3rd Taiwan–Lithuania Laser Conference

DATE October 8–10, 2026 VENUE Vilnius SPA, Druskininkai

Participants

25 registered

Name	Affiliation	Presentation title	Short abstract
Assoc. Prof. **Renata Butkutė**	Center for Physical Science and Technology, Vilnius, Lithuania	**A3-B5-Bi semiconductor microlasers for NIR photonic systems: technological progress and design innovation**	The research on photonics solutions based on A3-B5-Bi compounds was conducted by FTMC together with NSYSU under the Taiwan-Lithuanian Cooperation Program. The main focus of this research was on the development of A3-B5-Bi semiconductor microlasers with characteristic wavelengths in the range of (800 ÷ 1100) nm. The joint research was carried out in two directions. First, by molecular beam epitaxy, the multiple quantum well structures emitting in the target spectral region were optimized for two material systems – classical AlGaAs and novel GaAsBi, in order to apply them in the gain field. Second, the development of the device structure was focused on enhancing the performance of the lasers. The innovative design tested in both material systems improved two key laser parameters: output power and threshold current. The project activities highlighted two main trends: (i) the parabolic barrier potential profile employed in both quantum well systems responsible for the laser wavelength has a significant impact on the optical efficiency and (ii) the emission of Bi-containing quantum structures is characterized by lower temperature sensitivity. This research was funded by Research Council of Lithuania under Taiwan– Lithuania Cooperation Project “GaAsBi-based photonics solutions for hybrid photonics integrated circuits” (BiPho) 2024-2026 grant number S-LT-TW-24-8

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Assoc. Prof. **Chia-Yuan Chang**	National Cheng Kung University	**Multimodal Multiphoton Microscopy Optimization and Applications**	The ultrashort laser pulses provide a high-intensity field that could induce nonlinear optical effects. The multiphoton-excited signal and harmonic generation in the specimen, which occur at the focal plane of the objective, can be collected to reconstruct 3D images for functional and structural studies. However, the image contrast depends on laser focusing quality and background noise. By integrating the spatial-filtering grating, the stray light was successfully eliminated. Together with dispersion compensation and aberration correction, ultrashort laser pulse focusing could be optimized spatially and temporally for multiphoton excitation. Furthermore, fluorescence lifetime provides supplementary information that reveals microenvironmental variation and structural modification of the specimen. Therefore, multiphoton and fluorescence lifetime imaging show great potential for high-resolution, axially resolved biotissue and material applications using multimodal multiphoton microscopy.
Prof. **Lung-Chien Chen**	National Taipei University of Technology	**Physical Deposited Perovskite Films as Devices: Thermal Evaporation and Pulsed Laser Deposition**	Perovskite materials, based on the ABX_3 crystal structure, exhibit a range of unique optoelectronic properties, including low cost, tannable bandgap, low exciton binding energy, high absorption coefficient, and extended carrier diffusion length and lifetime, such them have garnered worldwide attention as a promising technology for the next generation of display devices. Although initial reports focused on laboratory-scale spin-coating techniques, rapid advances have prompted researchers to explore pathways for their scaled manufacture. Drawing inspiration from the semiconductor process, the community has begun to look at vapour deposition to build reliable perovskite films. This work examines the development of vapour-deposited perovskite films. Finally, we outline development opportunities in this evolving field.
Prof. **Yi-jen Chiu**	NSYSU	**Hybrid Si photonics integration based on NIR semiconductor multiple quantum wells and wafer bonding technology**	Heterogeneous Si photonics integration of NIR semiconductor multiple-quantum well (MQW) on different substrates has been demonstrated via wafer bonding technology. Using bandgap engineering on III-V quantum well and bonding surface, >30mW semiconductor laser has been shown. With hybrid photonics and wafer bonding technologies, variety of on-chip photonics functions and the related integration, such as optical modulator, optical amplifier, and photodetector have been realized, leading to different photonics applications, such as high-speed optical interconnect, microwave photonics, optical light source integration, and sensing.
Chair Prof. **Mitch Ming-Chi Chou**	National Cheng Kung University	**Recent research activities of the center of crystal research at NCKU**	The Center for Crystal Research at National Cheng Kung University (NCKU) possesses full in-house capabilities covering the entire value chain—from upstream crystal growth to downstream material processing. The center has successfully grown a wide range of advanced crystals, including ultra-high-power laser and nonlinear optical crystals, piezoelectric crystals, high-temperature superconductors, topological insulators, crystals for quantum memory applications, and third-generation semiconductors such as silicon carbide (SiC) and gallium oxide (Ga_2O_3).
Assoc. Prof. **Timothy Chou**	National Cheng Kung University	**Linear and Nonlinear Optical Responses of Two-Dimensional Materials on Femtosecond-Laser-Written Metal Arrays**	This work reports progress in integrating two-dimensional materials with periodic metal arrays fabricated by femtosecond direct laser writing. Gold, silver, and gold-silver alloy arrays with different periods and TiO_2 thicknesses were characterized by polarization- and angle-resolved reflectance spectroscopy. Gold arrays with a period of 690 nm exhibited the clearest dispersive spectral features, which were compared with finite-element simulations. MoS_2, WSe_2, and hBN were subsequently transferred onto selected arrays. Reflectance measurements before and after MoS_2 transfer revealed polarization-dependent spectral redistribution near the MoS_2 exciton energy. WSe_2-based samples showed second-harmonic signals at half the excitation wavelength, together with two-photon photoluminescence and polarization-dependent responses. These results establish an experimental platform for studying linear and nonlinear light-matter interactions in laser-written metal arrays and for evaluating their potential in nanoscale light sources.
Dr.	FTMC	*No presentation*	***Research interests:*** *ultrashort pulse laser material processing, effective ablation, glass cutting, glass milling.*

