UKNC Conference Programme

University of Cambridge

8th-9th January 2025

Code of Conduct.

The UKNC winter meeting aims to provide a harassment-free conference experience for everyone, regardless of gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, ethnicity, religion (or lack thereof), or technology choices. We do not tolerate harassment of conference participants in any form. Sexual language and imagery is not appropriate for any conference venue, including talks, workshops, parties, Twitter and other online media. Conference participants violating these rules may be sanctioned or expelled from the conference without a refund at the discretion of the conference organisers.

Harassment includes offensive verbal comments related to gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, ethnicity, religion, technology choices, sexual images in public spaces, deliberate intimidation, stalking, following, harassing photography or recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome sexual attention.

Any participants who have concerns that the Code of Conduct has been breached should contact one of the UKNC committee members responsible for conferences:

Prof David Binks: david.binks@manchester.ac.uk

Dr Gunnar Kusch: gk419@cam.ac.uk

Prof Rachel Oliver: rao28@cam.ac.uk

Our sponsors

Wednesday 8th of January 2025.

09:30-10:10 Arrival, Registration and Coffee (Sponsored by Attolight SA)
Quarry Auditorium

10:10-10:15 Opening Remarks
Quarry Auditorium

10:15-11.00 Foxon Lecture - Chair: Rob Martin
Quarry Auditorium

Multiscale simulation of recombination processes and carrier transport in III-N heterostructures
Stefan Schulz
Tyndall National Institute and University College Cork, Ireland

11.00-12.00 Session 1: UV Optoelectronics- Chair: Rob Martin
Quarry Auditorium

11.00-11.15 **Influence of quantum well thickness on the opto-electronic properties of AlGaN UV-C LEDs through the impact of threading dislocations**
V. Spūlis[1,2], D. Cameron[2], T. Wernicke[3], F. Biebler[3], M. Schilling[3], R. A. Oliver[1], R. W. Martin[2], G. Kusch[1]
[1]*Dept. of Materials Science and Metallurgy, Univ. of Cambridge, Cambridge, UK*
[2]*University of Strathclyde, Glasgow G4 0NG, United Kingdom;* [3]*Technische Universität Berlin, Institute of Solid State Physics, 10623, Berlin, Germany*

11.15-11.30 **Temperature-dependent investigation of polarisation doping in 330 nm ultraviolet light-emitting diodes**
Peter Milner[1,2], *Vitaly Z. Zubialevich*[1], *Sandeep M. Singh*[1,2,3], *Brian Corbett*[1], ***Peter J. Parbrook***[1,2]
[1]*Tyndall National Institute, University College Cork;* [2]*School of Engineering, University College Cork;* [3]*Centre for Nanoscience and Technology, University of Sheffield*

11.30-11.45 **Gbps UV-C Communications Up To 30 Metres using 235 nm and 255 nm commercial DUV LEDs**
Hichem Zimi[1], *Jonathan McKendry*[1], *Sina Babadi*[2], *Behnaz Majlesein*[2], *Isaac Osahon*[2], *Johannes Herrnsdorf*[1], *Harald Haas*[2], *Martin Dawson*[1]
[1]*University Of Strathclyde,* [2]*University of Cambridge*

11.45-12.00 **Radiation resilient $(Al_xGa_{1-x})_2O_3$ photodetectors for applications in Low Earth Orbit**

Sean Douglas[1], Arpit Nandi[2], Sai Vanjara[2], Dr Matthew Smith[2], Professor Martin Kuball[2], Viesturs Spulis[1], Professor Robert Martin[1], Professor Paul Mckenna[1], Dr Robbie Wilson[1], Dr Ross Gray[1], Dr Stephen Reynolds[3], Dr Fabien Massabuau[1]

[1]University of Strathclyde, [2]University of Bristol, [3]University of Dundee

12.00-13.00 Lunch (Sponsored by AFT)
The Diamond

13.00-13.45 The Humphreys Lecture - Chair: Fabien Massabuau
Quarry Auditorium

Novel wavelength conversion device structures based on GaN and AlN

Ryuji Katayama

Osaka University, Japan

13.45-14.30 Session 2: Electrical devices - Chair: Fabien Massabuau
Quarry Auditorium

