamental and application studies related to the development of laser sources, laser-plasma soft X-ray (SXR) and extreme ultraviolet (EUV) sources, as well as studies carried out with the use of lasers in military technology, materials engineering, measuring techniques, medicine, and art renovation. The division carries out research on the broad subject of diode pumped lasers (LPD), including: the design of optical systems, resonators, and LPD pulse designs for special and industrial applications; characterization of new active centres and nonlinear crystals; systems of nonlinear radiation conversion that include parametric generation and supercontinuum generation; and studies on the spatial distribution of laser beams. Highly qualified staff, modern laboratories, and extensive equipment ensure a high level of research and education.

RESEARCH

The Laser Technology Division is carrying out the following studies:

- Development and testing of high-efficiency stable sources of laser radiation and their applications in military, technology, and metrology equipment
- Development and testing of pulsed, tunable LPD generating in the 1 - 3 μm spectral range, and their applications in military, technology, and metrology equipment
- Development, testing, and construction of optoelectronic measurement systems
- Research on fibre-based near- and mid-infrared supercontinuum sources
- Development, testing, and construction of power supplies and parameter control systems for laser sources
- Development of laser-plasma SXR and EUV radiation sources
- Application of laser-plasma radiation sources in material testing, microscopy, surface engineering, microtreatment, and nanolithography
- Research on the interaction of high energy laser pulses with matter for military technology and nanotechnology
- Research on the process of laser ablation and applications of laser technology in art renovation

ACHIEVEMENTS

The most important achievements of the Laser Technology Division include:

- Development of Poland's first diode pumped neodymium lasers Nd:YAG, Nd:YLF, Nd:YVO4, lasers generating eye-safe radiation (Er:YAG, Tm:YLF, Tm:YAP, Tm:fiber, Ho:YAG, Ho:YLF), a series of nonlinear radiation conversion systems (OPO, harmonic generation, Raman lasers)
- First microsurgery systems using holmium and erbium lasers (2-3 μm) in Poland
- Development of novel high-power mid-infrared supercontinuum sources
- Development of novel fibre lasers and amplifiers operating at 1.55 μm and 2 μm
- Creation of micro- and submicro-periodic structures on different surfaces, including biocompatible materials, using laser induced interference lithography
- Development and commercialization of technology for art renovation using laser ablation applied to sedimentary rock, gypsum, museum and construction ceramics, animal bones, elephant ivory, fabrics, metal braid, varnishes, and wood
- Development of high-efficiency laser-plasma SXR and EUV radiation sources and their application in pulse radiography, microscopy, micro-treatment, and polymer surface modification

RESEARCH FACILITIES

The division has well-equipped, continuously upgraded facilities. In addition to the purchased equipment, original equipment is built and test stands are created in the division for practical and educational purposes. The unique measuring equipment located in the Research Facilities of the division includes:

- Femtosecond Ti:Sapphire laser system (Amplitude Technologies, 800nm, 10Hz, 500mJ, <50fs)
- Fibre Lasers:
  - Tm:fibre Pwy=120W, TYPE: IPG TLR-120-1940
  - Tm:fibre Pwy=20W TYPE: IPG TLR-20-LP
  - Yb:fibre Pwy=100 W TYPE: SPI SP-100C-0020
  - Yb:fibrer Pwy=20 W, pulses 100 ns; TYPE: Quantel Ylia M20EG
- 90W CW Laser, λ = 1532 nm TYPE: QPC Lasers BrightLock
- Nd:YAG Laser PL2210/SH/TH/FH: 60 ps, 1kHz, 1064nm (3mJ), 532nm (1.7mJ), 355nm (1.1mJ), 266nm (0.6mJ)
- Nd:YAG laser system: 10 J, 1-10 ns, 10 Hz
- VYTRAN GPX-3400 Fusion Splicer
- SP2300i Spectrometer, for 700 nm-3000 nm range
- OSA AQ6375 Yokogawa Optical Spectrum Analyser, for 1200 - 2400 nm range
- Ophir-Spiricon M2-200 Beam Propagation Analyser, for 248 – 2400 nm and 400 – 1100 nm ranges
- Ophir-Spiricon M2-200s Beam Propagation analyser
- Swamp Optics Laser-Pulse Measuring Device, Model 8-9-USB
- Tescan Vega II SBU Scanning Electron Microscope
- Quanta 3D FEG Scanning Electron Microscope
- EUV spectrometer, 10 – 100 nm, with toroidal diffraction grating (McPherson, Model 251)
- HiQuad Quadrupole Mass Spectrometer, Pfeiffer Vacuum
- Picosecond imaging cameras: streak C10910-01, Hamamatsu, 4-frames, 4 Picos, Stanford Computer Optics
- VISAR interferometer with optical fibres, TYPE: FDVI Mark IV-3000, from Martin, Froeschner, & Associates
- Laser system for tracking and visualization of nanoparticles, TYPE: NS500-HSB, from Nanosight
- Digital 3D microscope, TYPE: KH 8700, from Hirox

Laser Plasma

Neon activated by EUV radiation

Mid-infrared, all-fiber supercontinuum (SC) generator

Generation of high-order harmonics of the femtosecond laser in EUV range

The enthroned pantocrator sculpture during laser cleaning. The Tum Archcollegiate near Łęczyca (Poland)