Programme for UKNC Conference 2023

Bristol

5th - 6th January 2023

Code of Conduct

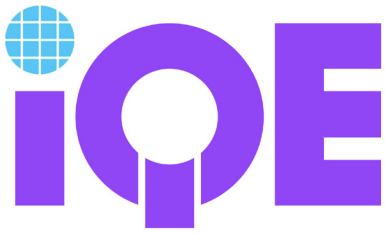
The UKNC winter meeting aims to provide a harassment-free conference experience for everyone, regardless of gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, ethnicity, religion (or lack thereof), or technology choices. We do not tolerate 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 our UKNC committee members.

Prof. Rachel Oliver (email: rao28@cam.ac.uk)
Prof. Rob Martin (email: r.w.martin@strath.ac.uk)

Conference Sponsors:



Conference Venue:

Lecture Theatre 1,

University of Bristol,

Chemistry Building on Cantock's Close,

Bristol

BS8 1TS

Conference Dinner Venue:

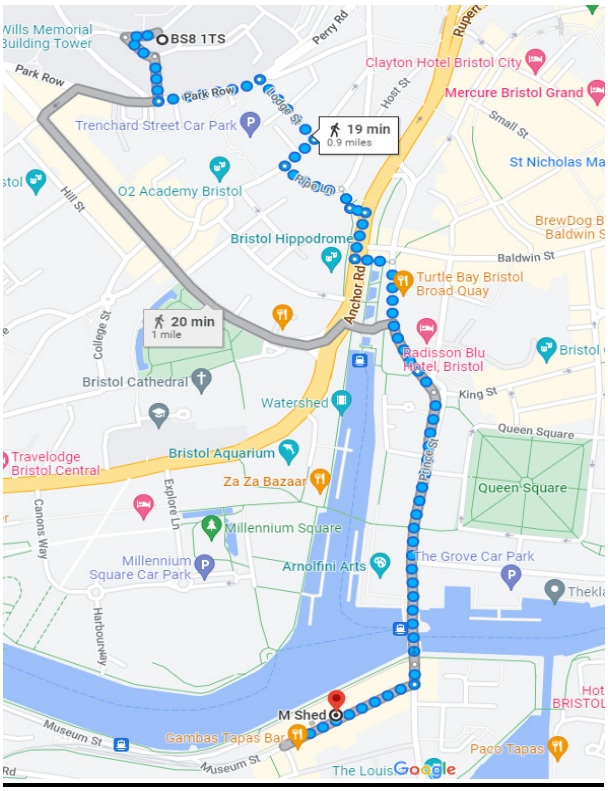
MSHED

Princes Wharf

Wapping Rd

Bristol

BS1 4RN



From conference venue (Chemistry Building) to conference dinner venue (MSHED)

Thursday 5th January 2023

10:30 - 11:00: Arrival/Registration/Coffee

11:00 - 11:15: Opening Remarks

11:15 - 12:00: The Foxon Lecture
Chair: **Rob Martin**

Nitrides and oxides at the nanoscale
Fabien Massabuau
University of Strathclyde, UK

12:00 - 12:15: Session 1: Emerging materials
Chair: **Philip Shields**

12:00 - 12:15 *Metalorganic Chemical Vapour deposition of beta-Ga_2O_3 on Diamond (100) substrates*
Arpit Nandi, **Indraneel Sanyal**, and Martin Kuball
Center for Device Thermography and Reliability, University of Bristol

12:15 - 12:30 *Ultra-high gain deep UV ($Sn_xGa_{1-x})_2O_3$ Schottky photodetectors – the role of deep-level defects*
P. Mukhopadhyay [1], I. Hatipoglu [1], W. V. Schoenfeld [1][2], Joel B. Varley [3], D. Hunter [4], P. R. Edwards [4], R. W. Martin [4] and **Naresh Gunasekar** [4][5]
[1] CREOL, The College of Optics and Photonics, University of Central Florida, 32816, USA
[2] Department of Electrical and Computer Engineering, University of Central Florida, USA
[3] Lawrence Livermore National Laboratory, Livermore, California 94550, USA
[4] Department of Physics, SUPA, University of Strathclyde, Glasgow G4 0NG, UK
[5] School of Physics and Astronomy, Cardiff University, Cardiff CF24 3AA, UK

