INSTITUTE OF SOLID STATE PHYSICS
UNIVERSITY OF LATVIA

RESEARCH STRATEGY

2025 - 2030

THINKING TOGETHER
IS A PROGRESS AND
WORKING TOGETHER
IS A SUCCESS

The Institute of Solid State Physics, University of Latvia (ISSP UL) is an internationally recognized leader in materials science and cross-disciplinary topics. We combine world-class expertise with state-of-the-art facilities to

- Conduct groundbreaking research that shapes the future of science
- Educate and inspire the next generation of scientists
- Deliver innovative solutions tailored to industry needs

OUR VISION

Our Vision is to be a world-class recognized Excellence Centre – an outstanding place for research and innovation.

OUR MISSION

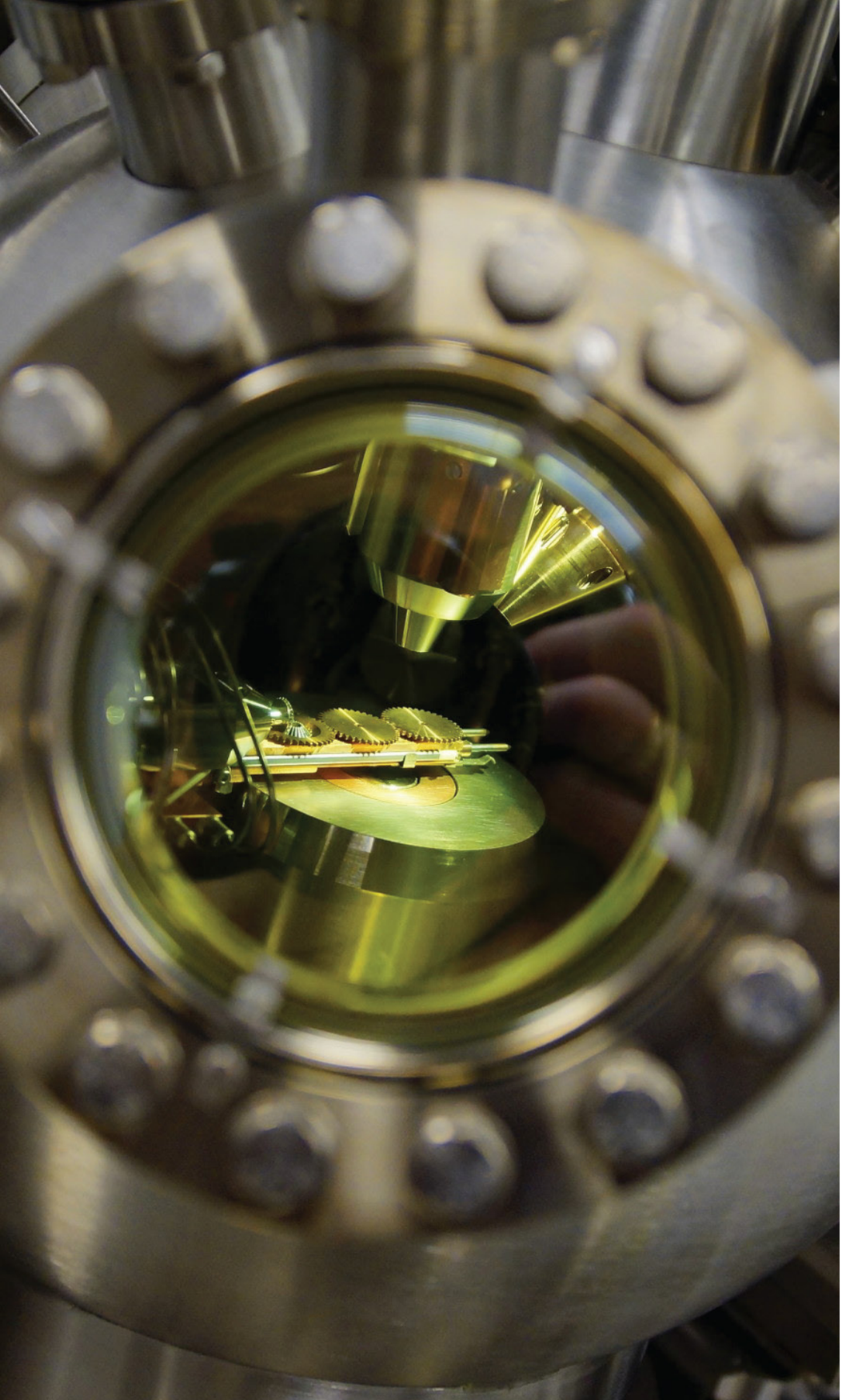
Our Mission is to create a dynamic environment for solutions of global societal and technological challenges, strengthening the role of Latvian and European science in the world.

