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ASEAN plus Photonics Symposium

April 8 - 11, 2026 at ICISE, Quy Nhon, Vietnam



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ASEAN Plus Photonics Symposium 2026

Abstract Booklet

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Posters

Author	Institution	Title
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Jason Soon Chye Koay	Nanyang Technological University	Controlling the exciton emission in twisted two-dimensional halide perovskites moiré superlattices at room temperature
Quang Truong Pham	LuMin laboratory, ENS Paris-Saclay, Université Paris-Saclay	Fabrication of plasmonic/photonic structures by direct laser writing method & nonlinear optics characterization

Keynote

Flat Band Physics and its Photonic Applications

Sergej Flach

Institute for Basic Science

Flat bands (FB) – single-particle energy bands – in tight-binding networks (TBN) have attracted attention due to the presence of macroscopic degeneracies and compact localized states (CLS), and their extreme sensitivity to perturbations. This makes them natural candidates for emerging exotic phases and unconventional orders. The challenging part however is to construct flat band networks through TBN finetuning. In this talk we introduce CLS based FB generators of the three different FB classes and the corresponding real space FB projector properties. We then discuss how the fine-tuning constructions can be further extended, adapted or exploited in presence of perturbations, both single- particle and many-body. This strategy has lead to the discovery of non- perturbative metal-insulator transitions, fractal phases, nonlinear and quantum caging and many-body nonergodic quantum models. I will match the above by reviewing a plethora of experimental photonic applications.

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Optical metasurfaces for imaging, sensing and display

Junsuk Rho

Pohang University of Science and Technology

Metamaterials and metasurfaces are novel optical components composed of nanostructure arrays. They offer the advantage of an ultracompact form factor and can image submicron objects with resolution approaching the diffraction limit of light. The scope of this imaging extends from simple microscopes to more advanced light imaging applications such as 3D sensors, LiDAR, bio-imaging, and cameras. The wavelength range of imaging is also diversifying to support various imaging applications. Metalenses operating in the UV region enable high-resolution imaging due to the short wavelength of light. In the visible light spectrum, metalenses can be used for imaging in VR/AR displays. Near-infrared metalenses have potential applications in night vision devices and endoscopes. The wavelength range extends further to include the ultrasound region, where it can be used in photoacoustic microscopy. Additionally, elastic metalenses can be applied for energy harvesting, and acoustic metalenses can be used to focus sound waves. Furthermore, metalenses can perform imaging with various functionalities. They can tune their focal length, demonstrate trichannel imaging based on spin, and even image single photons emitted from a source. While metalenses operate across various wavelengths and offer diverse functionalities for numerous imaging applications, their design is currently not scalable, making large-area designs computationally heavy and expensive. To address this, efficient computational methods like RCWA and AI/DB-based design approaches have been developed. However, even with advances in large-area design capabilities, their commercialization has been hindered by manufacturing limitations such as high cost and low throughput. To reduce the production cost of metalenses, nanoimprint lithography has been employed. To address the low refractive index of conventional imprint resins, high-refractive-index particles are incorporated, creating a one-step printable platform. On the other hand, ArF photolithography has been used to overcome low throughput and produce large-area metasurfaces at wafer scale. However, due to the high manufacturing costs associated with this method, research has been conducted on

mass-producing metasurfaces by using wafer-scale nanoimprint technology to replicate metasurfaces initially created through photolithography. These scalable manufacturing approaches are expected to propel metalenses beyond the research level and into practical applications.

Light-matter interaction with 2D materials

Weibo Gao

Nanyang Technological University

In this report, I will talk about the light matter interaction in 2D materials, including (1) circular photon detection assisted by valley degree of freedom in TMD materials (2) Manipulation of 2D spin properties through photons coupled to valleys.

Invited Talks

Mott insulator polariton in MoSe₂/WS₂ moiré lattice

Jie Gu

Fudan University

Transition metal dichalcogenide moiré superlattices host rich correlated electronic states with high tunability. Their integration with optical cavities offers a new platform to explore hybrid light-matter interactions. However, the interplay between electron correlations and polariton formation remains uncharted. Here, we demonstrate the realization of a Mott insulator polariton in a gate-tunable MoSe₂/WS₂ moiré heterostructure embedded in a microcavity at the moiré lattice filling of $\nu = 1$. A silver top layer was used to gate the moiré lattice and form the cavity reflection layer. Magnetic field studies indicate that the polaritons inherit valley Zeeman splitting from the moiré excitons, exhibiting saturation behavior similar to the bare moiré excitons. Our work establishes moiré polaritons as an electrically and magnetically tunable platform for engineering quantum phases of light and matter.

Light-matter interactions mediated by interface polaritons

Yingjie Wu

Zhejiang University

Polaritons are a kind of surface/interface electromagnetic waves originating from photons coupled to material excitations. A defining characteristic of interface polaritons is their extreme electromagnetic field confinement, which concentrates optical energy far below the diffraction limit and produces exceptionally high local field intensities. This strong confinement dramatically enhances interactions with the surrounding dielectric environment, molecular vibrations, and even other polariton modes. Such polariton-mediated light-matter interactions not only reshape the dispersion and propagation of polaritons themselves, but also enable emergent phenomena in the strong-coupling regime, including polariton-vibration coupling and polariton-polariton coupling. These developments establish interface polaritons as a powerful platform for engineering light-matter interactions and controlling optical energy flow at the deep-subwavelength scale, opening new opportunities in nanophotonics, molecular spectroscopy, and on-chip photonic technologies.