14.15-14.30 **4 kV β-Ga_2O_3 trench Schottky barrier diodes: reliability, defects and failure mechanisms**

Sai Charan Vanjari[1,2], Mr. Aditya Bhat Kundapura[1], Ms. Haiqi Huang[1], Dr. James Pomeroy[1], Dr. Matthew Smith[1], Prof. Martin Kuball[1,2]

[1]University Of Bristol; [2]Innovation and Knowledge Centre REWIRE, Bristol

14.30-14.45 **A capacitance-coupled Ga_2O_3 memristor**

Yaonan Hou[1,2], Lijie Li[1,2], Zengxia Mei[3,4], Huili Liang[3,4], Alfred Moore[1]

[1]Electronic and Electrical Engineering, Swansea University,

[2]Centre for Integrative Semiconductor Materials (CISM), Swansea University; [3]Songshan Lake Materials Laboratory, China; [4]Institute of Physics, Chinese Academy of Sciences

14.45-15.00 **Experimental investigation of GaN transistors radiated switching noise for low power loads**

Vlad Marsic[1], Soroush Faramehr[1], Isha Maini[2], David Moran[2], Petar Igic[1]

[1]Centre of E-mobility And Clean Growth, Coventry University; [2]School of Engineering, University of Glasgow

14:30-15.00 Coffee (Sponsored by Taiyo Nippon Sanso)
Quarry Auditorium

15.00-16.15 Session 3: Growth and Emerging Materials- Chair: David Binks
Quarry Auditorium

15.00-15.15 **Barrier–channel intermixing and 2DEG degradation in Al-rich Al(Ga)N/AlGaN HEMTs**
P. Pampili[1,2] *B. Modal,[1] J. Mukherjee,[3] V. Z. Zubialevich,[1] K. Cherkaoui[1], P. K. Hurley[1], S. Schulz,[1,4] D. Moran,[3] and P. J. Parbrook[1,2]*
[1]Tyndall National Institute University College Cork, Ireland; [2]School of Engineering, University College Cork, Ireland; [3]James Watt School of Engineering, University of Glasgow, UK; [4]School of Physics, University College Cork, Ireland.

15.15-15.30 ***Effects of TEGa flow rate on the phase-purity of κ-Ga2O3 films on AlGaN substrates in MOCVD***
Khai Ngo[1], Matthew Smith[1], Martin Kuball[1]
[1]University of Bristol

16.00 -16.15 ***Nucleation layer studies of MOVPE-grown zincblende GaN***
Martin Frentrup[1], Menno J Kappers[1], David J. Wallis[2], Rachel A. Oliver[1]
[1]University of Cambridge, [2]Cardiff University

16.15 -16.30 ***Towards Commercial Grade Gallium Oxide Epitaxy on Large Diameter Substrates***
Dr Indraneel Sanyal[1], Mr. Salwan Omar[2], Dr. Ken Tao[1], Dr. Andrew Pakes[1]
[1]Aixtron Ltd, Cambridge; [2]Aixtron Inc, Aachen, Germany

16.30 -16.45 ***Measurement of Ge doping levels in zincblende AlGaN***
Akis Minopetras[1], *Michael Deppe[2], Donat J As[2], Robert W Martin[1]*
[1]Department of Physics, University of Strathclyde, G4 0NG Glasgow, United Kingdom
[2]Department of Physics, University of Paderborn, Warburger Straße 100, 33098 Paderborn, Germany

17.00-18.00 AGM
Quarry Auditorium

19.00 Drinks Reception & Conference Dinner (Sponsored by Aixtron Ltd)
Dinging Hall

Thursday 9th of January 2025

09.00-09.45 Invited Talk- Chair: Rachel Oliver
Quarry Auditorium

Carrier transport and recombination in wide InGaN quantum wells
Prof Dr. Ulrich Schwarz
Technical University Chemnitz, Germany

09.45-10.45 Session 4: Visible and IR Optoelectronics - Chair: Rachel Oliver
Quarry Auditorium

