

NB-Photonics SYMPOSIUM

May 26, 2023

iGent-building (Auditorium) Technologiepark-Zwijnaarde

start end

9:00 9:15 Intro, Roel Baets

9:15 10:30 Oral presentations

Presenter, Introducer

*NB-Photonics
research
groups
involved*

Title

Short abstract

9:15 9:30 Jing Zhang, Gunther
Roelkens

PRG and
IDLab

Heterogeneous integration in
silicon photonics using micro-
transfer printing

Micro-transfer printing enables the intimate integration of a wide range of micro-components on a silicon photonics platform. This technique allows for wafer-scale integration in a massively parallel manner with high alignment accuracy and high throughput.

9:30 9:45 Pieter Geiregat

PCN and PRG

ERC-grant NOMISS - a route
towards low-cost, safe and
flexible infrared opto-
electronics

Solution processable or 'printable' semiconductor nanocrystals are excellent candidates to realize low cost opto-electronics, in particular for on-chip functionalities such as light emitting diodes and lasers. In NOMISS, a new suite of ROHS compatible materials will be developed to enable such groundbreaking applications in the challenging mid-infrared spectrum.

9:45 10:00 Migle Stebryte, Kristiaan
Neyts

LCP

Reflective optical components
based on photopatterned chiral
liquid crystal

Chiral liquid crystals have a chiral periodic structure, a photonic band gap and act as mirrors for circularly polarized light. In combination with periodic photoalignment flat optical components can be realized.

10:00 10:15 Chupao Lin, Nicolas Le
Thomas

PRG, CMST,
COCOON

UV Photonic Integrated Circuits
for advanced optical microscopy

Photonic Integrated Circuits are expected to add new functionalities in a considerable number of applications. Here, we show how structured illumination microscopy and quantitative phase imaging can benefit from PICs operating in the UV range.

10:15 10:30 Dieter Cuypers, Pieter
Schiettecatte, Geert Van
Steenberge or Zeger
Hens

CMST, PCN

Towards Full-Color μ -LED
Displays with Patterned InP-
Based Quantum Dots as Colour
Conversion Layer

Micro-light-emitting diodes (μ -LEDs) are the cornerstone of next-generation display technology. An attractive approach for realizing full-colour μ -LED displays is to use blue μ -LEDs with a colour conversion layer based on quantum dot (QD) materials. Here, we show green and red LEDs formed using InP-based QDs as on-chip color convertor for blue LEDs.