Loss offset using synthetic wave of complex frequency

Fuxin Guan

Nanjing University

Metamaterials offer unprecedented control over wave propagation, but suffer from optical losses due to wave dissipation, particularly in optical imaging and sensing systems. Recent advances leveraging complex-frequency wave excitations with temporal attenuation offer promising solutions for optical loss compensation. However, this approach faces limitations in extreme loss scenarios. The complex-frequency wave requires sufficient temporal attenuation to offset material loss, inevitably triggering rapid

signal decay to zero before reaching a quasi-static state. Here we engineer excitations with high-order temporal attenuation to slow down the decay rate. This allows the signal to persist for long enough to reach a quasi-static state and preserve the loss compensation efficiency. We experimentally demonstrate 20-fold noise suppression in plasmonic resonance systems compared with conventional complex-frequency excitations. This approach offers broad applicability across diverse fields, including imaging, biosensing and integrated photonic signal processing.

Nonlinear topological photonics

Daniel Leykam

Singapore University of Technology and Design

Topological photonic materials with remarkable properties protected by topological invariants show great promise for the design of photonic devices robust to fabrication imperfections. In recent years, the combination of topology with nonlinear optical effects has become a highly active area of research, with photonic device applications including integrated lasers, frequency combs for precision metrology, and optical isolators. I will survey the growth of this fascinating field, from the prediction and experimental observation edge solitons to more recent studies on the interplay between topology and modulational instability.

Nonlinear topological photonics

Feng Li

Xi'an Jiaotong University

Fabry-Perot (FP) microcavities with metal or DBR (distributed Bragg reflector)-coated mirrors provide an excellent platform for investigating the collective behavior of confined 2-dimensional photons and polaritons. The TE-TM mode splitting in such cavities acts as an effective magnetic field, leading to photonic spin-orbit (SO) coupling effect that the pseudospin of cavity photons changes anisotropically with their momenta. Such mechanism has led to interesting observations including optical spin-Hall effect, magnetic-monopole-like half solitons, spinor condensate with half-quantum circulation, and polaritonic topological insulators. In recent years, we report the direct measurement of the Berry curvature and quantum metric in anisotropic organic microcavities, which leads to divergent quantum metric at Voigt exceptional points and dual lasing of orthogonal polarization by polariton relaxation via the imaginary Fermi arcs.

Furthermore, by analyzing the photonic SO coupling mechanism with the perturbation theory of Hamiltonians, we predict that in fully confined systems the eigenstates of the second excited manifold under TE-TM splitting are degenerate skyrmions which can be selected and manipulated by the non-Hermitian properties. This theory was experimentally demonstrated by coupling the microcavity with a single quantum dot. We further explore how the evolution of the skyrmions wavefunction with non-Hermitian gain and loss, highlighting the special properties at the exceptional points.

High-Performance Lasers Based on Colloidal Quantum Dots and Quantum Wells

Duong Ta

Le Quy Don Technical University

Modern technologies, from high-speed optical communications to precision biomedical imaging, increasingly rely on the development of compact, tunable, and energy-efficient light sources. To meet these demands, semiconductor research has shifted toward low-dimensional gain materials, most notably quantum dots (QDs) and quantum wells (QWs). While the three-dimensional carrier confinement of QDs has spent the last two decades revolutionizing low-threshold lasing and wavelength stability, the parallel advancement of thin-layer QW heterostructures has further expanded the performance limits and spectral reach of semiconductor devices. This talk presents a comprehensive overview of recent progress in both QD- and QW-based lasers, tracing the path from innovative material growth to device fabrication. By exploring emerging applications such as photonic devices and lab-on-chip biosensors, this presentation highlights how the synergy between QD and QW technologies is defining the next generation of high-performance laser systems.

Photonic Crystal Surface Emitting Lasers over the Entire Visible Spectrum on a Silicon Nitride/Colloidal Nanocrystal Integrated Platform

Ivo Tanghe

UGent/imec

Silicon nitride photonics is rapidly emerging as an ultra-low-loss platform for visible light applications. Foundry-grown silicon nitride waveguides now achieve propagation losses below 1 dB/m, enabling a wide range of integrated photonic components for efficient light coupling, routing, and detection.

However, compared to III–V material platforms, silicon-based photonics lacks an efficient, high-quality monolithically integrated light source. To address this limitation, heterogeneous integration strategies have been developed to combine silicon photonics with active materials. These approaches include direct growth techniques as well as bonding, flip-chip integration, and the emerging method of transfer printing.

In this work, we explore an alternative strategy by employing solution-processable materials as on-chip light sources, specifically colloidal semiconductor nanocrystals. Synthesized through low-cost wet-chemical methods, these materials can be readily integrated using scalable techniques such as spin coating, dip coating, drop casting, and inkjet printing.

Photonic crystal surface-emitting laser (PCSEL) architectures serve as a versatile testbed to demonstrate lasing from a range of nanocrystal materials. With minimal design modifications and material substitution, lasing across the visible spectrum is achieved.

These results represent an important step toward multi-color on-chip laser sources and more advanced hybrid photonic integration schemes.

Quantifying Emission Processes in Weakly Coupled Light Emitter - Open Cavity System

Quynh Le-Van

VinUniversity

Quantifying emission enhancement in weakly coupled emitter–photonic cavity systems is fundamentally challenging because radiative-rate modification, photon extraction, and far-field collection are strongly intertwined. This problem is especially acute for ensemble thin-film emitters, where multiple photonic resonances coexist and conventional Purcell-based interpretations become ambiguous. We introduce an assumption-free framework that independently measures radiative, extraction, and collection processes by combining angle-resolved PL, absolute PLQY, wavelength-resolved lifetime analysis, back-focal-plane imaging, and full-wave simulations. Applied to CsPbI₃ nanocrystal films integrated with 1D TiO₂ photonic crystals, our approach reveals two distinct enhancement regimes. At the quasi-BIC resonance, the striking 110-fold PL enhancement is dominated by photon extraction ($\sim 21\times$) and directional collection ($\sim 3.25\times$), with only modest radiative-rate enhancement ($F_P \approx 1.9$) and simultaneous suppression of non-radiative decay. In contrast, enhancement at the Bloch resonance ($\sim 10\times$) arises from a more balanced interplay of extraction, intrinsic emission modification, and improved collection. This framework enables rigorous disentanglement of emission mechanisms and provides generalizable design rules for nanophotonic light-emitting platforms.

