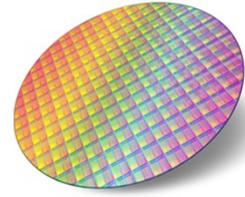




# SIOE 2023



## Semiconductor & Integrated Opto-electronics conference

4<sup>th</sup> – 6<sup>th</sup> of April 2023

Cardiff



**HUAWEI**

**IOP** Institute of Physics  
Cymru | Wales

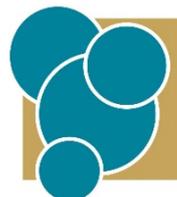
**IOP** | Institute of Physics  
**Semiconductor Physics Group**



Compound Semiconductor Centre



Institute for Compound  
Semiconductors  
Sefydliad ar gyfer  
Lled-ddargludyddion Cyfansawdd



EPSRC CDT in  
**Compound  
Semiconductor  
Manufacturing**

# *Welcome Message*

## *Croeso i SIOE*

It gives me great pleasure to welcome you to the 36<sup>th</sup> SIOE conference.

This is the first SIOE since many in Cardiff have moved into new facilities and we will make time in a busy schedule to offer you the chance to see our new capability. This is difficult with an exciting programme that covers everything from materials development through devices to integrated circuits and which showcases the continuing development of Semiconductor Integrated OptoElectronics.

On Tuesday afternoon we begin in the Centre for Student Life, which is opposite the Main University Building and in front of the Students Union (see map) with a session on Facilities available for general use in the UK and a session focussed on growth and topics with more of a materials perspective. This is followed by a poster session and buffet in the brand new Translational Research Hub (see map), allowing you to interact and talk with poster presenters, other delegates and to make new connections. We invite you to take a glass of local beer at the poster session, or alternative sustenance, kindly sponsored by The Compound Semiconductor Centre. and can offer you a souvenir glass kindly sponsored by Photon Design. We will also have tours of the facilities of the Institute for Compound Semiconductors available for those that are interested.

On Wednesday we return to the Centre for Student Life. We start with materials development move to lasers and then detectors and finish with integration.

We then move to Cardiff Castle for a reception supported by the Institute of Physics, Wales and finally onto the Castle Banquet, kindly sponsored by Huawei UK

On Thursday morning we finish with sessions on single photon sources and on VCSELs before a lunch in the Centre for Student Life and farewells.

I need to thank colleagues that have supported the conference programme Dr Sara Gillgrass, Dr Sam Shutts, Andrea Watkins and special thanks to Kate James, who has singlehandedly pulled most of it together.

I also wish to thank the following sponsors who have provided generous contributions: IOP Wales, IOP Semiconductor Physics Group, The Compound Semiconductor Centre (CSC), Photon Design and Huawei UK.



Prof. Peter Smowton, School of Physics and Astronomy, Cardiff University

# Conference Locations

Tues 4<sup>th</sup>, Wed 5<sup>th</sup> and Thurs 6<sup>th</sup> April

**Location:** Centre for Student Life

**Address:** Park Place, Cathays, Cardiff, CF10 3BB

**Parking:** On-street pay and display on Museum Avenue (we cannot reimburse costs)

**Registration location:** Centre for Student life, 2<sup>nd</sup> floor

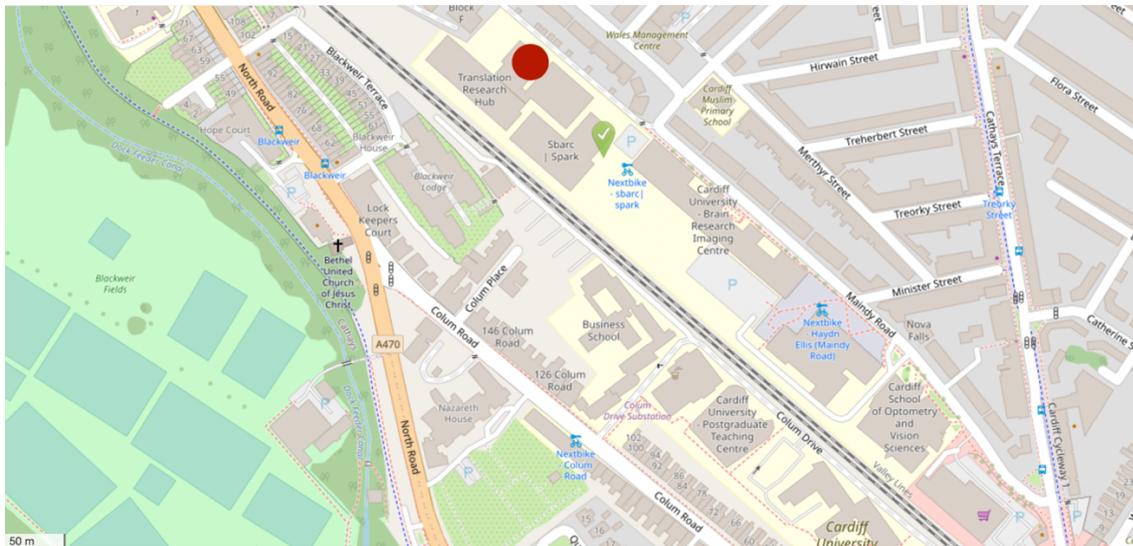
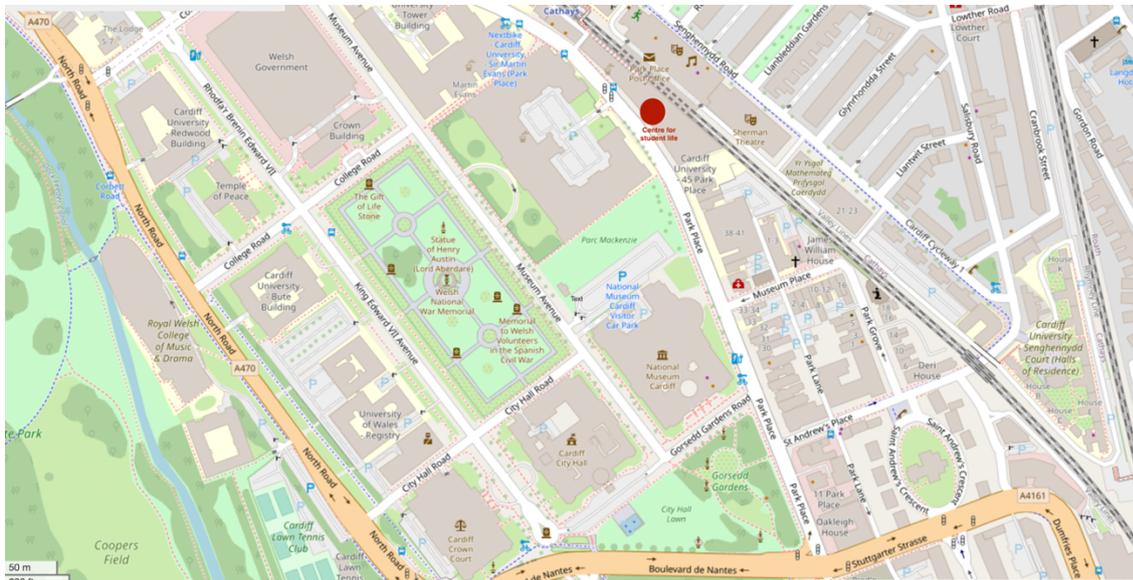
**Session location:** Sir Stanley Thomas Lecture Theatre, 2<sup>nd</sup> floor