12:30 - 13:30 Lunch

13:30 - 14:30 Session 2: Electronic Devices
Chair: **David Wallis**

13:30 - 13:45 *Suppression of Negative Buffer Charging in GaN HEMT under High Positive Substrate Bias*
P. Huang [1], M. J. Uren [1], M. D. Smith [1], B. Bakeroot [2][3], A. Vohra [2], S. Decoutere [2], M. Kuball [1]
[1] Centre for Device Thermography and Reliability (CDTR), H. H. Wills Physics Laboratory, University of Bristol, UK
[2] imec, Kapeldreef 75, 3001 Leuven, Belgium.
[3] CMST, imec & Ghent University, Technologiepark 126, 9052 Ghent, Belgium

13:45 - 14:00 *Optimising Electrical Contacts to AlGaN/GaN Heterostructures at Low Temperatures*
Francesca Adams [1], Saptarsi Ghosh [1], Chen Chen [1], Zhida Liang [1], Menno J. Kappers [1], David J. Wallis [1][2], Rachel A. Oliver [1]
[1] University of Cambridge
[2] University of Cardiff

14:00 - 14:15 *Characterization of low temperature grown diamond for integration with GaN HEMTs*
Xiang Zheng [1], James W. Pomeroy [1], Mohamadali Malakoutian [2], Kelly Woo [2], Rohith Soman [2], Anna Kasperovich [2], Srabanti Chowdhury [2], Martin Kuball [1]
[1] Center for Device Thermography and Reliability, University of Bristol, Bristol BS8 1TL, UK
[2] Department of Electrical Engineering, Stanford University, Stanford, CA 94305, USA

14:15 - 14:30 *Fabrication of enhancement-mode (11-22) semi-polar GaN MOSFETs using crystallographic wet etching technique*
Yidi Yin [1], Joseph Pinchbeck [1], Colm O'Regan [2], Ivor Guiney [3], David J. Wallis [3][4], and Kean Boon Lee [1]
[1] Department of Electronic and Electrical Engineering, The University of Sheffield, Sheffield S1 3JD United Kingdom
[2] Department of Material Science and Engineering, The University of Sheffield, Sheffield S3 7HQ United Kingdom
[3] Department of Materials Science and Metallurgy, University of Cambridge, 27 Charles Babbage Road, Cambridge CB3 0FS, United Kingdom
[4] Centre for High Frequency Engineering, University of Cardiff, 5 The Parade, Newport Road, Cardiff CF24 3AA, United Kingdom

14:30 - 15:00 Coffee Break

15:00 - 15:45 The Humphreys Lecture

Chair: **Rachel Oliver**

Nitride-based materials
Huili Grace Xing
Cornell University, US

15:45 - 16:15 Session 3: Electronic devices II

Chair: **Matthew Halsall**

15:45 - 16:00 *A Correlative Microscopy Case Study of GaN HEMT Power IC in a Fast Charger*
Chengliang Huang [1], **Andrew Elliott** [2] Yan Chen [1], Zhiqiang Wang [1], Hong Li [1], Bao Lu [1], Jiang Qiaohong [1], Lance Shen [1]
[1] Carl Zeiss Shanghai Co, Ltd.
[2] Carl Zeiss Ltd.

16:00 - 16:15 *How to optimise the setup of the scanning capacitance microscope for GaN-based high electron mobility transistor structures studies*
Chen Chen [1], Saptarsi Ghosh [1], Francesca Adams [1], Menno J. Kappers [1], David J. Wallis [1][2], and Rachel A. Oliver [1]
[1] Department of Materials Science and Metallurgy, University of Cambridge, Cambridge, UK, CB3 0FS
[2] Centre for High Frequency Engineering, University of Cardiff, Cardiff, UK, CF24 3AA

16:30 - 17:30 AGM (Lecture Theatre 1, Chemistry Building)

From 19:00 Arrival drink and conference dinner
Location:
MSHED
Princes Wharf
Wapping Rd
Bristol
BS1 4RN