09.45 -10.00 ***Multimodal micro-spectroscopy characterisation of wurtzite InGaN green LEDs***
Kimberly Nicholson[1*], *Raed Alshammary[1], Eve Burgess[1], Chen-Kai Kao[2], Oleg Laboutin[2], Hugues Marchand[2], J. Iwan Davies[3], Sara-Jayne Gillgrass[1], Craig Allford[1] and Naresh Gunasekar [1]*
[1]School of Physics and Astronomy, Cardiff University, Cardiff CF24 3AA, UK ;[2]IQE KC, LLC, 200 John Hancock Road, Taunton, MA 02780, USA; [3]IQE plc, Pascal Close, St. Mellons, Cardiff CF3 0LW, UK

10.00 -10.15 ***Polarisation-resolved cathodoluminescence study of a zincblende InGaN/GaN single quantum well***
Mr Xiuyuan Xu[1], Dr M. Frentrup[1], Dr G. Kusch[1], Dr Z. S. Pehlivan[1], Dr M. J. Kappers[1], Prof D. J. Wallis[1,2], Prof R. A. Oliver[1]
[1]Department of Materials Science and Metallurgy, University Of Cambridge,
[2]Centre for High Frequency Engineering, University of Cardiff

10.15 -10.30 ***Aluminium-Nitride-on-Sapphire Photonic Integrated Circuits Operating in the Telecommunications C-band.***
Mr Davey Davis Armstrong[1], Dr Joseph Cannon[1], Ms Olivia Kiely[1], Mr Husieyn Yagci[1], Prof Anthony Bennett[1]
[1]Cardiff University

10.30 -10.45 ***Simultaneous Data Display and Environment Sensing with a MicroLED Display***
Johnathan Gray[1], Jonathan J D McKendry[1], Robert K Henderson[2], Michael J Strain[1], Martin D Dawson[1], Johannes Herrnsdorf[1]
[1]University of Strathclyde, [2]University of Edinburgh

10.45-11.15 Coffee break (Sponsored by Bruker Nano GmbH)
Quarry Auditorium

11:15-12:15 Session 5: Characterization I - Chair: Peter Parbrook
Quarry Auditorium

11.30 -11.45 ***Luminescence properties of dislocations in α-Ga_2O_3***
M. Maruzane[1], *Y. Oshima[2], O. Makydonska[1], P. Edwards[1], R. W. Martin[1], F. Massabuau[1]*
[1]University of Strathclyde, Glasgow, UK.
[2]National Institute for Material Science, Tsukuba, Japan

11.45 -12.00 ***Deep level traps in as-grown epilayers of (010) β-Ga_2O_3 grown by metal organic chemical vapour deposition on native Sn-doped substrates***
Mr Christopher Dawe[1], Dr Vladimir Markevich[1], Professor Matthew Halsall[1], Dr Ian Hawkins[1], Dr Janet Jacobs[1], Prof Anthony Peaker[1], Mr Arpit Nandi[2], Dr Indraneel Sanyal[2], Prof Martin Kuball[2]
[1]University Of Manchester,[2]University of Bristol

12.00 -12.15 ***Thermal assessment of AlGaN alloys using ns-thermoreflectance***

Mr Leo Norman[1], Zeina Abdallah, James Pomeroy, Gergana Drandova, Jose Jimenez, Andy Xie, Antonio Lucero, Martin Kuball
[1]CDTR, University of Bristol

12.15-12.30 ***Strain and luminescence properties of hexagonal hillocks in N-polar GaN***

Dr Jochen Bruckbauer[1], Grzegorz Cios[2], Andrei Sarua[3], Peng Feng[4], Tao Wang[5], Ben Hourahine[1], Aimo Winkelmann[1,2], Carol Trager-Cowan[1], Robert W. Martin[1]
[1]University Of Strathclyde,[2]AGH University of Krakow, [3]University of Bristol, [4]University of Sheffield, [5]Cardiff University

12:15- 13:00 Flash Presentations for posters

Quarry Auditorium

2 minutes per poster (maximum of a title slide plus two other slides)