**Refreshment location:** Centre for Student life, 4<sup>th</sup> floor

**Poster Session & Reception location:** Transitional Research Hub

**Address:** Maindy Road, Cardiff, Wales, UK, CF24 4HQ

**Banquet location:** Cardiff Castle, Castle Street, CF10 3RB



# *Programme*

## **Tuesday 4<sup>th</sup> April**

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**Registration** CSL, Floor 2; 13.00 onwards

**Welcome Address** CSL, Stanley Thomas Lecture Theatre; 13.55 – 14.00

**Session 1: UK Facilities** CSL, Stanley Thomas Lecture Theatre; 14.00 – 15.15

*Refreshment Break 15.15 – 15.45; CSL, 4<sup>th</sup> Floor*

**Session 2: Epitaxial Growth** CSL, Stanley Thomas Lecture Theatre; 15.45 – 17.15

*Break and walk to venue 17.15 – 17.30*

**Session 3: Poster Session and tour of the Translational Research Hub Sponsored by Compound Semiconductor Centre and Photon Design** *(including buffet and drinks)*  
Translational Research Hub; 17.30 – 19.30

## **Wednesday 5<sup>th</sup> April**

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**Session 4: Materials Development** CSL, Stanley Thomas Lecture Theatre; 08.45 – 10.15

*Refreshment Break 10.15 – 10.45; CSL, 4<sup>th</sup> Floor*

**Session 5: Lasers** CSL, Stanley Thomas Lecture Theatre; 10.45 – 12.45

*Huawei Lunch 12.45 – 13.45; CSL, 4<sup>th</sup> Floor*

**Session 6: Detectors** CSL, Stanley Thomas Lecture Theatre; 13.45 – 15.15

*Break 15.15 – 15.45; 4<sup>th</sup> Floor CSL*

**Session 7: Integration components / technologies** CSL, Stanley Thomas Lecture Theatre;  
15.45 – 17.45

*Walk to venue Break 17.45 – 18.00*

**Conference Banquet Reception, sponsored by IOP Wales**      Cardiff Castle; 18.00 – 19.00

**Conference Banquet, sponsored by Huawei**      Cardiff Castle; 19.00 Onwards

## **Thursday 6<sup>th</sup> April**

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**Session 8: Photon Sources.**      CSL, Stanley Thomas Lecture Theatre; 09.00 – 10.30

*Refreshment Break 10.30 – 11.00; CSL, 4<sup>th</sup> Floor*

**Session 9: VCSELS**      CSL, Stanley Thomas Lecture Theatre; 11.00 – 12.45

*Huawei Lunch 12.45 – 13.45; CSL, 4<sup>th</sup> Floor*

**End of conference**

# Programme, Tuesday 12<sup>th</sup> April

## Registration

Centre for Student Life, Stanley Thomas Lecture Theatre; 13.00 onwards

## Welcome Address

Centre for Student Life, Stanley Thomas Lecture Theatre; 13.55 – 14.00

## Session 1: UK Facilities

Centre for Student Life, Stanley Thomas Lecture Theatre; 14.00 – 15.30

### 14.00<sup>S23\_16</sup> National Epitaxy Facility enabling semiconductor research in the UK

Z.K Bishop<sup>1\*</sup>, E Clarke<sup>1</sup>, E.M Sala<sup>1</sup>, I Farrer<sup>1</sup>, R.A Oliver<sup>2</sup>, H Liu<sup>3</sup>, M.S Skolnick<sup>4</sup>, and J Heffernan<sup>1</sup>

<sup>1</sup>Department of Electronic and Electrical Engineering, University of Sheffield, <sup>2</sup>Department of Materials Science and Metallurgy, University of Cambridge, <sup>3</sup>Department of Electronic and Electrical Engineering, University College London, <sup>4</sup>Department of Physics and Astronomy, University of Sheffield

### 14.15<sup>S23\_20</sup> CORNERSTONE's Open-Access Silicon Photonics Prototyping Platforms

A.E Kaplan<sup>1</sup>, C.G Littlejohns<sup>1</sup>, H Vizabaskaran<sup>1</sup>, Y Tran<sup>1</sup>, M Banakar<sup>1</sup>, X Yan<sup>1</sup>, M Ebert<sup>1</sup>, J Le Besque<sup>1</sup>, E Tsanidou<sup>1</sup>, E Di Gaetano<sup>2</sup>, M Sorel<sup>2</sup>, H.M.H. Chong<sup>3</sup>, Mashanovich<sup>1</sup>, D.J. Thomson<sup>1</sup> and G.T Reed<sup>1</sup>