At ISSP UL, we are driving innovation with a clear Research Strategy 2025 - 2030, guided by our Research Programme 2021 - 2025 - 2030. This roadmap sets ambitious goals to advance material science and its applications.

Our research is focused on

THREE STRATEGIC RESEARCH AREAS

- Materials for photonic devices
- Advanced materials for energy
- Microfluidics and biomedical technologies



RESEARCH AREA I

MATERIALS FOR PHOTONIC DEVICES

Key topics

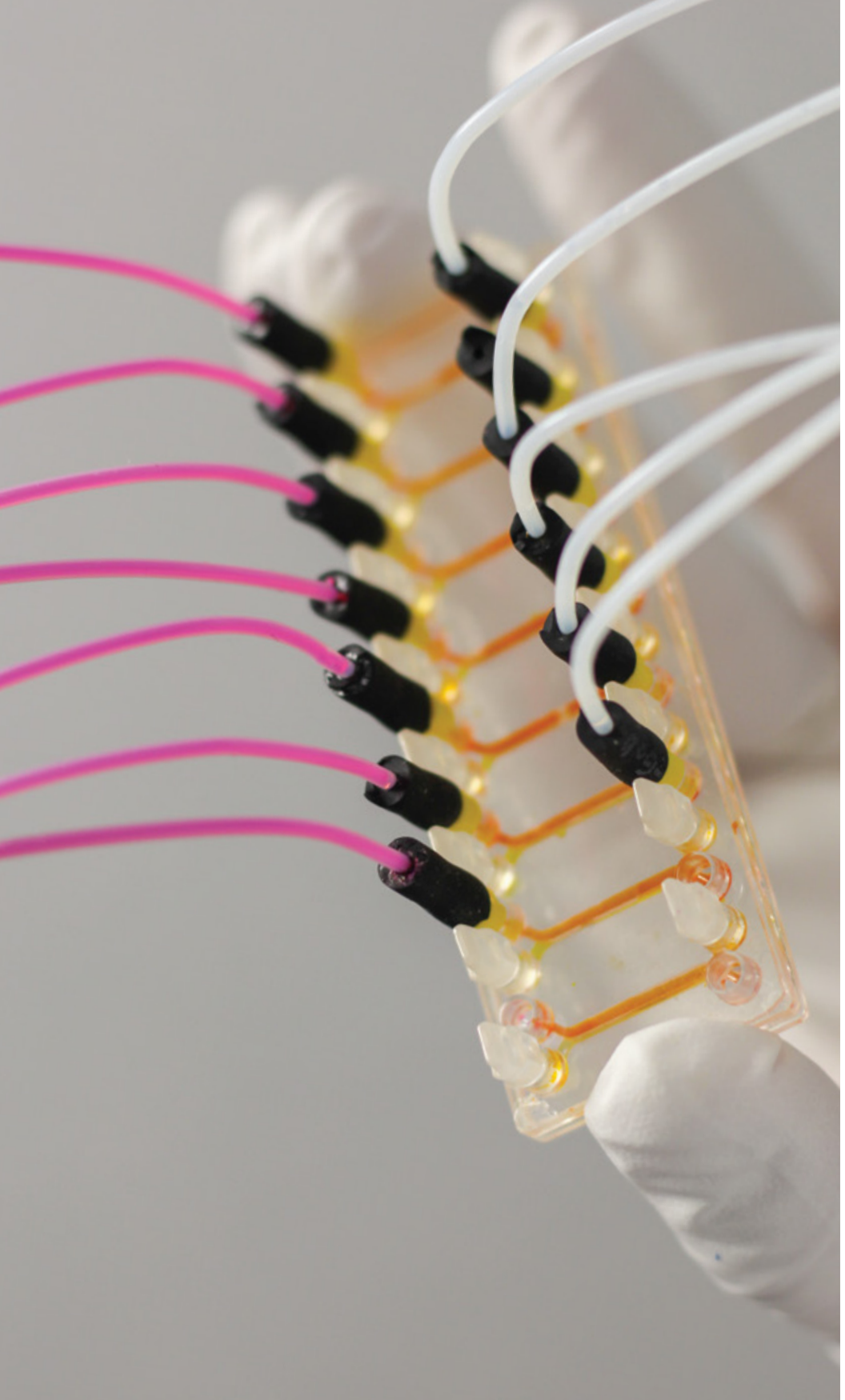
- Polymer and quantum integrated photonics
- Materials for nonlinear optics
- Materials for low-loss optical fiber waveguides
- Advanced studies of optical material properties using synchrotron radiation
- Luminescent materials for scintillators and dosimetry
- Semiconductor thin films and nanomaterials for photodetectors
- Organic light-emitting diodes and solid-state lasers
- Optical temperature sensors
- Surface-enhanced Raman scattering (SERS)