10:30 11:15 Coffee break

11:15 12:15 Digital poster session

1. Dongbo Wang, Bart Kuyken	PRG, CMST	Mid-infrared QCLs integrated with beam combiner based on Ge-on-Si platform	We demonstrate for the first time on-chip quantum cascade lasers integrated with a beam combiner, leveraging a mid-infrared Ge-on-Si integrated photonics platform and 3D self-alignment flip-chip bonding. The results enable low-cost mid-infrared spectroscopy for environmental monitoring applications, as developed within Horizon Europe M3NIR.
2. Maxime Delaey, Dirk Poelman	Lumilab, Biophotonics	Near-infrared luminescent nanocrystals for multimodal medical diagnostics	Infrared emitting inorganic luminescent nanoparticles can be used as probes in biomedical imaging. The choice for gadolinium-based compounds allows multimodal imaging, combining optical imaging with MRI and CT.
3. Ivo Tanghe, Pieter Geiregat	PCN, PRG	Printable Lasing Technology based on Colloidal Nanocrystals	Building on their excellent and tunable opto-electronic properties, colloidal NCs are now implemented as light emitting layer in many applications relying on spontaneous emission. In the last years, a fruitful collaboration within NB Photonics has brought about a revolution towards using stimulated light emission.
4. Mingxiang Yang, Geert Morthier	PRG	High performance grating couplers for vertical coupling by inverse design.	Apodized grating couplers for vertical coupling from silicon waveguides to optical fiber or free space are designed, fabricated and characterised. The design is optimised for the more common 220nm thick silicon waveguides with 70nm deep etch.
5. Jef Van Asch, Geert Van Steenberge	CMST, PRG, IDLab	Electrical and optical redistribution layers for dense integration of electronic and photonic ICs	A dense integration of electronic and photonic ICs is required for demanding applications such as high-port-count optical switches and the next generation of optical transceivers. We report an approach based on package-level electrical and optical redistribution layers compatible with wafer-scale processing.
6. Emiel Dieussaert, Yanlu Li	PRG	Silicon photonics-based laser Doppler vibrometry (LDV) for noncontact photoacoustics	We present a successful demonstration of using a compact pulsed laser diode and a small silicon photonics-based Laser Doppler Vibrometry (LDV) for photoacoustic (PA) measurements, indicating the potential for a contactless and portable PA system.
7. Mohammadreza Bahrami, Kristiaan Neyts	LCP	Smart Switchable Windows for the Control of Solar Irradiation	Electronic books are based on charged particles suspended in liquid that move under influence of an electric field. Electrophoresis can be used to make a window switch between a scattering/absorbing state and a clear state.
8. Pieter Schiettecatte, Zeger Hens	PCN	Bridging the Green Gap, Monochromatic InP-Based Quantum-Dot-on-Chip LEDs with >50% Color Conversion Efficiency	Here we show green, amber and red LEDs formed using InP-based QDs as on-chip color convertor for blue LEDs. Implementing QDs with near-unity photoluminescence efficiency results in unique properties.
9. Federico Pazzaglia, Jeroen Missinne	CMST	Soft probes for optical therapies in biomedical applications	We are developing small and soft probes to limit gliotic scarring and cellular damage upon implantation, targeting light-based therapies such as optogenetics and optopharmacology.
10. Dobromil Respecta, Zeger Hens	PCN	Exciton and biexcitons in InP/ZnSe core/shell quantum dots	In this study, a set of InP/ZnSe/ZnS core/shell/shell QDs with different InP-core sizes and different ZnSe shell thicknesses was analyzed by temperature-dependent transient absorption spectroscopy, and other methods.
11. Nagarjun KP, Wim Bogaerts	PRG, LCP, CMST	Making Lithographically defined liquid crystal cells for integration of silicon photonics with LCOS drivers	We have been developing a process to fabricate cells to use large-scale liquid crystal tuning on silicon photonic circuits. In the process we develop a lithographically defined tank to locally contain liquid crystal between two silicon chips, one containing optical waveguides, and the other containing liquid crystal driver circuitry.
12. Sumit Sumit, Filip Strubbe	LCP	Laser-scanning microscopy of quantum dots	In this work, laser scanning microscopy is used to measure the electrical charge of individual quantum dots in solution. Analysis reveals that quantum dots hop between different discrete charge levels.

12:15 13:15 Lunch break

13:15	13:30	Innovation Support in NB-Photonics, Eva Ryckeboer		
13:30	14:45	Oral presentations		
13:30	13:45	Manuel Chapa, Stephane Clemmen	PRG	Silicon photonics-based Geiger-operated avalanche PD for bio and quantum PICs.
				We report the first-of-its-kind silicon photonics avalanche photodiode operated in the Geiger regime for single photon detection. Measured detection efficiency, jitter and dark count level indicate its viability for future non cryogenic quantum integrated circuits.
13:45	14:00	Kobe De Geest, Dries Van Thourhout	LCP, PRG	Solution processed electro-optic materials: material characterisation & device integration
				In a collaboration between the SCRIPTS, LCP and PRG research groups, we developed a method for depositing layers with a strong electro-optical effect such as PZT and BTO on practically any planar substrate. In this presentation we report on improvements in the deposition process and a characterisation setup to determine the Pockels coefficient.
14:00	14:15	Bart Kuyken	PRG	Photonic integration for the visible
				Life science applications, like optical coherence tomography and flow cytometry, require visible wavelength photonic circuits for high water transparency. A platform that enables the sources, modulators, and detectors in this band is necessary for optimal performance.
14:15	14:30	Lukas Van Iseghem, Wim Bogaerts	PRG, LCP	Liquid Crystal Phase Shifters for Silicon Photonics
				We present efficient electro-optic phase shifters using liquid crystals integrated in silicon photonic circuits. The liquid crystal material can be integrated with inkjet printing onto waveguides in IMEC's iSiPP50G process, and can induce a phase shift of $>2\pi$ with $< 5V$ drive voltages.
14:30	14:45	Haolan Zhao, Roel Baets	PRG	Axithra – enabling rapid drug monitoring via on-chip Raman spectroscopy
				Raman-on-chip enables rapid drug identification and quantification directly from blood. Spin-off company Axithra is commercializing this technology to ensure the right drug at the right dose for each patient, aiming to improve treatment outcome and save costs.
14:45	15:00	Student chapter PSG, Victor Geudens		