<sup>1</sup>Optoelectronics Research Centre, University of Southampton, Southampton SO17 1BJ, UK, <sup>2</sup>School of Engineering, University of Glasgow, Glasgow G12 8LT, UK, <sup>3</sup>Electronics and Computer Science, University of Southampton, Southampton SO17 1BJ, UK

### 14.30<sup>S23\_15</sup> Ion Beam Facilities at UK National Ion Beam Centre

N Peng and R.P Webb

Surrey Ion Beam Centre, ATL, FEPS, University of Surrey, Guildford GU2 7XH, Surrey, UK

### 14.45<sup>S23\_60</sup> Institute for Compound Semiconductors, Cardiff University

T Peach

Institute for Compound Semiconductors, Translational Research Hub, Cardiff University, Maindy Road, Cardiff, CF24 4HQ, UK

### 15.00<sup>S23\_54</sup> UK National Open Access Foundry for Quantum Photonic Components

D Powell<sup>1</sup>, W Meredith<sup>1</sup>, I Davies<sup>2</sup>, S Shutts<sup>3</sup>, P Smowton<sup>3</sup>, M Missous<sup>4</sup>, A Robertson<sup>5</sup>, M Haji<sup>6</sup> and D Spence<sup>6</sup>

<sup>1</sup>Compound Semiconductor Centre Ltd, Cardiff, CF3 0LW, UK. <sup>2</sup>IQE Plc, Cardiff, CF3 0LW, UK. <sup>3</sup>School of Physics and Astronomy, Cardiff University, Cardiff, CF24 3AA. <sup>4</sup>Integrated Compound Semiconductors Ltd, Manchester, M17 1RW, UK. <sup>5</sup>Bay Photonics Ltd, Paignton, TQ4 7RZ, UK. <sup>6</sup>National Physical Laboratory, Teddington, TW11 0LW, UK

*Refreshment Break 15.15 – 15.45, Centre for Student Life, 4<sup>th</sup> Floor*

## Session 2: Epitaxial Growth

Centre for Student Life, Stanley Thomas Lecture Theatre; 15.45 – 17.15

### 15.45<sup>S23\_52</sup> MOCVD Selective area growth of InGaAs/AlGaAs/GaAs using shadow mask

A. Kasukawa, M. Tajima and M. Arai\*

*Furukawa Electric Co., R&D Division, \*Department of Applied Physics and Electrical Engineering, University of Miyazaki 6 Yawata Kaigan-dori, Ichihara, Chiba 290-8555, Japan*

### 16.00<sup>S23\_40</sup> Molecular Beam Epitaxy Growth of Ge Buffer on V-Groove Si

K Mtunzi<sup>1</sup>, H Jia<sup>1</sup>, Y Hou<sup>2</sup>, X Yu<sup>1</sup>, M Tang<sup>1</sup>, H Liu<sup>1\*</sup>

*<sup>1</sup> Department of Electronic and Electrical Engineering, University College London, Torrington Place, London WC1E 7JE, United Kingdom, <sup>2</sup> Optoelectronics Research Centre, Centre for Photonic Metamaterials, University of Southampton, Southampton, SO17 1BJ, United Kingdom*

### 16.15<sup>S23\_10</sup> Thermal quenching in GaAs<sub>1-x</sub>Bix MQW structures

N.A Adham, F Harun, T.B.O Rockett, J.P.R David and R.D Richards

*University of Sheffield*

### 16.30<sup>S23\_44</sup> Strategies for low threading dislocation density and antiphase boundary-free GaAs epitaxy on on-axis Si (001) substrates

J-S Park<sup>1</sup>, J Yang<sup>1</sup>, K Li<sup>1</sup>, H Jia<sup>1</sup>, H Deng<sup>1</sup>, X Yu<sup>1</sup>, P Jurczak<sup>1</sup>, S Pan<sup>1</sup>, W Li<sup>2</sup>, S Chen<sup>1</sup>, A Seeds<sup>1</sup>, M Tang<sup>1</sup>, and H Liu<sup>1</sup>

*<sup>1</sup>Department of Electronic and Electrical Engineering, University College London, London WC1E 7JE, UK, <sup>2</sup>Institute of the Microstructure and Properties of Advanced Materials, Beijing, University of Technology, Beijing, 100124, China*

### 16.45<sup>S23\_23</sup> MOCVD growth of InAs/InAlGaAs quantum dots for C-band to near 2 $\mu\text{m}$ emission

S Liu<sup>1</sup>, Z Yan<sup>1</sup>, B-P Ratiu<sup>1</sup>, H Jia<sup>2</sup>, T Grieb<sup>3</sup>, P Wong<sup>1</sup>, M Tang<sup>2</sup>, A Rosenauer<sup>3</sup>, H Liu<sup>2</sup>, S Shutts<sup>1</sup>, P.M Smowton<sup>1</sup>, and Q Li<sup>1\*</sup>

*<sup>1</sup>School of Physics and Astronomy, Cardiff University, United Kingdom, <sup>2</sup>Department of Electronic and Electrical Engineering, University College London, United Kingdom, <sup>3</sup>Institute of Solid State Physics, University of Bremen, Germany*

### 17.00<sup>S23\_32</sup> Optically active 1550nm InAs/InAlGaAs/InP (001) quantum dot materials grown by molecular beam epitaxy

C Dear, X Yu, H Jia, J Yuan, H Deng, M Tang and Huiyun Liu

*Department of Electronic and Electrical Engineering, University College London*

*Break and walk to venue 17.15 – 17.30*

## Session 3: Posters & Reception Sponsored by Compound Semiconductor Centre and Photon Design

Transitional Research Hub, 17.30 – 19.30

**S23\_51 Inhomogeneous Broadening in the Photoluminescence Spectrum of InGaAs Nanowires**

N.A Almalki, B Maglio, Q Li, and P.M Smowton

*School of Physics and Astronomy, Cardiff University, The Parade, Cardiff CF24 3AA, United Kingdom*

