SUSSP81 Summer School in Photonic Sensing and Metrology for the United Nations Sustainable Development Goals

SUSSP81 DRAFT HANDBOOK

7th-15th June 2025
University of Stirling

PLEASE NOTE THIS IS A DRAFT WHICH IS SUBJECT TO CHANGE

CENTRE FOR DOCTORAL TRAINING IN APPLIED PHOTONICS
Use-Inspired Photonic Sensing and Metrology

OPTICA

SUSSP
SCOTTISH UNIVERSITIES SUMMER SCHOOL IN PHYSICS

University of St Andrews · The University of Edinburgh · University of Dundee · University of Glasgow · Heriot Watt University · University of Huddersfield, Inspiring global professionals · NPL National Physical Laboratory · University of Strathclyde Glasgow · UKRI Engineering and Physical Sciences Research Council

Welcome

Welcome to the programme of the SUSSP81 International Summer School in Photonic Sensing and Metrology for the United Nations Sustainable Development Goals.

The Centre for Doctoral Training in Applied Photonics is delighted to be hosting our summer school at the University of Stirling for the first time.

We are grateful to our sponsors SUSSP and Optica for supporting this event.

Throughout the week you will hear a series of three lectures from each of our six esteemed technical speakers, aligning with our topical theme of the United Nations sustainable development goals.

To complement the technical programme, we are offering a range of developmental workshops and career-oriented talks from CDT alumni, Optica, Technology Scotland, the Royal Academy of Engineering, and Heriot-Watt University.

We have a busy social programme, and our new location, Stirling, allows us to offer new opportunities for excursions and sightseeing which we hope you will enjoy.

Delegates will have the opportunity to present their posters at two dedicated sessions.

In 2023 we introduced a very successful photonics hackathon to the summer school programme, and this year we will run a half-day photonics hackathon, giving opportunities for teamwork, knowledge sharing, problem solving and hopefully some fun.

We hope SUSSP81 will be an enjoyable and memorable experience for everyone, and we look forward to welcoming you to Stirling this June.

Louise Exton

SUSSP81 Director

Contents

Programme

Programme at a glance

Arrival day - Saturday 7th June: check-in from 15:00 (unless otherwise arranged), dinner at 18:00, and welcome event at 19:30 in Refresh, ground floor, Willow Court.

Departure day - Sunday 15th June: breakfast is available from 7:30-9:00, check-out by 10:00 (unless otherwise arranged).

	Sunday 8/6/25	Monday 9/6/25	Tuesday 10/6/25	Wednesday 11/6/15	Thursday 12/6/25	Friday 13/6/25	Saturday 14/6/25
7.30-8.50	Breakfast						
9.00-10.00	Damien Weidmann	Sarah Bohndiek	Greg Rieker	Excursions / leisure day	Stephanie Loeb	Sarah Bohndiek	Justus Ndukaife
10.00-11.00	Stephanie Loeb	Damien Weidmann	Sarah Bohndiek		Justus Ndukaife	Jian Jin	Greg Rieker
11.00-11.30	Break	Break	Break		Break	Break	Break
11.30-12.30	Yann Amouroux	Leonardo Del Bino, Natalie Flaherty, Adam Sroka	Sarah Bohndiek		Jennifer MacDonald	Greg Rieker	Jian Jin
12.30-13.50	Lunch There will be a group photograph before lunch on 9/6/25 A packed lunch will be provided on 11/6/25 – please collect this at breakfast on 11/6/25						
14.00-15.00	Alison McLeod	Poster session, including afternoon tea/coffee break	Damien Weidmann	Excursions / leisure day	Hackathon and pizza evening	Justus Ndukaife	Farnaz Mohsenpour
15.00-16.00	Martin Lavery, Derryck Reid, Gordon Robb		Stephanie Loeb			Poster session, including afternoon tea/coffee break	TBC
16.00-16.30	Break		Break				Break
16.30-17.30	Martin Lavery, Derryck Reid, Gordon Robb		Jian Jin				Bill MacPherson
18.00-19.00	Dinner	Dinner		Dinner		Dinner	Dinner
From 19.30	Quiz night	Sports / board games night	Formal dinner	Free evening		Movie night	Ceilidh

Lecture and poster locations

All lectures and talks will take place in Lecture Theatre A3, Floor 2, Cottrell Building unless otherwise stated.