Friday 6th January 2023

9:30 - 10:15 **Invited Talk**
Chair: **David Binks**

Cathodoluminescence lifetime spectroscopy for efficient III-nitride LEDs
Gwénolé Jacopin
Institut Néel, France

10:15 - 10:45 **Coffee Break**

10:45 - 11:45 **Session 4: Quantum wells & quantum dots**
Chair: **Fabien Massabuau**

10:45 - 11:00 *Disentangling the impact of defect density and carrier localisation on efficiency droop in InGaN/GaN quantum wells*
R. M. Barrett [1], J. M. McMahon [2] [3], R. Ahumada-Lazo [1], J. A Alanis [1], P Parkinson [1], S. Schulz [2] [3], M. J. Kappers [4], R. A. Oliver [4], D. Binks [1]
[1] Department of Physics & Astronomy, University of Manchester, Manchester, UK,
[2] Department of Physics, University College Cork, Cork, RoI,
[3] Tyndall National Institute, University of Cork, Cork, RoI,
[4] Department of Materials & Metallurgy, University of Cambridge, Cambridge, UK

11:00 -11:15 *Theory of Unconventional Biexcitons in (In,Ga)N/GaN Quantum Dots*
James McCloskey [1][2], Stefan Schulz [1][2]
[1] Tyndall National Institute,
[2] Physics Department UCC

11:15 - 11:30 *Properties of $B_xAl_yGa_{1-x-y}N$/AlGaN multiple quantum wells for ultraviolet emission*
Thomas O'Connor [1][2], Vitaly Z. Zubialevich [1], Praveen Kumar [3], Miryam Arredondo [3], Stefan Schulz [1] [4] and Peter J. Parbrook [1] [2]
[1] Tyndall National Institute, University College Cork, Cork, T12 R5CP, Ireland
[2] School of Engineering, University College Cork, Cork, T12 K8AF, Ireland
[3] School of Mathematics and Physics, Queen's University Belfast, Belfast, BT7 1NN, United Kingdom
[4] Department of Physics, University College Cork, Cork, T12 YN60, Ireland

11:30 - 11:45 *Theoretical study of carrier transport in deep-UV (Al,Ga)N quantum wells*
Robert Finn [1], Michael O'Donovan [1][2], Patricio Farrell [3], Timo Streckenbach [3], Thomas Koprucki [3], Stefan Schulz [1][2]
[1] Tyndall National Institute, University College Cork, Lee Maltings, Dyke Parade, Cork, Ireland
[2] Department of Physics, University College Cork, Cork, T12 YN60, Ireland
[3] Weierstrass Institute (WIAS), Mohrenstr. 39, 10117 Berlin, Germany

11:45 - 12:30 Poster Session

12:30 - 13:30 Lunch

13:30 - 14:30 Session 5: Optical Devices
Chair: **Peter Parbrook**

13:30 - 13:45 *Investigation of deep etch ridge waveguide InGaN/GaN laser diodes*
Abhinandan Hazarika [1], Muhammet Genc [2], Brian Corbett [3], Zhi Li [4]
[1] Tyndall National Institute, University College Cork
[2] Tyndall National Institute, University College Cork
[3] Tyndall National Institute, University College Cork
[4] Tyndall National Institute, University College Cork

13:45 - 14:00 *MicroLED Display Integration on 300mm Advanced CMOS Platform: A path towards Augmented Reality products*
Emmanuel Le Boulbar [1], Soeren Steudel [1], Johan Vertommen [1], Giuseppe Buscemi [1], Lars Bach [1], Stefaan Van Huylenbroeck [2], Hariharan Arumugam [2], Douglas Charles La Tulipe [2], Joeri De Vos [2], Andy Miller [2], Haris Osman [2], Kenneth June Rebibis [2]
[1] MICLEDI Microdisplay BV, Sluisstraat 79, 3000 Leuven, Belgium
[2] imec, Kapeldreef 75, 3001 Leuven, Belgium

14:00 - 14:15 *The effects of device size on DUV LED-based optical wireless communications*
Jordan Hill [1], Cheng Chen [2], Enyuan Xie [1], Johannes Herrnsdorf [2], Erdan Gu [1], Harald Haas [2], Martin D Dawson [1]
[1] Institute of Photonics, University of Strathclyde,
[2] Lifi Research and Development Centre, University of Strathclyde