**S23\_53 An Ultra-low Threading Dislocation Density III-V Buffer Layer Grown on Si Substrate with Ultra-Low Thickness**

M Dang, M Tang, H Deng and H Liu

*Department of Electronic and Electrical Engineering, University College London, London WC1E 7JE, UK,*

**S23\_46 High-order gratings fabricated with mask-less projection lithography for distributed feedback lasers**

B Salmond<sup>1</sup>, Z Cao<sup>1</sup>, S-J Gillgrass<sup>1</sup>, T Peach<sup>2</sup>, M Wale<sup>3</sup>, W Meredith<sup>4</sup>, P.M Smowton<sup>1,2</sup> and S Shutts<sup>1,2</sup>

*<sup>1</sup>School of Physics and Astronomy, The Parade, Cardiff University, CF24 3AA, UK. <sup>2</sup>Institute for Compound Semiconductors (ICS), Translational Research Hub, Maindy Road, Cardiff, CF24 4HQ, UK. <sup>3</sup>Department of Electronic and Electrical Engineering, University College London, WC1E 7JE. <sup>4</sup>Compound Semiconductor Centre Ltd, St Mellons, Cardiff, CF3 0LW*

**S23\_35 Distributed Bragg Reflectors in Photonic Integrated Circuits for Quantum Applications**

J Blatcher, M.J Cryan and J Pugh

*Department of Electrical & Electronic Engineering, University of Bristol*

**S23\_57 Non-Mechanical beam steering technologies for low SWaP FSO terminals**

J Francis and P.M Smowton

*School of Physics and Astronomy, Cardiff University, The Parade, Cardiff, CF24 3AA*

**S23\_58 Implementation strategy for a quantum dot based photonic device model**

B Jakobs<sup>1</sup>, D Gallagher<sup>2</sup>, L Ponnampalam<sup>3</sup> and P.M Smowton<sup>1</sup>

*<sup>1</sup>School of Physics and Astronomy, Cardiff University, Cardiff, UK, <sup>2</sup>PhotonDesign, Oxford, UK, <sup>3</sup>Department of Electronic and Electrical Engineering, University College London, London, UK*

**S23\_59 Photonic Integrated Circuit for Optical Coherence Tomography**

L Michael<sup>1</sup>, G Berry<sup>2</sup>, M Robertson<sup>2</sup>, G.F Cotella<sup>2</sup>, H Liu<sup>3</sup> and P.M Smowton<sup>1,4</sup>

*<sup>1</sup>School of Physics and Astronomy, Cardiff University, The Parade, Cardiff, CF24 3AA, <sup>2</sup>Ipswich Research Centre, Huawei Technologies Research and Development (UK) Limited, Phoenix House, B55 Adastral Park, Martlesham Heath, Ipswich, IP5 3RE. <sup>3</sup>Department of Electronic and Electrical Engineering, University College London, Torrington Place, London, WC1E 7JE. <sup>4</sup>Institute of Compound Semiconductors (ICS), Cardiff University, Translational Research Hub, Maindy*

**S23\_61 AlGaInAs-InP Lasers Operating at 1.55  $\mu\text{m}$**

M.S Alsayyadi<sup>1</sup>, S Shutts<sup>1,2</sup> and P.M Smowton<sup>1,2</sup>

*<sup>1</sup> School of Physics and Astronomy, Cardiff University, the Parade, Cardiff, CF24 3AA <sup>2</sup>Institute of Compound Semiconductors (ICS), Cardiff University, Translational Research Hub, Maindy Road, Cardiff, CF24 4HQ*

# Programme, Wednesday 5<sup>th</sup> April

## Session 4: Materials Development

Centre for Student Life, Stanley Thomas Lecture Theatre; 08.45 – 10.15

### 08.45<sup>S23\_45</sup> Low Threading Dislocation Density Thin Ge Buffer on Si Achieved by N-type Dopants Facilitated Growth

H Jia<sup>1\*</sup>, X Yu<sup>1</sup>, K Mtunzi<sup>1</sup>, J Yang<sup>1</sup>, S Huo<sup>2</sup>, H Deng<sup>1</sup>, M Tang<sup>1</sup> and H Liu<sup>1</sup>

<sup>1</sup>Department of Electronic and Electrical Engineering, University College London, Torrington Place, London WC1E 7JE, United Kingdom, <sup>2</sup>London Centre for Nanotechnology, 17-19 Gordon Street, London WC1H 0AH, United Kingdom

### 09.00<sup>S23\_36</sup> Photoconductivity measurement as proposed technique to monitor defect states in Cu<sub>2</sub>O crystal at room temperature.

A.S Albeladi<sup>1,2</sup>, C Hodges<sup>1</sup>, C Allford<sup>1</sup> and S Lynch<sup>1</sup>

<sup>1</sup>School of Physics and Astronomy, Cardiff University, The Parade, Cardiff CF24 3AA, United Kingdom. <sup>2</sup>Department of Physics, College of Science and Art, KAU, Rabigh 25732, Saudi Arabia.

### 09.15<sup>S23\_37</sup> Blue Light Emission from Flexible InGaN/GaN Nanowires LED Structures Down to 3 mm Radius of Curvature

J Duraz<sup>1\*</sup>, J Bosch<sup>2</sup>, N Amador-Mendez<sup>3</sup>, E Herth<sup>1</sup>, B Alloing<sup>2</sup>, M Tchernycheva<sup>1</sup> and S Bouchoule<sup>1</sup>

<sup>1</sup>C2N, CNRS - Université Paris-Saclay, 91120 Palaiseau, France <sup>2</sup>Université Côte d'Azur, CNRS, CRHEA, Sophia Antipolis, Valbonne, France <sup>3</sup>ISOM-Dept. Ing. Electrónica, ETSIT, Univ. Politécnica, Madrid, Spain