Electrically Tunable Nonlinear Photonics using 2D Ferroelectric Integration

Sanghoon Chae

Nanyang Technological University

Niobium oxide dihalides exhibit vanishing interlayer electronic coupling and strong, thickness-dependent second-harmonic generation (SHG), making them promising for free-space nonlinear optics (NLO). However, practical on-chip integration demands not only high NLO efficiency but also robust electrical tunability, a critical feature yet to be achieved. Here, we demonstrate the first in-situ electrically tunable NLO response in a photonic integrated circuit (PIC) using NbOBr₂, a material that combines strong intrinsic second-order susceptibility with exceptional tunability from in-plane ferroelectricity. In the PIC platform, NbOBr₂ achieves enhanced SHG efficiency due to reduced index contrast and superior modulation capability enabled by its strong ferroelectric polarization. We realize dynamic and non-volatile SHG modulation exceeding 53%, with the polarization state retained after electric field removal. This work establishes 2D ferroelectric NbOBr₂ as a versatile platform for scalable, reconfigurable, and ultracompact NLO devices, opening new avenues for tunable light sources, optical computing, and quantum photonics.

Engineering Optical Fields: Vortices, Singularities, and Envelope Function Control

Ségolène Callard

Centrale Lyon/ Lyon Insitut of Nanotechnology

We demonstrate all-optical control of far-field topological singularities in a photonic-crystal (PhC) laser by shaping mesoscopic pump potentials that trap Bloch bands into programmable envelope states. Using a two-dimensional honeycomb PhC slab supporting a bound state in the continuum (BIC), we show that spatially structured optical pumping can confine photonic modes analogously to particles in a potential well, effectively turning the PhC into a 2D Schrödinger solver for light.

In the lasing regime, these trapped modes generate topological singularities both in real and momentum space. By dynamically reconfiguring the pump profile, we realize single-, double-, and triple-spot potentials, leading to single- and multi-mode lasing with tunable real-space vortex patterns, while the intrinsic Gamma-point singularity of the BIC remains robust. This approach allows precise, on-demand reconfiguration of vortex beams without altering the PhC structure.

Our results provide a versatile platform for programmable vortex lasers and advanced topological photonic devices. The method combines the robustness of momentum-space BIC singularities with flexible real-space control, opening perspectives for dynamically tunable topological lasers and PhC-based quantum emulation, and demonstrating a new paradigm for mesoscopic control of light in structured photonic media.

Engineering Förster Resonance Energy Transfer (FRET) through controlling materials and nanophotonic structures

(Steve) Cuong DANG

Nanyang Technological University (NTU)

Förster resonance energy transfer (FRET) enables efficient non-radiative energy transfer between donor and acceptor species. The process requires spectral energy matching, sufficient exciton population, and nanoscale proximity (typically <10 nm) between donors and acceptors. By engineering materials to tune energy alignment, tailoring optical excitation to control exciton populations, and manipulating the local density of optical states using nanophotonic structures, FRET can be actively controlled. In this talk, we present recent studies demonstrating bidirectional FRET between two materials, switching of exciton flow, and an order-of-magnitude extension of the effective FRET transfer distance enabled by nanophotonic environments.

From Metasurfaces to Metadevices: A New Era of Optoelectronics

Son Tung Ha

*Institute of Material Research and Engineering, A*STAR*

Metasurfaces—planar arrays of resonant nanostructures capable of tailoring the amplitude, phase, and polarization of light—have emerged as a powerful platform for

manipulating light at the subwavelength scale. While early research primarily focused on demonstrating fundamental optical functionalities, recent advances in design, nanofabrication, and system integration are enabling the transition from individual metasurface components to fully functional metadevices. These devices integrate multiple optical functions within ultra-compact architectures, opening new opportunities for next-generation optoelectronic systems.

In this talk, we present the evolution from metasurface concepts to practical metadevices and discuss how resonant nanostructures can enable compact imaging systems, high-efficiency light emitters, and advanced display technologies. We will highlight recent progress in integrating metasurfaces with optoelectronic devices to power emerging photonic systems. Finally, we discuss future prospects and challenges in scaling these technologies toward real-world applications, signalling a new era in optoelectronics driven by flat-optics and nanophotonic engineering

Emergent Multispectral Photonics from Self-Assembly of Chiral Building Blocks

Prashant Kumar

Nanyang Technological University College of Engineering

Chirality is a geometrical property described by continuous mathematical functions. However, in chemical disciplines chirality is often treated as a binary left/right characteristic of molecules rather than a continuity of chiral shapes. While being theoretically possible, a family of stable chemical structures with the same shape and progressively tunable chirality is yet unknown. Here we present such structures in the form of nanostructured microparticles with anisotropic bowtie shape and widely tunable twist angle, pitch, size, thickness, and length. The self-limited assembly of the bowties enables high synthetic reproducibility, size monodispersity, and computational predictability of their geometries for different assembly conditions. The bowties nanoassemblies display multiple strong circular dichroism peaks originating from absorptive and scattering phenomena. Unlike classical chiral molecules, these particles display a continuum of chirality measures that correlate exponentially with the spectral positions of the circular dichroism peaks. Bowtie particles with variable polarization rotation were used to print photonically active metasurfaces with spectrally tunable positive/negative polarization signatures for light detection and ranging (LIDAR) devices. Avenues for utilizing the bulk scale synthesis of chiral metamaterials for applications in the field of biosensing, spintronics, and spectral encryption will be further discussed.