15:00 16:00 Digital poster session

1. Chao Pang, Pieter Geiregat	PCN, PRG	Integrated PbS Colloidal Quantum Dot Photodiodes on Silicon Nitride Waveguides	In this work, the integration of photodiodes (PDs) based on PbS QDs on silicon nitride waveguides is demonstrated for the first time. We found one of the main limitations preventing the integration of efficient PDs on waveguides was the high optical power density induced saturation.
2. Isaac Luntadila Lufungula, Dries Van Thourhout	PRG	uTP4Q: A versatile quantum photonic IC platform enabled by micro-transfer printing	The project uTP4Q aims to demonstrate the benefits of heterogeneous integration of different materials by combining InAs quantum dot emitters, Lithium Niobate modulators and switches, and superconducting detectors on a mature foundry-based silicon nitride waveguide interposer.
3. Davide Colucci, Dries Van Thourhout	PRG	Nanoridge lasers on silicon through direct epitaxy	The nanoridge platform for growing III-V materials on silicon developed by imec offers unique possibilities for developing highly integrated lasers on silicon. In this poster we will review our recent work on realizing new types of lasers based on this platform.
4. Brecht Berteloot, Kristiaan Neyts	LCP	Fabrication of 3D liquid crystal structures	Photoalignment of liquid crystals can define the orientation of the preferred orientation at a surface. By using a spatial light modulator with millions of pixels to define patterns, 3D configurations can be generated.
5. Konstantinos Akriditis, Bart Kuyken	PRG, LCP	Evanescently coupled lasers at 900 nm	Evanescently coupled lasers at 900 nm can be integrated on silicon nitride. The integration allows for multiplexed operation and a high tunability.
6. Ezat Kheradmand, Zeger Hens	PCN	InSb quantum dots for detection of short-wave infrared light, from synthesis to high mobility charge transport	InSb quantum dots are promising materials for short-wave infrared opto-electronics. Here, we show the formation of InSb quantum dots by colloidal synthesis, assess the surface chemistry of these materials and use this understanding for the formation of InSb films that behave as a high mobility, p-type semiconductor.
7. Muhammed Gouda, Peter Bienstman	PRG	Label-Free flow cytometry using event-based vision and Spiking neural networks	Spiking neural networks (SNNs) are bio-inspired neural networks that mimic the workings of our brains. In a similar fashion, event-based vision sensors try to replicate a biological eye as close as possible. In this work, we integrate both technologies together for the purpose of classifying micro-particles/cells.
8. Verena Fritz, Philippe Smet	LumiLab	Brightening The Way: A Field Test of Outdoor Glow-in-the-Dark Safety Signage	A first field test for persistent phosphor outdoor safety signage - consisting of a concrete tile with integrated light and temperature sensors - provides insights about their performance with changing weather conditions
9. Jing Bai, Zeger Hens	PCN	Formation of InAs quantum dots with band-gap absorption up to 1600 nm	TBD
10. Margot Niels, Bart Kuyken	PRG	Lithium Niobate on a chip	The integration of the material lithium niobate on a photonic chip allows to exploit its strong electro-optic properties. It will allow for the next generation of ultra-fast modulators or low-loss low-power switches
11. Hong Deng, Wim Bogaerts	PRG, IDLab	An integrated microwave photonic filtering circuit	We have built a photonic integrated circuit to process microwave signals in the optical domain. The circuit combines high-speed modulators and detectors, and an on-chip tunable laser and a programmable filter bank.

16:00 17:00 Wrap-up drink and networking