### 09.30<sup>S23\_56</sup> Tantalum Oxide (TaOx) Anti-Reflective Thin Films for C-Band Optoelectronic Devices

J Travers-Nabialek<sup>1</sup>, S-J Gillgrass<sup>1</sup>, R Forrest<sup>1</sup>, Z Cao<sup>1</sup>, S Shutts<sup>1,2</sup> and P.M Smowton<sup>1,2</sup>

<sup>1</sup>School of Physics and Astronomy, Cardiff University, The Parade, Cardiff, CF24 3AA. <sup>2</sup>Institute for Compound Semiconductors (ICS) Cardiff University, Translational Research Hub, Maindy Road, Cardiff, CF24 4HQ,

### 09.45<sup>S23\_47</sup> Growth and characterisation of broadband InP based quantum dot LEDs grown by MOVPE

O Moynihan, S Ghosh, G Juska, E.E Mura, K Thomas, E Pelucchi and B Corbett

Tyndall National Institute, University College Cork Ireland

### 10.00<sup>S23\_43</sup> Improved performance of 1.3 μm quantum dot by direct Si doping

H Deng<sup>1</sup>, H Jia<sup>1</sup>, J Yuan<sup>1</sup>, X Zhang<sup>1</sup>, M Tang<sup>1</sup>, P Smowton<sup>2</sup>, C Jin<sup>3</sup>, A Seeds<sup>1</sup> and H Liu<sup>1</sup>

<sup>1</sup>Department of Electronic and Electrical Engineering, University College London, London, WC1E 7JE, UK <sup>2</sup>School of Physics and Astronomy, Cardiff University, Cardiff, CF10 3AT, U.K. <sup>3</sup>College of Information Science and Electronic Engineering, Zhejiang University, Hangzhou 310007, China

*Refreshment Break 10.15 – 10.45, Centre for Student Life, 4<sup>th</sup> Floor*

## Session 5: Lasers

Centre for Student Life, Stanley Thomas Lecture Theatre; 10.45 – 12.45

### 10.45<sup>S23\_48</sup> Determining the impact of facet roughness on etched facet InP laser devices, making comparisons to theoretical models.

T.T Burman<sup>1</sup>, J Patel<sup>2</sup>, H Ashraf<sup>2</sup>, T Grange<sup>2</sup>, S Shutts<sup>1</sup>, P.M Smowton<sup>1</sup>

<sup>1</sup>School of Physics and Astronomy, Cardiff University, CF24 3AA, UK. <sup>2</sup>KLA (SPTS Division), Ringland Way, Newport NP18 2TA, UK

### 11.00<sup>S23\_30</sup> Room temperature low threshold nanobeam lasers using InGaAs/GaAs nanowires on silicon-on-insulator grown by MOCVD

B-P Ratiu<sup>1</sup>, Z Yan<sup>1</sup>, B Temu<sup>1</sup>, T Grieb<sup>2</sup>, P Wong<sup>1</sup>, A Rosenauer<sup>2</sup>, S Soon Oh<sup>1</sup> and Q Li<sup>1</sup>

<sup>1</sup>School of Physics and Astronomy, Cardiff University, Cardiff, United Kingdom. <sup>2</sup>Institute of Solid State Physics, University of Bremen, Bremen, Germany

### 11.15<sup>S23\_28</sup> Optically pumped Nano-ridge Laser Emitting in the Telecom O-band Epitaxially Grown on a 300 mm Si Wafer

D Colucci<sup>1,2</sup>, M Baryshnikova<sup>2</sup>, Y Shi<sup>1</sup>, Y Mols<sup>2</sup>, M Muneeb<sup>1</sup>, Y De Koninck<sup>2</sup>, D Yudistira<sup>2</sup>, M Pantouvaki<sup>2</sup>, J Van Campenhout<sup>2</sup>, R Langer<sup>2</sup>, D Van Thourhout<sup>1</sup> and B Kunert<sup>2</sup>

<sup>1</sup>INTEC Departement, Ghent University, Technologiepark-Zwijnaarde 15, 9052 Ghent, Belgium. <sup>2</sup>Imec, Kapeldreef 75, 3001 Heverlee, Belgium

### 11.30<sup>S23\_50</sup> Multi-Mode Interference Reflector for Integrated Photonics

F.T Albeladi<sup>1,2</sup>, S Gillgrass<sup>1</sup>, J Nabialek<sup>1</sup>, P Mishra<sup>1</sup>, R Forrest<sup>1</sup>, T.R Albiladi<sup>1,3</sup>, C.P Allford<sup>1</sup>, S Shutts<sup>1</sup>, and P.M Smowton<sup>1</sup>

<sup>1</sup>School of Physics and Astronomy, Cardiff University, The Parade, Cardiff. CF24 3AA. UK. <sup>2</sup>Physics Department, Faculty of Science, University of Jeddah, Jeddah 21589, Saudi Arabia. <sup>3</sup>Physics and Astronomy Department, Faculty of Science, King Saud University, Riyadh 11451, Saudi Arabia

### 11.45<sup>S23\_55</sup> The effects of Co-doping on the temperature stability of 1.3µm InAs Quantum Dot Lasers

A Enderson<sup>1,2</sup>, L Jarvis<sup>1</sup>, P Mishra<sup>1</sup>, B Maglio<sup>1</sup>, S-J Gillgrass<sup>1</sup>, C Allford<sup>1</sup>, F Albeladi<sup>1,2</sup>, H Deng<sup>3</sup>, M Tang<sup>3</sup>, H Liu<sup>3</sup>, S Shutts<sup>1</sup> and P.M Smowton<sup>1</sup>

<sup>1</sup>EPSRC Compound Semiconductor Manufacturing Hub, School of Physics and Astronomy, Cardiff University, Cardiff CF24 3AA, United Kingdom. <sup>2</sup>Physics Department, Faculty of Science, University of Jeddah, Jeddah 21589, Saudi Arabia. <sup>3</sup>Department of Electronic and Electrical Engineering, University College London, Torrington Place, London, WC1E 7JE, United Kingdom

### 12.00<sup>S23\_17</sup> High Quality Microwave Photonic Signal Generation in an Optically Injected Discrete-mode Semiconductor Lasers