Name	Affiliation	Presentation title	Short abstract
Paulius Gečys			
Prof. **Hui-Hsin Hsiao**	Department of Engineering Science and Ocean Engineering, National Taiwan University	**Nanophotonics in sensing, nonlinear optics, and metadevices**	Plasmonic nanostructures with their unique ability in confining strong electromagnetic fields into subwavelength regions have led to a great diversity of applications. We have utilized various designs to study plasmonic thermal emitters and surface-enhanced Raman scattering substrates. Recently, optical resonator arrays with spatially varying geometry and subwavelength separation known as metasurfaces demonstrate additional degree of freedom to accomplish polarization control and wavefront shaping. We employed integrated resonant units designs, which combine multi-nanorod configuration into one unit cell, to develop a broadband high efficiency polarized beam splitting metagrating working in the near infrared. Recently, the low-loss and high-index dielectric nanostructures provide an alternative platform to support multipolar resonances. The interference of multipolar modes leads to high quality-factor Fano resonances or quasi-bound states in the continuum, which are promising for the applications of refractive-index sensing and nonlinear optics.
Asst. Prof. **Po-Han Huang**	National Tsing Hua University	**Postprocessing-free 3D printing of glasses via multiphoton lithography for integrated optics**	Integrated optical microsystems are key to next-generation communication, sensing, and quantum technologies, with the potential to exceed the capabilities of conventional microelectronics. Such systems rely on precise control of light, but creating optimal 3D micro-optics is challenging for conventional microfabrication technologies. Multiphoton lithography (MPL) offers nanoscale 3D printing capabilities, while efforts to extend MPL to high-performance glasses typically involve harsh high-temperature or chemical postprocessing that is incompatible with integrated microsystems. To address this, we explore the use of hydrogen silsesquioxane (HSQ), an inorganic precursor, for MPL. We demonstrate postprocessing-free 3D printing of solid silica glass and self-forming glass nanogratings with nanoscale resolution. These advances enable the direct integration of glass micro-optics on chips and optical fibers. We present functional 3D-printed glass optical devices, including on-chip ring resonators and photoluminescent sources, and fiber-tip refractive index sensors and polarization beam splitters, opening new avenues for high-performance optical microsystem integration.
Prof. **Yen-Chieh Huang**	National Tsing Hua University	**free-electron laser on silicon chip**	A typical free electron laser has a large size, usually built in a national facility. We report a chip-size free-electron laser realized by injecting a keV electron beam atop a silicon-based micro- or nano-structured grating waveguide. Distributed feedback and Cherenkov phase matching in the grating enable low threshold lasing for the chip-size free-electron laser.
Dr. **Justinas Jorudas**	Center for Physical Sciences and Technology (FTMC)	**Direct femtosecond laser micro-machining for fabrication of β-Ga_2O_3 electronics**	Direct laser micro-machining (DLM) is a promising technique in material processing, due to its maskless and contactless nature, sub-micron precision, and high speed. We developed the DLM processing technology on β-Ga_2O_3 epilayers grown on sapphire substrate aiming to form shallow recesses suitable for maskless fabrication of semiconductor devices. Using optimized DLM parameters, we have developed the processes to fabricate shallow recesses over a large surface area, with the average depth ranging from 300 nm down to 20 nm. As a proof of concept, the β-Ga_2O_3 MOSFETs with a laser-recessed gates were fabricated to demonstrate the versatility of the DLM fabrication technique. These findings highlight DLM as a viable, green and maskless technique for high-precision mesa isolation and recess formation on the wide-bandgap semiconductor layers.
Assoc. Prof. **Oleksandr Kapustynskyi**	Vilnius Gediminas Technical University (VILNIUS TECH)	**Non-Contact 2D/3D Metrology for Quantitative Evaluation of Laser-Modified S355 Steel**	Laser surface processing can generate highly localized geometric and topographic changes that require quantitative, non-contact characterization. This work presents a metrology-oriented evaluation of pulsed-laser-modified S355 structural steel using a Mitutoyo Quick Vision Hyper WLI system combining vision measurement and white-light interferometry. Laser-processed tracks are assessed by surface geometry, height/depth profiles, cross-sectional shape, and selected 3D surface texture parameters. The study shows how integrated 2D dimensional measurement and 3D optical topography can support evaluation of laser-process outcomes and complement microstructural characterization. Particular attention is given to accessible measurands,