Coupling of a single photon source into a polymeric structure for a future quantum device

Ngoc Diep Lai

Ecole Normale Supérieure Paris-Saclay

In the last few years, the broad research fields of Nanophotonic and Quantum Optics have shown increasing common interests, which are now regularly explored with nano-

emitters. A major tool to develop quantum functionalities in integrated optical circuit or nanostructures is guiding or confining light at the nanoscale. Shaping the electromagnetic environment of a single photon emitter using dielectric cavities allows a full control of the emitter spontaneous emission and the fabrication of bright single photon sources (SPS). A challenge is to couple deterministically a single emitter to a photonic multi-dimensional structure in order to fully enhance its optical properties (such as brightness, spectrum, lifetime, etc.), and also to manipulate the propagation of light on demand, which is crucial for quantum information application. In this talk, I will first show three typical quantum emitters which are excellent candidates for single photon generation. Then, I will explain how a robust technique called LOPA (Low one-photon absorption) direct laser writing (DLW) allows us to very flexibly realizing of 2D and 3D polymeric structures containing a single quantum emitter at desired position inside photonic structures. This SPS/photonic structure coupling was demonstrated to improve its optical properties and to manipulate the quantum light beam in 3D spaces, which will be a first step toward future optical quantum devices.

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Heterogeneous integration and nanophotonics: prospects for solar energy conversion and environmental sensing

Christian Seassal

Institut des Nanotechnologies de Lyon

In order to develop compact, low-environmental-footprint photonic systems for energy and environmental applications, heterogeneous integration is a promising approach. This involves combining different media with complementary properties, such as converting photons into electricity or fuel, emitting light, or converting wavelengths, on a single platform. Reducing the need for active materials is appealing, but it necessarily implies to reinforce light–matter interaction to achieve high-efficiency systems. To this end, the use of simple periodic gratings or more exotic photonic structures that exhibit optical singularities is of great interest. In this talk, we will present two implementations that combine heterogeneous integration and photonic resonators. We will first consider the control of photochemical reactions for environmental remediation and solar fuel generation. To achieve this, we make use of surface-addressable slow-light resonances in 2D photonic crystal slabs combined with photocatalysts [1] or upconverting media [2]. We will then discuss the integration of laser heterostructures that emit in the mid-infrared range, such as QCLs [3] and ICLs [4], with silicon or silicon-germanium photonic integrated circuits. This paves the way for the development of on-chip systems for gas sensing and environmental monitoring.

References: [1] J. Capitolis et al., Nano Select 2022, 3, 108; [2] D. Rinnert et al., arXiv:2601.16732; [3] M. Lepage et al. Opt. Express 2025, 33, 37614; [4] Y. Billiet et al. Optica Advanced Photonics Congress 2025, Jul 2025, Marseille, France. hal-05355773.

Two-dimensional halide perovskites for advanced optical applications

Tran Thuat Nguyen

VNU Semiconductor and Advanced Materials Institute

This report provides an overview of two-dimensional perovskite materials, highlighting their significance as a prominent research focus globally. We emphasize a key property that enables their extensive use in advanced optical devices. Our recent findings demonstrate the successful fabrication of single-crystalline two-dimensional perovskite thin films and quantum dots for optical applications. The single crystals are integrated as active layers between two distributed Bragg reflectors, achieving strong coupling between cavity optical modes and excitonic modes of a two-dimensional halide perovskite, consistent with our simulations and revealing quantifiable coupling strength. Additionally, the quantum dots are employed in light emission devices, where varying the number of lead iodide octahedral layers yields intriguing results, combining electroluminescence and photoluminescence at the same sample position. These findings lay a critical foundation for advancing optical quantum applications.

The Semiclassical Approach for Nonrelativistic & Relativistic Quantum Billiards and Dielectric Cavities

Barbara Dietz

Max Planck Institute for the Physics of Complex Systems

I will briefly review aspects of quantum chaos and semiclassical periodic orbit theory. The semiclassical approach provides an approximation for the fluctuating part of the spectral density in terms of a trace formula, which is a sum over periodic orbits of its classical counterpart. This connection between the eigenvalue spectrum of a quantum system and the classical periodic orbits is discernible in the Fourier transform of the spectral density from wavenumber to length. It exhibits peaks at the lengths of the periodic orbits. The semiclassical approach is of particular importance for the understanding of the properties of quantum systems that do not have a well-defined classical limit. I will briefly introduce a semiclassical trace formula for nonrelativistic and relativistic quantum billiards and illustrate their applicability for one example [1]. Then I will speak about applications to experimental spectra of dielectric resonators and microcavities [2] with a non-orientable surface or with constant negative curvature [3] for an understanding of their ray dynamics.

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Contributed Talks

Nonlocal Entanglement and Dicke Superradiance Mediated by Bound States in the Continuum

Emmanuel Lassalle

*Agency for Science, Technology and Research (A*STAR)*

In this talk, I will discuss how nonlocal metasurfaces supporting delocalized resonances called "bound-states-in-the-continuum" can be used to mediate long-range interactions between quantum emitters positioned in their near-field. I will illustrate this with two specific collective phenomena: The spontaneous creation of quantum entanglement between two initially uncorrelated emitters [1]; The generation of collective quantum light emission, i.e. superradiance, from ordered arrays of quantum emitters [2]. Due to their 2D geometries, compatible with large quantum emitter arrays, nonlocal metasurfaces constitute an attractive platform that is practical and scalable for leading-edge quantum photonics.