RESEARCH AREA II

ADVANCED MATERIALS FOR ENERGY

Key topics

- Electrodes and ionic liquid-based electrolytes for batteries and supercapacitors
- Theoretical modelling of materials for renewable energetics and hydrogen production, photocatalysis
- Clean hydrogen technologies for energy production and storage
- Studies of functional and construction materials for nuclear fusion reactors
- Organic and hybrid photovoltaics
- Smart window coatings for zero energy buildings
- Novel lead-free and low-dimensional ferroelectric materials
- Novel thermoelectric materials
- Ultrawide bandgap materials for energy-efficient power electronics



RESEARCH AREA III

MICROFLUDICS AND BIOMEDICAL TECHNOLOGIES

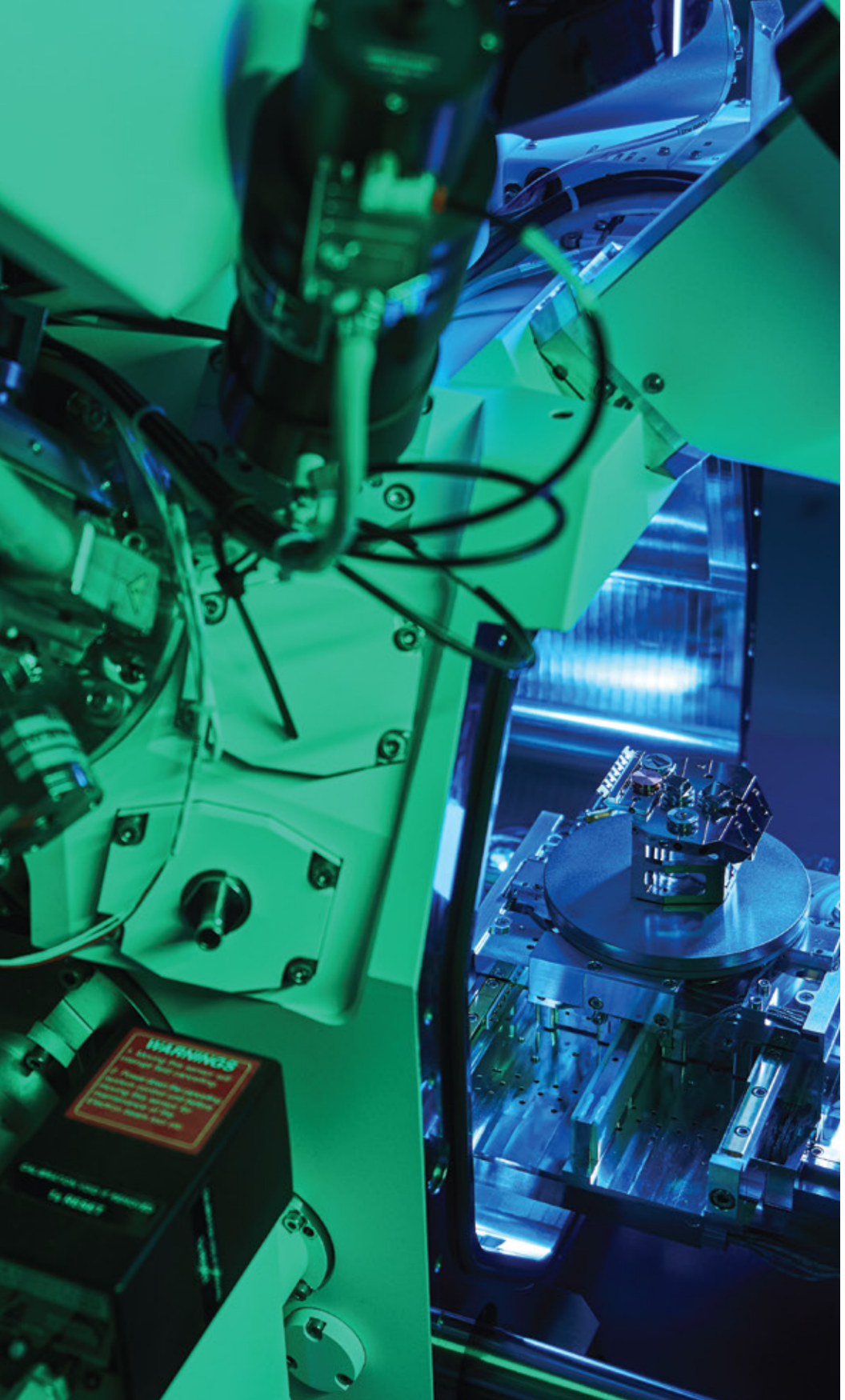
Key topics

- Organ-on-chip microfluidic devices
- Development and integration of sensors in microfluidic devices
- Membrane engineering and microfluidic devices for biomarker and extra cellular vesicle research
- Novel persistent luminescence materials for biomedical applications
- Anti-microbial, anti-viral and anti-yeasticidal coatings

To support fundamental and application-oriented studies,

OPEN ACCESS RESEARCH CENTRES

are developed and further modernized



CENTRES FOR FUNDAMENTAL RESEARCH

Computing Centre

Hosting the Latvian SuperCluster (LASC) with advanced computing capabilities. LASC is a heterogeneous high-performance computing cluster based on reliable multiprocessor servers and running the Linux operating system, with a theoretical peak performance