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			measurement workflow, and practical limitations for laser-modified metallic surfaces. The approach is illustrated using S355 specimens from an ongoing Lithuania–Taiwan collaborative study.
Dr. **Irmantas Kašalynas**	FTMC	**Maskless Femtosecond-Laser Micromachining of Recessed Electric Contacts in MOSFETs**	Maskless patterning routes that enable rapid, flexible prototyping of ultrawide bandgap transistors are highly desirable for emerging power and high-frequency electronics. In this work, we demonstrate the femtosecond (fs) laser micromachining as a lithography free approach to define recessed electric contacts in MOSFETs.
Prof. **Chaokuei Lee**	Department of Photonics, NSYSU	*No presentation*	***Research interests: TBA***
Assoc. Prof. **Wei-Chun Lin**	National Sun Yat-sen University	*No presentation*	***Research interests:*** *Our group investigates fundamental problems in semiconductor/silicon photonic devices, polymers, and biology using surface analysis techniques.*
Prof. **Yuan-Yao Lin**	National Sun Yat-sen University	**Wavefront pre-compensated multi-pass Yb:YAG thin-disk laser amplifier for structured light amplification**	Using highly uniform 10 at.% Yb:YAG crystals grown by a modified Czochralski process with precisely controlled temperature gradients and rotation rates, we demonstrated a multi-pass thin-disk laser amplifier with active phase pre-compensation. Energy-dispersive X-ray spectroscopy (EDX) confirmed the crystals' high quality and compositional uniformity. The crystals were fabricated into thin-disk gain media with thicknesses of 100 to 200 µm and surface flatness better than λ/10 for a multi-pass pumping architecture. A spatial light modulator (SLM) was employed to pre-compensate the incident beam phase, overcoming the power-handling limitations of conventional SLM-based structured-light systems. The amplifier delivered high-quality structured laser beams with power amplification factors of 10 to 25 while maintaining beam fidelity above 95% relative to the target profile. This approach enables high-power structured-light generation for advanced manufacturing applications.
Dr. **Pik-Hun Ngoo**	National Synchrotron Radiation Research Center	**Toward Ring-Based FEL Development Enabled by Beam Based Synchronization in TPS and TLS**	Precise synchronization between external lasers and electron bunches is a key enabling technology for advanced accelerator based photon science, including pump-probe experiments, beam diagnostics, and laser-assisted beam manipulation. We propose a beam-based synchronization scheme in which an external laser is directly synchronized to synchrotron radiation rather than the RF system. This approach has the potential to reduce timing jitter to below 10 fs, significantly improving synchronization performance for ultrafast applications. The synchronized laser system can support femtosecond-resolution longitudinal beam diagnostics, laser slicing, laser-induced microbunching, and the generation of THz, MIR-UV, and HHG-based radiation sources. Furthermore, preliminary studies indicate that such synchronization capabilities may facilitate future ring-based FEL concepts in TPS and TLS. Initial analyses suggest that significant harmonic bunching can be maintained without requiring magnetic chicanes or complex transverse-gradient undulators, providing a promising pathway toward storage-ring FEL development.
Dr. **Gediminas Račiukaitis**	FTMC	**Lithuanian laser ecosystem and Taiwan [provisional title]**	To be announced.
Dr. **Patrik Ščajev**	Vilnius University	**Charge carrier transport in GeSn layers**	We study carrier transport in GeSn layers using femtosecond pump–probe spectroscopy, Hall and Magnetoresistivity. A series of GeSn samples with thicknesses ranging from 100 to 400 nm and Sn contents ranging from 4 to 9% were grown on Si substrates using molecular beam epitaxy via a 200-nm-thick Ge buffer layer. The GeSn layers were excited using 200 fs above-bandgap laser pulses at 760 nm and probed with an infrared supercontinuum, enabling measurements of carrier lifetimes as functions of temperature (80–300 K), excitation fluence, and Sn content. Increasing the Sn content shifts the bandgap toward longer infrared wavelengths while simultaneously reducing the carrier lifetime from approximately 400 ps to 100 ps. The