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Non-Hermitian corner skin effect in a two-dimensional photonic crystal

Thanh Huyen Phan

Center for Materials Innovation and Technology, VinUniversity, Vietnam

The topological properties of photonic crystals have been theoretically and experimentally realized in many photonic systems. One of the most important properties is the topological states at the boundary of the structures, which are resulted from the nontrivial phase of the bulk wavefunctions. This is known as the topology of eigenfunctions. On the other hand, in the non-Hermitian systems, where the angular frequencies (eigenvalues) are complex numbers, not only the eigenfunctions but also the eigenvalues exhibit topological properties. Studies of non-Hermitian band theory have pointed out a surprising effect named skin effect [1,2], where all electromagnetic (EM) waves states of truncated structures are confined at boundaries. This is a unique property without the Hermitian counterpart. In this work, we theoretically design 2D non-Hermitian photonic systems made from magneto-optical material, which are in the broken of inversion and mirror symmetries. The 1st order non-Hermitian skin effect is numerically observed, which is protected by non-trivial winding of the complex bulk eigenfrequencies. Moreover, non-Hermitian topological edge states are also observed in the line gap between the 1st and the 2nd bands. We numerically calculate the complex topological phases of the bulk

wavefunctions, which is consistent with the emergence of topological edge states. These topological edge states are also form point gap in the complex plane. This point gap is responsible for the 2nd order skin effect emerge at the corner of finite structure. Our results of non-Hermitian topological states are essential and put a step to experimentally realize non-Hermitian effects.

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Non-Linear FDTD for exciton-polariton systems and applications

KEVIN DINI

Nanyang Technological University

Recently emerging complex photonic structures exhibiting giant optical nonlinearity through strong light-matter coupling require new theoretical approaches to accurately capture the interplay of the photonic and interacting-matter degrees of freedom. Extending the finite-difference time-domain method, we develop an algorithm for solving the nonlinear Maxwell-Bloch equations. This allows first-principles modeling of exciton-polariton systems for arbitrarily complex photonic structures with photon-exciton coupling and frequency dependent nonlinear response included without approximations or phenomenological parameters. We first validate the algorithm by reproducing the bistable hysteresis cycle of polaritons in the nonlinear regime. We then give a key example of its utility by simulating polariton dynamics in integrated photonic circuitry composed of spatially localized bistable nodes connected by high speed waveguides. We then confirm the validity and interest of the method by predicting, optimizing and describing non-linear effects in an experimental realization of photonic crystal dressed Rydberg exciton-polaritons.

References:

- K Dini, H Sigurðsson, NWE Seet, PM Walker, TCH Liew, "Nonlinear finite-difference time-domain method for exciton-polaritons: Application to saltatory conduction in polariton neurons", Physical Review B 110 (21), 214303 (2024).
- Q. Shang, K. Dini, H. Jiang, N. W E. Seet, X. Cai, S. Ru, X. Lu, W. C. Yu, J. Zhao, Q. Xiong, T.C.H. Liew, J. Zúñiga-Pérez, W. Gao, "On-chip photonic crystal dressed Rydberg exciton polaritons with enhanced nonlinearity in monolayer WS₂", Nature Communications 16 (1), 10352 (2025).

A photonic tautochrone

Simone Zanotti

NANYANG TECHNOLOGICAL UNIVERSITY

In classical mechanics, there exists a trajectory for which particles falling from different positions without initial velocity reach the bottom of the potential at the same time. This curve is known as a cycloid and gives rise to the so-called tautochrone effect.

Here we propose the photonic analogue of this effect, where photons initially distributed across a system are synchronously focused at its centre by means of a specifically tailored harmonic potential [1]. This tight and synchronised focusing leads to extremely high intensities starting from an initially low photon density. When the linear system is periodically driven by Gaussian pulses with a period matching the tautochrone time, each subsequent pulse constructively interferes with the previous ones, producing an extremely high intensity at the focusing point.

Thanks to the large density peak reached during the focusing stage, optical nonlinear interactions are strongly enhanced, leading to a large phase shift at each focusing event. This phase shift progressively detunes the system from the driving pulses, ultimately resulting in a phase-shift-induced optical limiting effect. Building upon this mechanism, we show that the system can reach bistability and, under a train of independent pulses, multistable regimes enabling the encoding of a multi-level photonic memory. Finally, we demonstrate that tautochrone focusing enhances single-photon antibunching, as confirmed by second-order correlation simulations. Possible physical implementations of the photonic tautochrone are also discussed.

[1] . Verstraelen, S. Zanotti, N. W. E. Seet, J. Zhao, D. Sanvitto, J. Zuñiga-Perez, K. Dini, Y. G. Rubo, T. C. H. Liew, "A Photonic Tautochrone", arXiv:2603.03691v2 (2026)

Coherent Excitation of Exciton-Polariton Bound States in the Continuum via Optical Parametric Oscillation

Wei En Nathan Seet

Nanyang Technological University

Excitonpolariton bound states in the continuum (BICs) are hybrid quasiparticles formed under strong coupling between optical BICs and excitons. However, as BICs have vanishing line width, it is impossible to excite them directly with external optical sources. Consequently, their infinite lifetime cannot be efficiently utilized for coherently driven polaritonic applications. In this session, we show that the nonlinear nature of excitonpolaritons enables an efficient coherent excitation of the BIC via optical parametric oscillation (OPO). Thanks to the enhanced lifetime of the BIC, the requirement for the pump and the idler to be in resonance with a polariton mode is lifted. This allows the OPO process to take place over a large range of pump wavevectors and energy, thereby efficiently populating the polariton BICs.