Poster presentations on Monday 9th and Friday 13th June will take place on Level 3, Campus Central.

Saturday 7th June

From 15:00	Arrival at University of Stirling campus and accommodation check-in at Willow Court
18:00-19:00	Dinner
19:30-21:00	Welcome Event and Icebreaker, Refresh at Willow Court

Sunday 8th June

07:30-08:50	Breakfast
09:00-10:00	**Lecture: Spectroscopic sensing of atmospheric composition** Damien Weidmann, RAL Space Spectroscopy
10:00-11:00	**Lecture: Light driven processes in environmental engineering** Stephanie Loeb, McGill University
11:00-11:30	Morning tea and coffee break
11:30-12:30	**Optica and the role of scientific societies** Yann Amouroux, Optica
12:30-13:50	Lunch
14:00-15:00	**Photonics in Scotland: a great career opportunity** Alison McLeod, Technology Scotland
15:00-16:00	**Publishing workshop** Yann Amouroux, Optica, Martin Lavery, University of Glasgow, Derryck Reid, Heriot-Watt University, Gordon Robb, University of Strathclyde
16:00-16:30	Afternoon tea and coffee break
16:30-17:30	**Publishing workshop** Yann Amouroux, Optica, Martin Lavery, University of Glasgow, Derryck Reid, Heriot-Watt University, Gordon Robb, University of Strathclyde
18:00-19:00	Dinner
19:30-21:00	Quiz night, Refresh at Willow Court

Monday 9th June

07:30-08:50	Breakfast
09:00-10:00	**Lecture: Optics and photonics in early cancer detection** Sarah Bohndiek, University of Cambridge
10:00-11:00	**Lecture: Greenhouse gas emission monitoring at facility scale** Damien Weidmann, RAL Space Spectroscopy
11:00-11:30	Morning tea and coffee break
11:30-12:30	**CDT in Applied Photonics alumni journeys and panel discussion** Leonardo Del Bino, Akhetonics, Natalie Flaherty, Thales, and Adam Sroka, Hypercube
12:30-13:00	Group photo
13:00-13:50	Lunch
14:00-16:00	**Poster presentations** Campus Central, Level 3
16:00-16:30	Afternoon tea and coffee break
16:30-17:30	**Poster presentations** Campus Central, Level 3
18:00-19:00	Dinner
19:30-21:00	**Sports night**, large sports hall, campus sports centre OR **board games night**, Refresh at Willow Court

Tuesday 10th June

07:30-08:50	Breakfast
09:00-10:00	**Lecture: Striking a molecular chord – an introduction to quantitative absorption spectroscopy** Greg Rieker, University of Colorado Boulder
10:00-11:00	**Lecture: Augmenting the vision of the endoscopist** Sarah Bohndiek, University of Cambridge
11:00-11.30	Morning tea and coffee break
11:30-12.30	**Seizing opportunities in multidisciplinary careers** Sarah Bohndiek, Aria
12:30-13:50	Lunch
14:00-15:00	**Lecture: Greenhouse gas emission monitoring at facility scale** Damien Weidmann, RAL Space Spectroscopy
15:00-16:00	**Lecture: Photonics enabled technologies for water treatment** Stephanie Loeb, McGill University
16:00-16:30	Afternoon tea and coffee break
16:30-17:30	**Lecture: Plant phenotyping facilities** Jian Jin, Purdue University
18:30-19:30	Welcome drinks and canapes Stirling Highland Hotel, Spittal Street, Stirling FK8 1DU **Please make your own way to the Stirling Highland Hotel (using Unilink bus service, followed by a short walk)**
18:30-19:30	Observatory tours (3 x 20-minute tours, restricted numbers) There will be paper sign-up sheets available during the day on 10/6/25 for those who wish to join an observatory tour.
19:30-22:00	Formal dinner Stirling Highland Hotel, Spittal Street, Stirling FK8 1DU