S.D Feng<sup>1</sup>, D Chang<sup>2</sup>, Z.Q Zhong<sup>1</sup>, J.W Wei<sup>1</sup>, W Jin<sup>2</sup>, S Jiang<sup>2</sup>, and Y.H Hong<sup>2</sup>

<sup>1</sup>College of Science, Chongqing University of Technology, Chongqing 400054, China. <sup>2</sup>School of Computer Science and Electronic Engineering, Bangor University, Bangor, LL57 1UT, UK

### **12.15<sup>S23\_49</sup> Aperiodic lattice THz quantum cascade lasers: from tunable photonic ICs to THz- over-Fibre**

S Chakraborty

*Department of Electrical and Electronic Engineering University of Manchester, Manchester M13 9PL, UK*

### **12.30<sup>S23\_01</sup> Chaos-Based Photonic Information-Processing Platforms: Capabilities and Challenges**

K.A Shore<sup>1</sup>, P Li<sup>2,3</sup> and Y. C Wang<sup>2</sup>

*<sup>1</sup>Bangor University, School of Computer Science and Electronic Engineering, LL57 1UT, Wales, UK ;<sup>2</sup>Guangdong Provincial Key Laboratory of Photonics Information Technology, School of Information Engineering, Guangdong University of Technology, Guangzhou 510006, China; <sup>3</sup>Key Laboratory of Advanced Transducers and Intelligent Control System, Ministry of Education, Taiyuan University of Technology, Taiyuan 030024, China*

*Huawei Lunch 12.45 – 13.45; Centre for Student Life, 4<sup>th</sup> Floor*

## **Session 6: Detectors**

*Centre for Student Life, Stanley Thomas Lecture Theatre; 13.45 – 15.15*

### **13.45<sup>S23\_02</sup> InGaAs/InAlAs linear mode avalanche photodiode for 1550nm detections**

X Jin<sup>1</sup>, Q Tian<sup>1</sup>, X Yi<sup>2</sup>, M Kesaria<sup>3</sup>, V Srivastava<sup>3</sup>, G Buller<sup>2</sup>, I Davies<sup>4</sup> and J.R David<sup>1</sup>

*<sup>1</sup>Department of Electronic and Electrical Engineering, University of Sheffield, Sheffield S1 3JD, United Kingdom.*

*<sup>2</sup>School of Engineering & Physical Sciences, Heriot-Watt's University, Edinburgh, EH14 4AS, United Kingdom.*

*<sup>3</sup>School of Physics and Astronomy, University of Cardiff, Cardiff, CF24 4HQ, United Kingdom. <sup>4</sup>IQE plc. Cardiff, Wales, CF3 0LW, United Kingdom*

### **14.00<sup>S23\_25</sup> Characterisation of GaAsBi Multiple quantum well photodiodes**

X Tao<sup>1</sup>, X Jin<sup>1</sup>, Y Liu<sup>1</sup>, C.H Tan<sup>1</sup>, R.D Richards<sup>1</sup>, J.P.R David<sup>1</sup> and X Yi<sup>2</sup>

*<sup>1</sup>Department of Electronic and Electrical Engineering, University of Sheffield, Sheffield, S1 3JD, U.K. <sup>2</sup>School of Engineering & Physical Sciences, Heriot-Watt's University, Edinburgh, EH14 4AS, U.K.*

### **14.15<sup>S23\_07</sup> Afterpulsing in Planar Ge-on-Si Single-Photon Avalanche Diodes**

X Yi<sup>1</sup>, Z Greener<sup>1</sup>, F Fleming<sup>1</sup>, J Kirdoda<sup>2</sup>, D.C.S Dumas<sup>2</sup>, L Saalbach<sup>1</sup>, L Ferre-Llin<sup>2</sup>, R.W Millar<sup>2</sup>, D.J Paul<sup>2</sup> and G.S Buller<sup>1</sup>

*<sup>1</sup>Institute of Photonics and Quantum Sciences, School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh EH14 4AS, UK. <sup>2</sup>James Watt School of Engineering, University of Glasgow, Rankine Building, Oakfield Avenue, Glasgow G12 8LT, U.K.*

### **14.30<sup>S23\_21</sup> Characterisation of InAlAsBi pin photodiodes**

R.D Richards<sup>1</sup>, X Tao<sup>1</sup>, X Jin<sup>1</sup>, C.H Tan<sup>1</sup>, J Bork<sup>2</sup>, J.M.O Zide<sup>2</sup>, J.P.R David<sup>1</sup>

*<sup>1</sup>Department of Electronic and Electrical Engineering, University of Sheffield, Sheffield S1 3JD, United Kingdom.*

*<sup>2</sup>Department of Materials Science and Engineering, University of Delaware Newark, DE 19716, United States of America*

### **14.45<sup>S23\_22</sup> Characterization of GaAsSb on InP for 1550nm Detection**

Y Liu<sup>1</sup>, X Jin<sup>1</sup>, J.P.R David<sup>1</sup>, H Jung<sup>2</sup>, S Lee<sup>2</sup> and S Krishna<sup>2</sup>

<sup>1</sup>Department of Electronic and Electrical Engineering, University of Sheffield, Sheffield, S1 3JD, UK. <sup>2</sup>Department of Electrical and Computer Engineering, The Ohio State University, Columbus, Ohio, 43210, USA

**15.00<sup>S23\_41</sup> Improvements of GaAs nanowire-based visible-light photodetectors**

X Li<sup>1,2</sup>, X Yu<sup>1</sup>, H Zeng<sup>1</sup>, G Boras<sup>1</sup>, K Shen,<sup>1,2</sup> Y Zhang<sup>1</sup>, J Wu<sup>2</sup>, K.L Choy<sup>3</sup> and H Liu<sup>1</sup>

<sup>1</sup>Department of Electronic and Electrical Engineering, University College London, London WC1E 7JE, United Kingdom. <sup>2</sup>Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China, Chengdu 610054, People's Republic of China. <sup>3</sup>Institute for Materials Discovery, University College London, Roberts Building, Malet Place, London WC1E 7JE, United Kingdom