All-Dielectric Photonic Semi-Dirac Dispersion for Anisotropic Zero-Index Materials

CHU HUY HOANG

NANYANG TECHNOLOGICAL UNIVERSITY

Near-zero-index (NZI) materials enable extraordinary wave manipulation, including perfect collimation, relaxed phase-matching for second-harmonic generation (SHG), and enhanced superradiance through local field intensity boosting. We present an all-dielectric anisotropic NZI photonic crystal (PhC) based on amorphous silicon (a-Si) on quartz. The design achieves this unique dispersion by merging three Bound States in the Continuum (BICs) at the Gamma point—specifically by closing the gap through the emergence and alignment of symmetry-protected and accidental BICs. Numerical simulations confirm an effective refractive index approaching zero at the Dirac point. The sample was fabricated using electron-beam lithography and reactive-ion etching, and the NZI property was experimentally demonstrated via the supercoupling effect using angle-resolved spectroscopy.

Topological Lasing from Thouless Pumping in Bilayer Photonic Grating

Duy Hoang Minh Nguyen

University of Basque Country

Inspired by the concept of topological transport, we propose a programmable photonic platform that integrates Thouless pumping and reconfigurable lasing in sliding bilayer photonic crystals. By engineering two periodic potentials - a slowly moving photonic grating atop a stationary one - we demonstrate how their interplay yields distinct topological phases characterized by either robust light transport (Thouless pumping) or localized spatial oscillation (trapping). A heterojunction between crystals in these two regimes supports an interface mode stemming from the topological phase transition across the boundary. This interface mode can be actively tuned via microelectromechanical systems or switched through the integration of phase-change materials. We further establish the feasibility of lasing action at this interface mode, offering a pathway toward topologically robust and reconfigurable lasers. Our findings provide a framework for exploring topological phase transitions and unify the fields of topological photonics and programmable photonic devices, opening avenues for multidimensionally tunable light sources.

Posters

Ultrafast and Nonlinear Optical Probing of Diamond Interfaces for Quantum Photonics

Quang Khai Dao

Max Planck Institute for Polymer Research

Diamond is an emerging photonic material for sensing and quantum technologies due to its wide bandgap, high optical transparency, and the presence of optically addressable color centers such as nitrogen–vacancy (NV) and group-IV vacancy (SiV, GeV, SnV, PbV, etc.) centers. Among them, the NV center is uniquely suited for room-temperature quantum sensing and photonic applications because of its long spin coherence time and stable optical transitions, while shallow NV centers enable near-field coupling to external spins, charges, and molecular emitters at the diamond surface. For shallow NV centers and nanodiamonds, the optical response is strongly governed by surface termination and interfacial energy-transfer processes, which directly influence charge and spin stability, emission efficiency, and near-field coupling. The ability to characterize and control diamond surface properties is therefore essential for optimizing NV-based quantum sensors, nanoscale light sources, and hybrid photonic systems. In this poster, we aim to establish optical strategies to probe surface termination and to quantify energy transfer from molecular emitters to shallow NV centers, providing insight into the interactions between NV centers and the environment at the diamond interface.

To achieve this goal, we introduce a toolbox of nonlinear and ultrafast spectroscopic techniques. Sum-frequency generation (SFG) spectroscopy is used as a surface-selective nonlinear optical probe to identify and distinguish diamond surface terminations through their vibrational modes with high chemical sensitivity, providing an optical alternative to conventional X-ray photoelectron spectroscopy (XPS), which is typically used for surface analysis. Furthermore, our experimental platform integrates time-resolved photoluminescence and ultrafast pump-probe spectroscopy to resolve excited-state dynamics, charge transfer, and energy transfer processes in diamond-based systems. While the weak interfacial signal currently limits direct pump-probe measurements at the diamond surface, this technique is applied to bulk diamond as a reference to establish the relevant photophysical timescales. Complementary terahertz (THz) spectroscopy is explored to access transient charge carrier responses induced by optical excitation, likewise focusing on bulk diamond to benchmark carrier dynamics. Together, these techniques demonstrate how nonlinear and ultrafast optical techniques can be used to characterize surface termination and interfacial energy transfer in diamond, with direct implications for quantum emitters and photonic sensing applications.

Controlling the exciton emission in twisted two-dimensional halide perovskites moiré superlattices at room temperature

Jason Soon Chye Koay

Nanyang Technological University

Excitons in moiré superlattices exhibit unique properties, including tunable diffusion dynamics, extended lifetimes, accelerated radiative emission, and coherent emission. Nonetheless, these moiré effects have mainly been investigated in twisted van der Waals bilayers, where the relatively small moiré potential is highly susceptible to thermal fluctuations render them unobservable at room temperature. Here, we utilize a newly discovered platform—twisted 2D halide perovskite moiré superlattices—to realize tunable moiré exciton emission at room temperature. Ultrathin Ruddlesden–Popper (RP) phase $(\text{BA})_2\text{MAPb}_2\text{Br}_7$ crystals, with thicknesses down to 10 nm and lateral dimensions up to 100 μm , were grown via the solution–air interfacial crystal growth method and collected with polydimethylsiloxane (PDMS) stamps. The RP perovskite flakes were then deterministically stacked with controlled twist angles, followed by a ligand exchange process to convert them into ultrathin 3D MAPbBr_3 . The strong ionic interactions in MAPbBr_3 generate a significantly larger moiré potential, enabling pronounced moiré effects at room temperature. The excitonic properties of the twisted MAPbBr_3 structures—including photoluminescence intensity, emission rate, and lifetime—are demonstrated to be tunable as a function of twist angle.

Fabrication of plasmonic/photonic structures by direct laser writing method & nonlinear optics characterization

Quang Truong Pham

LuMin laboratory, ENS Paris-Saclay, Université Paris-Saclay

Incorporating metallic nanoparticles (NPs) into photonic structures provides powerful opportunities to enhance light–matter interactions through plasmonic effects and plasmonic–photonic coupling. Such hybrid systems are promising for a wide range of applications including metamaterials, nonlinear optics, optical data storage, and advanced imaging techniques. However, developing simple and versatile fabrication methods that enable control of metallic nanostructures remains a challenge.