of about 150 TFlops. It will be upgraded in the coming years to offer significantly enhanced performance and, for the first time, provide access to high-performance graphical processors, which are essential for efficient parallel data processing in emerging technologies such as artificial intelligence and machine learning.

X-Ray Absorption Knowledge Excellence Centre

Focuses on the study of materials structure using synchrotron radiation X-ray absorption spectroscopy. It uses advanced theoretical calculations and simulations of experimental data to gain insight in the structure-property relationships in materials.

Spectroscopy Centre

Conducts material science research using optical, magnetic, and electron spectroscopy. State of the art commercial instruments like FTIR Vertex 80v, Raman spectrometer TriVista CRS, Spectroscopic ellipsometer RC2-XI, photoluminescence spectrometer FLS1000, TL-OSL reader Lexsyg research, EPR spectrometer Elexsys-II E500 CW, XPS/UPS system are located in close vicinity. Custom built setups based on tunable nanosecond, picosecond and femtosecond lasers for excitation and various detection systems including Time-Correlated Single Photon Counting are available at centre.

Microscopy and Structure Analysis Centre

Provides cutting edge tools for macro-to-nano scale explorations: SEM Tescan Lyra 3 dual beam system; TEM FEI Tecnai G2 F20; SEM Helios 5UX (Thermo Fisher Scientific); AFM Veeco AFM CP-II; Profiler Dektak 150; Vero interferometric AFM (Oxford Instruments).