*Refreshment Break 15.15 – 15.45, Centre for Student Life, 4<sup>th</sup> Floor*

**Session 7: Integration Components / Technologies**

Centre for Student Life, Stanley Thomas Lecture Theatre; 15.45 – 17.45

**15.45<sup>S23\_03</sup> ITO as a Novel Material for Tunable Photonic Modulators**

S.F.J Blair, J.S Male, C.P Reardon and T.F Krauss

*School of Physics, Electronics & Technology, University of York, York, YO10 5DD, United Kingdom*

**16.00<sup>S23\_04</sup> Fully Integrated 2.4 GHz Rectennas Using Novel Tunnel Diodes**

C Walsh, S.G Muttlak, and M Missous

*Department of Electrical & Electronic Engineering, The University of Manchester, Manchester, M13 9PL, United Kingdom*

**16.15<sup>S23\_12</sup> Thermally Tunable Silicon Nitride Platform Racetrack Resonator with Integrated Amorphous Silicon Waveguide**

Z Zhang, R Ma, Q Cheng and R Penty

*Centre for Photonic Systems, Electrical Division, Department of Engineering, University of Cambridge, 9 JJ Thomson Avenue, Cambridge, CB3 0FA, United Kingdom*

**16.30<sup>S23\_24</sup> Highly Efficient Dual-Mode Waveguide Modulators in Epsilon-Near-Zero Materials**

J.S Male, S.F.J. Blair, C.P Reardon, and T.F Krauss

*School of Physics, Electronics & Technology, University of York, York, YO10 5DD, United Kingdom*

**16.45<sup>S23\_14</sup> Novel method for the 3D reconstruction of fabricated photonic devices from SEM images**

D.O Armstrong<sup>1,2</sup>, S. Ibrahim<sup>1,2</sup>, I.C Stoddard-Jones<sup>3</sup>, J.P Lee<sup>4</sup> and A.J Bennett<sup>1,2</sup>

<sup>1</sup>School of Engineering, Cardiff University, Queens Building, The Parade, Cardiff, UK, CF24 3AA. <sup>2</sup>Translational Research Hub, Cardiff University, Maindy Road, Cathays, Cardiff, UK, CF24 4HQ. <sup>3</sup>School of Physics and Astronomy, Cardiff University, Queens Building, The Parade, Cardiff, UK, CF24 3AA. <sup>4</sup>Wave Photonics, St John's Innovation Centre, Cowley Road, Cambridge, UK, CB4 0WS

**17.00<sup>S23\_31</sup> Design Centering and Yield Optimization for Photonic Integrated Circuits**

B Wang, J Pugh and M Cryan

*Department of Electrical and Electronic Engineering, University of Bristol*

**17.15<sup>S23\_27</sup> Development of a lab-on-chip optical biosensor for multiplexed detection of biomarkers**

F Masia<sup>1</sup>, N Monim<sup>1</sup>, B Santos-Gomes<sup>1</sup>, L Payne<sup>1</sup>, D Regan<sup>1</sup> and W Langbein<sup>2</sup>

<sup>1</sup>*School of Biosciences, Cardiff University.* <sup>2</sup>*School of Physics and Astronomy, Cardiff University*

**17.30<sup>S23\_06</sup> QWHE sensors for real time magnetic imaging under High Temperature conditions using an MFL scanning system**

N Sathappan, J Sexton, R Murshudov and M Missous

*Department of Electrical & Electronic Engineering, The University of Manchester*

17-45 Walk to venue

**Conference Banquet Reception; Sponsored by IOP Wales**

Cardiff Castle; 18.00 – 19.00

**Conference Banquet; Sponsored by Huawei**

Cardiff Castle; 19.00 onwards

# Programme, Thursday 6<sup>th</sup> April

## Session 8: Photon Sources

Centre for Student Life, Stanley Thomas Lecture Theatre; 9.00 – 10.30

### 09.00<sup>S23\_26</sup> Photonics design theory enhancing light extraction efficiency in quantum dot light emitting diodes

D.M Othman<sup>1</sup>, J Weinstein<sup>2</sup>, Q.Q Lyu<sup>3</sup>, and B Hou<sup>1</sup>

<sup>1</sup>School of Physics and Astronomy, Cardiff University, Cardiff CF24 3AA, UK. <sup>2</sup>Department of Chemistry, The University of Sheffield, Sheffield, S10 2TN, UK. <sup>3</sup>Ipswich Research Centre, Huawei Technologies Research & Development (UK) Ltd. Ipswich IP5 3RE, UK

### 09.15<sup>S23\_19</sup> Enhanced collection efficiency from single colour centres in aluminium nitride nanopillars

H.B Yağcı<sup>a,b</sup>, S.G Bishop<sup>a,b</sup>, J.K Cannon<sup>a,b</sup>, J.P Hadden<sup>a,b</sup>, and A.J Bennett<sup>a,b</sup>

<sup>a</sup>School of Engineering, Cardiff University, Queen's Buildings, The Parade, Cardiff, UK, CF24 3AA.