In this work, we demonstrate efficient fabrication of plasmonic/photonic structures using a direct laser writing (DLW) technique based on optically induced local thermal effects. Two complementary strategies are investigated. First, plasmonic nanostructures are fabricated on a gold-coated glass substrate. By focusing a continuous-wave laser at 532 nm, localized heating induces the evaporation of the Au thin film at the focal spot, leading to the formation of gold nanoholes (Au NHs) with submicron dimensions. Second, the same optically assisted thermal process can be applied to hybrid metal–complex/photoresist materials, where it simultaneously reduces metal ions and facilitates solvent evaporation from the polymer, resulting in the formation of Au NPs within the polymerized photoresist. By controlling the movement of the focused laser beam, various multidimensional plasmonic/photonic structures containing Au NPs can be patterned as

desired. Furthermore, the second-harmonic generation (SHG) response of both Au NHs and Au NPs is characterized under pulsed infrared excitation. Strong SHG signals are observed, which are attributed to symmetry breaking at the metal interfaces and plasmon-induced local electric-field enhancement. This simple, efficient fabrication method could open new opportunities for applications in plasmonic and nanophotonic fields.

PROGRAM

Time: 10:30~18:15 April 08, 2026

Time	Presentation Topic	
10:30	Bus to ICISE	
11:00-12:00	Registration at ICISE	
12:00~13:00	Lunch	
13:30~14:00	Welcome and Opening	Gia Lai Province Leaders Tran Thanh Son ICISE Guangwei Hu <i>Nanyang Technological University</i>
14:00~15:00	Keynote	Flat Band Physics and its Photonic Applications
		Sergej Flach <i>Institute for Basic Science</i>
15:00~15:15	Break	
15:15~15:45	Invited Talk	Photonic Crystal Surface Emitting Lasers over the Entire Visible Spectrum on a Silicon
		Ivo Tanghe <i>UGent/imec</i>
15:45~16:15	Invited Talk	Mott insulator polariton in MoSe ₂ /WS ₂ moiré lattice
		Jie Gu <i>Fudan University</i>
16:15~16:30	Contributed Talk	Nonlocal Entanglement and Dicke Superradiance Mediated by Bound States in the Continuum
		Emmanuel Lassalle <i>A*STAR</i>
16:30~16:45	Break	
16:45~17:15	Invited Talk	Loss offset using syntheic wave of complex frequency
		Fuxin Guan <i>Nanjing University</i>
17:15~17:45	Invited talk	High-Performance Lasers Based on Colloidal Quantum Dots and Quantum Wells
		Duong Ta <i>Le Quy Don Technical University</i>
17:45~18:00	Contributed Talk	Non-Hermitian corner skin effect in a two-dimensional photonic crystal
		Thanh Huyen Phan <i>VinUniversity</i>
18:00~18:30	Back to hotel	

Time: 08:30~20:00 April 09, 2026

Time	Presentation Topic	
8:30	Bus to ICISE	
9:00~10:00	Keynote	Optical metasurfaces for imaging, sensing and display
		Junsuk Rho <i>Pohang University of Science and Technology</i>

10:00~10:30	Invited Talk	Light-matter interactions mediated by interface polaritons
		Yingjie Wu <i>Zhejiang University</i>
10:30~10:45	Contributed Talk	Topological Lasing from Thouless Pumping in Bilayer Photonic Grating
		Duy Hoang Minh Nguyen <i>University of Basque Country</i>
10:45~11:00	Break	
11:00~11:30	Invited Talk	Nonlinear topological photonics
		Daniel Leykam <i>Singapore University of Technology and Design</i>
11:30~12:00	Invited Talk	Optical skyrmions in single microcavities formed by photonic spin-orbit coupling
		Feng Li <i>Xi'an Jiaotong University</i>
12:00~12:30	Invited Talk	Two-dimensional halide perovskites for advanced optical applications
		Tran Thuat Nguyen <i>VNU Semiconductor and Advanced Materials Institute</i>
12:30~13:30	Lunch	
13:30~14:00	Invited Talk	Quantifying Emission Processes in Weakly Coupled Light Emitter - Open Cavity System
		Quynh Le-Van <i>VinUniversity</i>
14:00~14:30	Invited Talk	Engineering Förster Resonance Energy Transfer (FRET) through controlling materials and nanophotonic structures
		(Steve) Cuong Dang <i>Nanyang Technological University</i>
14:30~14:45	Break	
14:45~15:15	Invited Talk	Engineering Optical Fields: Vortices, Singularities, and Envelope Function Control
		Ségolène Callard <i>Centrale Lyon/ Lyon Insitute of Nanotechnology</i>
15:15~15:45	Invited Talk	From Metasurfaces to Metadevices: A New Era of Optoelectronics
		Son Tung Ha <i>A*STAR</i>
15:45~17:15	Break	
17:15~17:45	Invited Talk	Emergent Multispectral Photonics from Self-Assembly of Chiral Building Blocks
		Prashant Kumar <i>Nanyang Technological University College of Engineering</i>
17:45~18:15	Invited Talk	Coupling of a single photon source into a polymeric structure for a future quantum device
		Ngoc Diep Lai <i>Ecole Normale Supérieure Paris-Saclay</i>
18:15~18:30	Contributed Talk	Non-Linear FDTD for exciton-polariton systems and applications
		Kevin Dini <i>Nanyang Technological University</i>
18:30~20:30	Banquet	