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			increase of temperature-dependent charge carrier lifetime with increasing excitation fluence was attributed to saturation of bulk nonradiative traps. A decrease in lifetime with increasing temperature was observed for lower Sn contents, whereas the lifetime exhibited the opposite trend for higher Sn contents, indicating competition between thermally activated trapping, carrier localization, and nonradiative recombination pathways. We found that the mobility values of 100-400 cm^2/Vs and carrier densities of 10^{16}–10^{18} cm^{-3} increase with increasing temperature and Sn content.
Prof. **Kestutis Staliunas**	Vilnius University	**Non-Hermitian Mode Control for Enhancement of Brightness in Broad Area Edge Emitting Lasers**	I will present a new LT-TW collaboration project between Vilnius University and National United University, on Semiconductor Broad Area Edge Emitting Lasers, starting from 2026. Such lasers are highly compact and very convenient coherent light sources. Despite their high emission power, many of their implementations are severely hindered by a highly multimode beam (low beam quality) and its significant divergence. Existing methods to improve spatial beam quality, such as restricting the lasing area to form single-mode ridge lasers, result in a drastic power reduction. Alternatively, external cavity stabilization significantly affects device compactness and mechanical stability. This project aims to resolve this problem by applying a novel non-Hermitian mode-cleaning technique, based on specific spatial modulation of the gain-loss profile to suppress higher-order transverse modes, and to achieve a high spatial quality beam.
Dr. **Evaldas Stankevičius**	FTMC	**Laser-engineered plasmonic metasurfaces: from tunable resonances to new directions in photonics**	This presentation will provide an overview of our recent research on plasmonic metasurfaces fabricated by femtosecond direct laser writing. Particular attention will be given to the control of nanostructure morphology and periodicity, and their influence on the optical response of laser-patterned metallic surfaces. The tunability of plasmonic resonances through structure geometry, grating period, polarization, and angle of incidence will be discussed, together with recent results on grating-coupled plasmonic modes in two-dimensional nanobump arrays. Applications of these structures in refractive-index sensing and surface-enhanced Raman spectroscopy will also be presented, including the development of bimetallic plasmonic sensors. Finally, emerging research directions will be briefly introduced, including ongoing studies of photoluminescence in hybrid plasmonic-two-dimensional material systems.
Prof. **Wei-Nien Su**	National Taiwan University of Science and Technology (NTUST)	**Polymer-assisted Solutions for a Tailored Interface Toward Practical and Dendrite-Free Lithium Metal Batteries**	To enable high-energy-density lithium-metal batteries, stabilizing the lithium/electrolyte interface against dendritic growth and continuous side reactions remains a critical challenge. Here, we present a scalable strategy integrating Roll-to-Roll (R2R) melt-deposition with gas-phase plasma surface engineering to produce uniform 20–30 µm lithium coatings on copper current collectors (Li@Cu). Gas-phase plasma treatments were developed to passivate the metallic lithium surface, forming a highly ion-conductive, nitride-based artificial solid electrolyte interphase (SEI). To systematically assess these modified interfaces prior to cell integration, a robust four-step diagnostic screening protocol was established: (1) top-view SEM-EDS for surface morphology and elemental purity, (2) cross-sectional SEM for layer thickness and defect/void detection, (3) X-ray photoelectron spectroscopy (XPS) for chemical state resolution, and (4) symmetric cell plating/stripping measurements to determine Coulombic efficiency and critical current density (CCD). Evaluated under practical conditions using custom-formulated standard electrolytes, the optimized plasma-treated nitride interfacial layers significantly reduced interfacial resistance and effectively suppressed dendrite formation. Consequently, the passivated Li@Cu anodes demonstrated a two-fold increase in cycle life compared to bare lithium controls and successfully enabled stable cycling in NMC-based cells.

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Director **Shun-Fen Tzeng**	Division of Science and Technology, Taiwanese Representative Office	*Not specified*	***Research interests: TBA***
Prof. **Renaldas Urniezius**	Kaunas University of Technology	*No presentation*	***Research interests: TBA***
Prof. **Chung Kuang Yang**	National Taipei University of Technology	**Microscale Mechanistic Studies on Specialized Local Laser Stren… [title incomplete in registration]**	This collaborative project investigates a weight-neutral, local laser reinforcement strategy for thin-sheet S355 structural steel using pulsed Nd laser processing. By generating microscale, rib-like reinforced tracks, the study aims to create shallow sorbitic zones while avoiding brittle martensitic structures. The research employs the laser processing, three-dimensional surface metrology, mechanical testing, and finite-element modelling will be carried out along with the complementary advanced characterization, including SEM/EDS, EBSD, XRD residual-stress analysis, and surface morphology.