14:15 - 14:30 *A detected rate of nearly one million photons per second from a red colour centre in aluminium nitride*
J.K.Cannon [1][2], S.G.Bishop [1][2], H.B.Ya ̆gcı [1][2], R.N.Clark [1][2], J.P.Hadden [1][2], A.J. Bennett [1][2]
[1] School of Engineering, Cardiff University, Queen's Buildings, The Parade, Cardiff, UK, CF24 3AA
[2] Translational Research Hub, Cardiff University, Maindy Road, Cathays, Cardiff, UK, CF24 4HQ

14:30 - 14:40 Closing Remarks & Student Prizes

14:40 - 15:00 Coffee

Posters (6th Jan 2023 11:45-12:30)

1. *Carbons Doping Concentration and Charge transport in the Buffer Layers of GaN on Si HEMTs*
   Upeksha De Silva, Kean Boon Lee
   University of Sheffield

2. *Defects with Deep Levels in As-grown and Electron-irradiated n-type GaN Layers grown on Ammono-GaN Substrates*
   L.J. Sun [1], V.P. Markevich [1], D. Binks [2], M.P. Halsall [1], I.F. Crowe [1], A.R. Peaker [1], A. Kedziora [2], P. Kruszewski [3], J. Plesiewicz [3], P. Prystawko [3], S. Bulka [4]
   [1] Photon Science Institute and Department of Electrical and Electronic Engineering, The University of Manchester, Manchester M13 9PL, United Kingdom
   [2] Department of Physics & Astronomy, University of Manchester, Manchester, UK
   [3] Institute of High Pressure Physics, Polish Academy of Sciences, Sokolowska 29/37, 01-142 Warsaw, Poland
   [4] Institute of Nuclear Chemistry and Technology, Dorodna 16, 03-195 Warsaw, Poland

3. *Identifying Ga2O3 polymorphs by electron backscatter diffraction*
   M. S. Williams [1], I. Hatipoglu [2], P. Mukhopadhyay [2], W. V. Schoenfeld [2][3], S. Shanthi [4], D. Krishnamurthy [5], K. Sasaki [5], A. Kuramata [5], R. W. Martin [6] and **G. Naresh-Kumar** [1][6]
   [1] Department of Physics, SUPA, University of Strathclyde, Glasgow G4 0NG, UK
   [2] CREOL, The College of Optics and Photonics, University of Central Florida, 32816, USA
   [3] Department of Electrical and Computer Engineering, University of Central Florida, USA
   [4] Crystal growth centre, Anna University, 600 0025, India
   [5] Novel Crystal Technology, Hirosedai, Saitama prefecture, Saitama city, 350-1328, Japan
   [6] School of Physics and Astronomy, Cardiff University, Cardiff CF24 3AA, UK

4. *Low temperature cathodoluminescence study of a cubic zincblende InGaN/GaN single quantum well structure*
   A. Gundimeda [1], **G. Kusch** [1], M. Frentrup [1], M. J. Kappers [1], D. J. Wallis [1][2] and R. Oliver [1]
   [1] Department of Materials Science and Metallurgy, University of Cambridge, United Kingdom
   [2] Centre for High Frequency Engineering, University of Cardiff, United Kingdom

5. *Single-Photon Communications with a 128 x 128 Micro-LED Array*
   Johnathan Gray, Jonathan McKendry, Michael Strain, Martin Dawson, Johannes Herrnsdorf
   Institute of Photonics, Department of Physics, University of Strathclyde, Glasgow

6. *Sub-Surface Back-Scattered Electron Imaging of Porous Gallium Nitride*
   Maruf Sarkar [1], Francesca Adams [1], Sidra Abbas [1], Saptarsi Ghosh [1], Jordan Penn [2], Tongtong Zhu [3], Chaowang Liu [4], Hasan Hirshy [4], Menno J. Kappers [1], Gunnar Kusch [1], & Rachel A. Oliver [1]
   [1] Department of Materials Science and Metallurgy, University of Cambridge, Cambridge, UK
   [2] Department of Physics, University of Oxford, Oxford, UK
   [3] Porotech, Cambridge, UK
   [4] IQE, Cardiff, UK