Time: 08:30~18:00 April 10, 2026

Time	Presentation Topic	
8:30	Bus to ICISE	
09:00~10:00	Keynote	Light-matter interaction with 2D materials
		Weibo Gao <i>Nanyang Technological University</i>
10:00~10:30	Invited Talk	Electrically Tunable Nonlinear Photonics using 2D Ferroelectric Integration
		Sanghoon Chae <i>Nanyang Technological University</i>
10:30~10:45	Contributed Talk	All-Dielectric Photonic Semi-Dirac Dispersion for Anisotropic Zero-Index Materials
		Chu Huy Hoang <i>Nanyang Technological University</i>
10:45~11:15	Break	
11:15~11:45	Invited Talk	Heterogeneous integration and nanophotonics: prospects for solar energy conversion and environmental sensing
		Christian Seassal <i>Institut des Nanotechnologies de Lyon</i>
11:45~12:00	Contributed Talk	Coherent Excitation of Exciton-Polariton Bound States in the Continuum via Optical Parametric Oscillation
		Wei En Nathan Seet <i>Nanyang Technological University</i>
12:00~12:15	Contributed Talk	A photonic tautochrone
		Simone Zanotti <i>Nanyang Technological University</i>
12:15~12:45	Invited Talk	The Semiclassical Approach for Nonrelativistic & Relativistic Quantum Billiards and Dielectric Cavities
		Barbara Dietz <i>Max Planck Institute for the Physics of Complex Systems</i>
12:45~13:00	Closing Hai Son Nguyen	
13:00~14:00	Lunch	
14:00~18:00	Excursion (Cham Tower)	
18:30	Back to Hotel	

Time: 09:00~13:00 April 11, 2026

9:00	Bus to ICISE
09:00~12:00	Visit fishing village

USEFUL INFORMATION

Internet: WIFI is available at the ICISE. The password is **ICISE20130812** for guests.

Wifi is available almost anywhere in Vietnam: for example, you can get wifi access in any local cafe if you ask waiters for the password.

Beach time: Shower rooms and changing rooms are available on the beach. Your laptops – NOT YOUR BELONGINGS – can be stored in the conference room. Bring along your towel, bathing suit, and sunscreen if you want to swim.

(At the hotel beach, local people usually swim during sunrise (05:30 - 06:30 am): if the weather permits, you should try that too!)

Prepaid Mobile phone and 4G internet SIM card:

Prepaid SIM card for phone and internet data is relatively cheap in Vietnam. Viettel, Vinaphone, and Mobifone are three phone and internet providers that provide a Tourist SIM card which costs around 200.000 VND or 10 USD. These tourist SIM cards offer you around 50 minutes of international calls, 100 minutes of domestic calls, free text messages, 4G internet connection (depending on the provider). These SIM cards can be bought at the airport, in electronic or phone shops.

Telephone: If you share a room, please keep track of your calls because there is only one telephone per room and the billing is done for each room. Telephone bills should be settled before you leave.

Banking facilities: Exchange currency service is available at the hotel reception, local bank branches or any jewelry shops. ATM machines can be found nearby the hotel.

Departure to the airport: We will arrange transportation to the airport according to your itinerary given to us. Please contact the conference secretaries for any assistance with airport transfers. We will stick the departure list on the announcement board at ICISE hall. Please complete and let us know if anything is wrong.

REMEMBER TO GET BACK YOUR PASSPORT AT THE HOTEL RECEPTION DESK BEFORE YOU LEAVE!

Special announcements

Information about the conference will be posted on the paperboard in the hotel lobby. Please check it regularly for updates.

A paperboard in ICISE entrance hall, near the Secretary office, and in the hotel reception hall will be used for special announcements. Please check it regularly.

Suggestion: The accompanying person can take a taxi to go to the ICISE center to enjoy the beach or to have a rest in the park.

Emergency contacts

You can call us any time if you have any emergency requests including pick up, medical help...

ICISE contacts: (What'sapp/Zalo)

Mr. The: + 84 (0) 869 259 577

Ms. Loan: + 84 (0) 384 255 689

Hotel reception:

Seagull hotel: + 84 (0) 2563 846 377

LADO taxi: + 84 (0) 2563 666 777

GENERAL INFORMATION

Registration: The registration of the conference will take place on

- **Wednesday, April 8 from 11:00 – 12:00 at ICISE Centre.**

Please register as soon as you arrive!

The conference venue:

The conference venue is located at ICISE (**International Centre for Interdisciplinary Science and Education - Trung tâm Quốc tế Khoa học và Giáo dục Liên Ngành**):

Address: *Số 07 Đại lộ Khoa học, phường Quy Nhơn Nam, tỉnh Gia Lai*

07 Science Avenue, Quy Nhơn Nam ward, Gia Lai province

Telephone: (+84) 0256 3540 099 – 0256 3646 609

The conference secretariat office is located at ICISE, open from 8:00 to 12:00 and from 13:30 to 17:30.

Meals:

Please also let us know your preference (vegetarian, vegan...) so that we can inform the hotel/caterer.

Alcoholic or soft drinks will be charged to your hotel account. If you are sharing a room, please find an arrangement with your roommate for both your telephone and beverage bills.

Breakfast will be served at your hotel from 6:00 – 8:00. You will need the daily coupon provided by the hotel (together with your room key).

Coffee breaks will be served at ICISE.

Lunch: will be served at ICISE for all participants, check the announcement board daily for more information.

Gala dinner: will be served at ICISE for all participants on **Thursday, April 9, 2026 at ICISE.**

Shuttle Bus: HOTEL ⇄ ICISE: The shuttle buses are only available at Seagull Hotel

(489 An Duong Vuong Street, Quy Nhơn Nam, Gia Lai)

- Buses to ICISE centre:

Bus station	Wednesday	Thursday	Friday	Saturday
Seagull Hotel	10:30	8:30	8:30	8:00

- Buses back to the hotel: will depart after the last session each day.

You can also take a taxi if you wish. In case of need, please contact the hotel reception or the conference secretariat for help; it takes 10-15 min from the hotel to ICISE or *vice versa*.

Internet: WIFI is available at the ICISE. The password is **ICISE20130812** for guests.

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