13:00- 14:30 Lunch (Sponsored by Carl Zeiss Ltd) & Poster Session

The Diamond

14:30- 15:45 Session 6: Characterization II - Matthew Halsall

Quarry Auditorium

14.30 -14.45 ***Indium segregation at stacking faults in zincblende InGaN epilayers***

Petr Vacek[1], Martin Frentrup[1], Menno Kappers[1], David Wallis[1,2], Rachel Oliver[1]
[1]Department of Materials Science and Metallurgy, University of Cambridge,
[2]Centre for High Frequency Engineering, Cardiff University

14.45 -15.00 ***The FeGa(0/-) acceptor defect level in dilute $Al_xGa_{1-x}N$***

Piotr Kruszewski[1], Jerzy Plesiewicz[1], Sz Grzanka[1], E. Grzanka[1], P. Prystawko[1], Vladimir Markevich[2], Anthony Peaker[2], Lijie Sun[2], Christopher Dawe[2], Iris Liu[3], Jim Speck[3], David Binks[2], Matthew Halsall[2]
[1]Institute of High Pressure Physics, Warsaw, Poland; [2]University of Manchester; [3]The University of California, Santa Barbara, USA

15.00 -15.15 ***A cascade model for the defect-mediated electrochemical etching of porous gallium nitride distributed Bragg reflectors***

Ben Thornley[1], Maruf Sarkar[1], Saptarsi Ghosh[2], Menno Kappers[1], Rachel Oliver[1]
[1]Department of Materials Science and Metallurgy, University Of Cambridge,
[2]Department of Electrical and Electronic Engineering, Swansea University

15.15 -15.30 ***Investigation of (mis-)orientation in zincblende GaN grown on micro-patterned Si(001) using electron backscatter diffraction***

Dale M. Waters[1], Bethany Thompson[1], Gergely Ferenczi[1], Ben Hourahine[1], Grzegorz Cios[2], Aimo Winkelmann[1,2], Christoph J. M. Stark[3], Christian Wetzel[3], Carol Trager-Cowan[1], Jochen Bruckbauer[1]
[1]University Of Strathclyde, [2]AGH University of Krakow, [3]Rensselaer Polytechnic Institute

15.30 -15.45 ***Multimodal micro-spectroscopy for quantifying compositional and phase variations in $(In_xGa_{1-x})_2O_3$ thin films***

Dr Naresh Gunasekar[3], Dr Daniel Hunter[1], Mr Raed Alshammary[3], Dr Paul Edwards[1], Prof. Holger Wenckstern[2], Prof. Marius Grundmann[2], Prof. Robert Martin[1]
[1]Department of Physics SUPA University of Strathclyde, Glasgow, UK,
[2]Felix-Bloch-Institut für Festkörperphysik, Fakultät für Physik und Geowissenschaften, Universität Leipzig, Leipzig, Germany,
[3]Institute for Compound Semiconductors, School of Physics and Astronomy, Cardiff University, Cardiff, UK

15:45-16:00 Closing Remarks & Student Prizes
Quarry Auditorium

16:00 Depart

Posters (9th Jan 2025 13.00-14:30)

The Diamond

1. Influence of Rapid Thermal Annealing on Metal Contacts in Gallium Nitride and Gallium Oxide

*Jonathan Evans[1], Indraneel Sanyal[2], Fasih Khan[1], Ahmed Ben Khaial[1], Finn Monaghan[1], Owen J Guy[1], Mike Jennings[1], **Saptarsi Ghosh[1*]***
[1]Centre for Integrative Semiconductor Materials (CISM), Swansea University, Swansea, United Kingdom
[2]Aixtron Ltd., Buckingway Business Park, Cambridge CB24 4FQ, United Kingdom

2. Microstructural characterisation of InGaN/GaN MQWs on silicon

Raed Alshammary[1], Kimberly Nicholson[1], Chen-Kai Kao[2], Oleg Laboutin[2], Hugues Marchand[2], J. Iwan Davies[3], Naresh Gunasekar[1]*
1School of Physics and Astronomy, Cardiff University, Cardiff CF24 3AA, UK
2IQE KC, LLC, 200 John Hancock Road, Taunton, MA 02780, USA
3IQE plc, Pascal Close, St. Mellons, Cardiff CF3 0LW, UK