<sup>b</sup>Translational Research Hub, Cardiff University, Maindy Road, Cathays, Cardiff, UK, CF24 4HQ

### 09.30<sup>S23\_09</sup> Metallic nano-rings to increase the collection of single photons emitted by quantum dots

C Haws<sup>1</sup>, E Perez<sup>2</sup>, M Davanco<sup>2</sup>, J Dong Song<sup>3</sup>, K Srinivasan<sup>2</sup> and L Sapienza<sup>1</sup>

<sup>1</sup>Advanced Research Centre, University of Glasgow, Glasgow G11 6EW. UK <sup>2</sup>National Institute of Standards and Technology, Gaithersburg, MD 20899, USA <sup>3</sup>Korea Institute of Science and Technology, Seoul 136-791, South Korea

### 09.45<sup>S23\_33</sup> Cavity effects in type-II GaSb quantum ring devices at telecommunication wavelengths

G Acar<sup>1</sup>, S Jones<sup>1</sup>, P Hodgson<sup>1</sup>, F Alvarado-Cesar<sup>2</sup>, R Beanland<sup>1</sup> and M Hayne<sup>1</sup>

<sup>1</sup>Department of Physics, Lancaster University, Lancaster LA1 4YB, UK. <sup>2</sup>Department of Physics, University of Warwick, Coventry CV4 7AL

### 10.00<sup>S23\_18</sup> Towards the quantum candela: a calibrated flux of five million single photons per second delivered by single-mode fibre

R.N Clark<sup>1,2</sup>, P Androvitsaneas<sup>1,2</sup>, L Arabskyj<sup>3</sup>, P.R Dolan<sup>3</sup>, T.S Santana<sup>3</sup>, C.J Chunnillall<sup>3</sup>, A.G Sinclair<sup>3</sup>, I Farrer<sup>4</sup> and A.J Bennett<sup>1,2</sup>

<sup>1</sup>School of Engineering, Cardiff University, The Parade, Cardiff CF24 3AA. <sup>2</sup>Translational Research Facility, Institute for Compound Semiconductors, Cardiff University, Maindy Road, CF24 4HQ <sup>3</sup>National Physical Laboratory, Hampton Road, Teddington, TW11 0LW. <sup>4</sup>School of Electrical and Electronic Engineering, University of Sheffield, Sir Frederick Mappin Building, Sheffield S1 3JD

### 10.15<sup>S23\_08</sup> Aperiodic devices as a platform for nano- and quantum photonics

O.J Trojak<sup>1</sup>, S Gorsky<sup>2</sup>, F Sgrignoli<sup>2</sup>, F.A. Pinheiro<sup>3</sup>, J Dong Song<sup>4</sup>, L Dal Negro<sup>2</sup> and L Sapienza<sup>1</sup>

<sup>1</sup>Advanced Research Centre, University of Glasgow, Glasgow G11 6EW, UK. <sup>2</sup>Department of Electrical and Computer Engineering, Boston University, Massachusetts, USA. <sup>3</sup>Instituto de Fisica, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil. <sup>4</sup>Korea Institute of Science and Technology, Seoul 136-791, South Korea

*Refreshment Break 10.30 – 11.00, Centre for Student Life, 4<sup>th</sup> Floor*

## **Session 9: VCSELs**

Centre for Student Life, Stanley Thomas Lecture Theatre; 11.00-12.45

### **11.00<sup>S23\_34</sup> GaSb/GaAs Quantum-Ring Vertical-Cavity Surface-Emitting Lasers for Telecommunications and Sensing**

S Jones, P.D Hodgson, R Beanland and M. Hayne

*Department of Physics, Lancaster University, Lancaster LA1 4YB. <sup>+</sup>Department of Physics, University of Warwick, Coventry CV4 7AL*

### **11.15<sup>S23\_29</sup> Modelling of Vertical Cavity Surface Emitting Laser Operating at 795nm for Atomic Magnetometer Applications**

S.G Muttalak<sup>1</sup>, I Kostakis<sup>2</sup> and M Missous<sup>1</sup>

*<sup>1</sup>Department of Electrical and Electronic Engineering, the University of Manchester, United Kingdom. <sup>2</sup>Integrated Compound Semiconductors, Manchester, United Kingdom*

### **11.30<sup>S23\_42</sup> Characterisation of a polarisation pinned VCSEL: Spatial and Spectral Analysis of Lasing Modes**

D Lei<sup>1,2</sup>, D-H Kim<sup>2</sup>, M Tang<sup>1</sup>, H Liu<sup>1</sup> and R.A Hogg<sup>2</sup>

*<sup>1</sup>University College London, London WC1E 7JE, U.K., <sup>2</sup>The University of Glasgow, Glasgow, G12 8LT UK*

### **11.45<sup>S23\_38</sup> Spin and pseudo-spin lasing in commercial VCSELs**

T Almabetov, A Young, R Oulton and E Harbord

*Quantum Engineering Technology Labs and Photonics and Quantum, Department of Electrical and Electronic Engineering, University of Bristol, Bristol BS8 1UB, U.K.*

### **12.00<sup>S23\_39</sup> Novel VCSEL Geometries for Miniaturised Magnetometers**

J Meiklejohn<sup>1</sup>, J Baker<sup>1</sup>, C.P Allford<sup>1</sup>, C Hentschel<sup>1</sup>, S-J Gillgrass<sup>1</sup>, J Nabialek<sup>1</sup>, R Forrest<sup>1</sup>, M Haji<sup>2</sup>, W Chalupczak<sup>2</sup>, D Powell<sup>3</sup>, W Meredith<sup>3</sup>, D Mowbray<sup>4</sup>, P.M Smowton<sup>1</sup> and S Shutts<sup>1</sup>

*<sup>1</sup>EPSRC Future Compound Semiconductor Manufacturing Hub, School of Physics and Astronomy, Cardiff University; <sup>2</sup>National Physical Laboratory, Teddington; <sup>3</sup>Compound Semiconductor Centre, Cardiff; <sup>4</sup>Department of Physics and Astronomy, Sheffield University*

### **12.15<sup>S23\_13</sup> Development of Tamm-Assisted Metasurface Emitting Lasers (TAMSELS).**

M Bai, T Alshammari, P Jiang, R Oulton and E Harbord

*Quantum Engineering Technology Labs, School of Physics and Department of Electrical and Electronic Engineering, University of Bristol, Bristol BS8 1UB, UK*

### **12.30<sup>S23\_11</sup> GHz-Rate Photonic Spiking Neural Network with a Single VCSEL**

D Owen-Newns, J Robertson, M Hejda and A Hurtado

*Institute of Photonics, University of Strathclyde, Glasgow G1 1RD, Scotland, United Kingdom*

*Huawei Lunch 12.45 – 13.45; CSL, 4<sup>th</sup> Floor*

**Conference Close**