CENTRES FOR APPLIED RESEARCH

Electrochemistry Centre

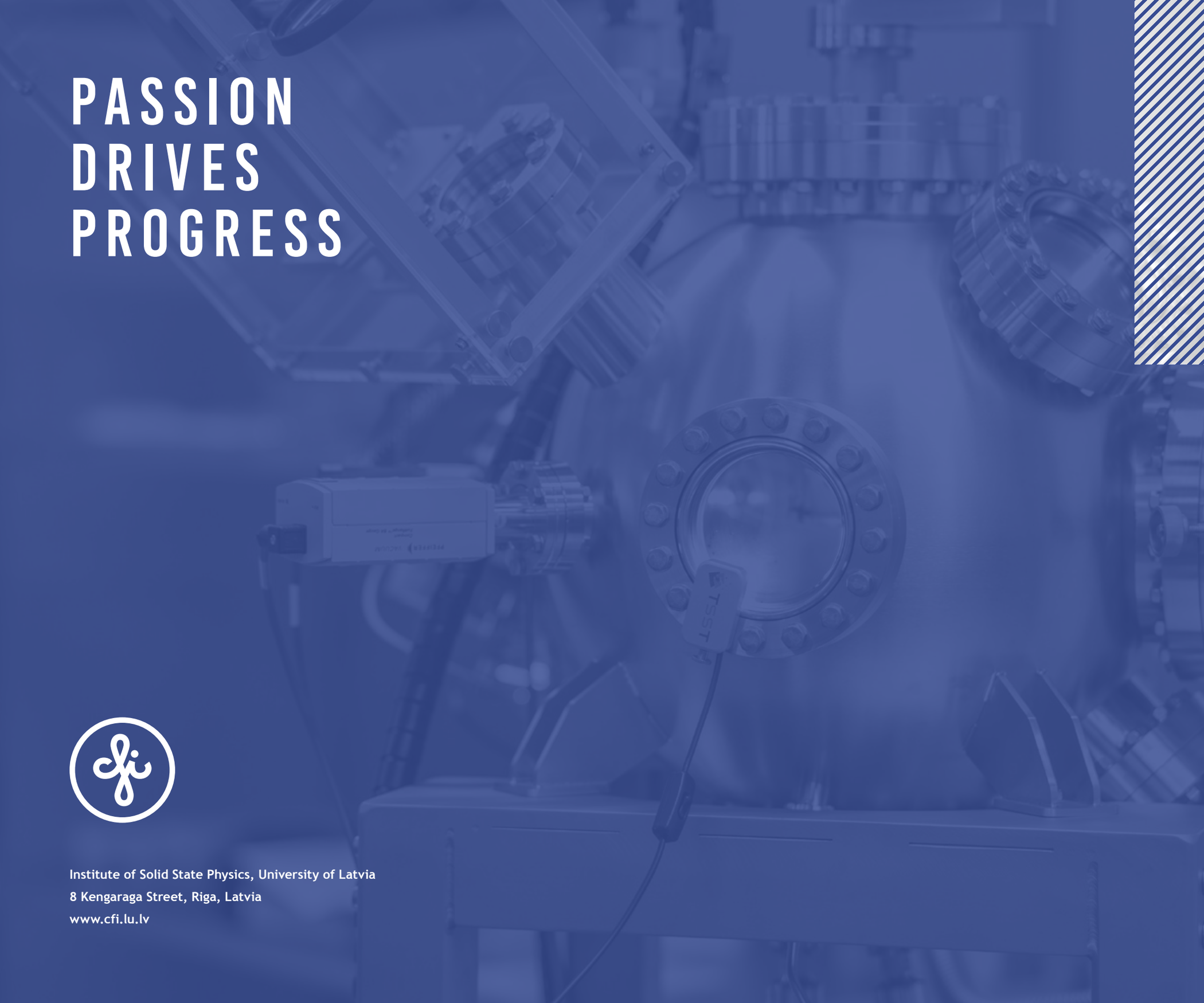
Research in materials for lithium and sodium-ion batteries, hydrogen technology, and electrochemical characterization: 90+ electrochemical test channels, incl VMP3 potentiostat/galvanostat (BioLogic); Ar-filled glovebox; Particle size analyses equipment Litesizer 500; Differential scanning calorimeter (DSC).

Thin Films Centre

Advanced thin film deposition services: Roll-to-Roll PVD semi-industrial large scale PVD Magnetron deposition; Epitaxial Dual Magnetron Sputtering (HIPIMS, DC, RF); Multifunctional cluster tool R&D SAF 25/50 (HIPIMS, e-beam, organic-inorganic evaporation); PLD oxide and sulphide epitaxial grows; ALD Savannah; MOCVD; AP-CVD; Spin coater Laurell WS400/WS650.

Nanotechnology Centre

Operating a 650 m2 cleanroom with cleanliness level ranging from ISO 4 to ISO 8 standards for micro and nanofabrication: Mask aligner Suss MAG Gen 4; EBL Raith eLine Plus; Laser writer Heidelberg MPG 101; Wire bonder F&S Bonder 53107&5332; Dry etching facility PlasmaPro 100 ICP 300; Microfluidics Pilot Line including injection moulding and ultrasonic welding tools.



PASSION DRIVES PROGRESS

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