3. Evaluating Ohmic Contacts to Si-doped Cubic GaN Epilayers

***Surender Subburaj**[*1], Menno J Kappers[2], Rachel A Oliver[2], and David J Wallis[1,2]*
[1]Centre for High frequency Engineering, Cardiff University, Cardiff, United Kingdom
[2]Dept. of Materials Science and Metallurgy, University of Cambridge, United Kingdom

4. Microanalysis of β-$(Al_xGa_{1-x})_2O_3$ grown by MOCVD

***Mugove Maruzane** [1], Arpit Nandi [2], Sean Douglas [1], Lewis Penman[1], Sai Charan Vanjari [2], Indra Sanyal [2], Matthew Smith [2], Rob Martin [1], Martin Kuball [2], Fabien Massabuau [1]*
1 Department of Physics, SUPA, University of Strathclyde, Glasgow, United Kingdom
2 Center for Device Thermography and Reliability, University of Bristol, Bristol, United Kingdom

5. Applications of GaN HEMTs in Cryogenic Power Electronics

***Matthew Pearce**[1], Charley Shi, Aaron Wadsworth, Francesca Adams, Rachel Oliver, Duleepa Thrimawithana, Rod Badcock*
[1]The University of Auckland, New Zealand

6. COMSOL Multiphysics Modelling of porous gallium nitride distributed Bragg reflectors

***Zetai Xu**, Ben Thornley, Sivaloganathan Kumaran, Rachel Oliver*
University Of Cambridge

7. Defect Characterisation of Nitride Semiconductors for High Power Electronics

***Aisha Mariam**[1], Martin Frentrup[1], Sidra A Dar[1], Menno J Kappers[1], Matthew D Smith[2], Rachel A Oliver[1]*
[1]University Of Cambridge, [2]University of Bristol

8. Elastic properties of wurtzite BN and boron containing III-N alloys: From first principles to semi-empirical models

***Aisling Power**[1,2], Cara-Lena Nies[1], Stefan Schulz[1,2]*
[1]Tyndall National Institute, University College Cork,

[2]*School of Physics, University College Cork*

9. Electrochemical Etching of GaN: Insights into the Role of Etchant pH and Oxalate Anions

Thom Harris-Lee, *Menno Kappers, Rachel Oliver*
University of Cambridge

10. Fabrication and characteristics of Quasi-Vertical GaN-on-Si FinFET

Chengzhi Zhang, *Martin Kuball, Matthew D. Smith*
Center for Device Thermography and Reliability, University of Bristol

11. Modelling of acid etching pathways in porous GaN distributed Bragg reflectors

Piotr Sokolinski, *Ben Thornley, Rachel Oliver*
Department of Materials Science and Metallurgy, University of Cambridge

12. Porous GaN Waveguides: Unlocking New Potential for Hazardous Gas Sensing

Sivaloganathan Kumaran[1,2], *Bogdan Spiridon*[1], *Simon Fairclough*[1], *Saptarsi Ghosh*[1,3], *Jiawei Zhang*[1], *Benjamin Thornley, Thom Harrison-Lee*[1], *Francesca Adams*[1], *Rachel Oliver*[1]
[1]*Cambridge Centre for Gallium Nitride, University of Cambridge,*
[2]*Cavendish Laboratory, University of Cambridge,*
[3]*Centre for Integrative Semiconductor Materials, Department of Electronic and Electrical Engineering, Swansea University*

13. Structure Evolution of Porous GaN with Defect Mediated Etching

Mr Jiawei Zhang[1], *Mr Ben Thornley*[1], *Dr Sidra Dar*[1], *Dr Thom Harris-Lee*[1], *Dr Menno Kappers*[1], *Prof Rachel Oliver*[1]
[1]*University Of Cambridge*

14. Applications of energetic ion beams for semiconductor surface modification and characterization at Surrey Ion Beam Centre

Nianhua Peng
Advanced Technology Institute, University of Surrey