Wednesday 11th June

07:30-08:50	Breakfast
09:00 sharp	Coach departs University of Stirling for Pitlochry: Pickup location The journey to Pitlochry will take 60-90 minutes depending on traffic. The coach will arrive at and depart from Pitlochry train station. There will be a range of leisure activities available in Pitlochry; and you will also have the opportunity to go off and do your own thing. **NB: if participating in water-based activities on Loch Faskally you should be mindful of your abilities in the water, be prepared to get wet and please ensure you bring your own towel and swimwear (or suitable clothing and footwear). Buoyancy aids will be provided.** If remaining in Stirling, you have the option to visit Stirling Castle or do your own thing. Lunch is provided in the form of a packed lunch from University of Stirling which you should collect at breakfast on the day.
17:00	Coach returns to University of Stirling campus
18:00-19:00	Dinner
From 19:00	Free evening

Thursday 12th June

07:30-08:50	Breakfast
09:00-10:00	**Lecture: Colorimetric and optical detection of environmental contaminants** Stephanie Loeb, McGill University
10:00-11:00	**Lecture: Introduction to optical nanotweezers and latest developments** Justus Ndukaife, Vanderbilt University
11:00-11:30	Morning tea and coffee break
11:30-12:30	**Inclusive environments in engineering** Jennifer MacDonald, Royal Academy of Engineering
12:30-13:50	Lunch
14:00-18:00	**Hackathon**
From 18:00	Pizza/informal dinner

Friday 13th June

07:30-08:50	Breakfast
09:00-10:00	**Lecture: Overcoming skin tone associated measurement bias** Sarah Bohndiek, University of Cambridge
10:00-11:00	**Lecture: Leading edge plant sensor innovations and their applications** Jian Jin, Purdue University
11:00-11:30	Morning tea and coffee break
11:30-12:30	**Lecture: Success through adaptability – absorption spectroscopy approaches for environmental applications** Greg Rieker, University of Colorado Boulder
12:30-13:50	Lunch
14:00-15:00	**Lecture: Single bio-particle analysis using optical nanotweezers** Justus Ndukaife, Vanderbilt University
15:00-16:00	**Poster presentations** Campus Central, Level 3
16:00-16:30	Afternoon tea and coffee break
16:30-17:30	**Poster presentations** Campus Central, Level 3
18:00-19:00	Dinner
19:30-21:00	Movie night – Interstellar, MacRobert Arts Centre, University of Stirling campus

Saturday 14th June

07:30-08:50	Breakfast
09:00-10:00	**Lecture: Nanoplastics characterization with optical nanotweezers** Justus Ndukaife, Vanderbilt University
10:00-11:00	**Lecture: Have 100,000 lasers, will travel – how frequency comb lasers are helping to understand and reduce harmful emissions** Greg Rieker, University of Colorado Boulder
11:00-11:30	Morning tea and coffee break
11:30-12:30	**Building a culture of inclusion in engineering: my career journey as an ED&I enthusiast** Farnaz Mohsenpour, Heriot-Watt University
12:30-13:50	Lunch
14:00-15:00	**Lecture: Future of digital agriculture** Jian Jin, Purdue University
15:00-16:00	TBC
16:00-16:30	Afternoon tea and coffee break
16:30-17:30	**Prize giving and closing remarks** Bill MacPherson, Director, CDT in Applied Photonics Euan Martin, CDT Cross-Cohort Student Representative
18:00-19:00	Dinner
19:30-23:00	Ceilidh (traditional Scottish dance) Bridge of Allan parish church hall, 12 Kier Street, FK9 4NW **Please make your own way to the Bridge of Allan parish church hall (a 20 minute walk from the University of Stirling campus)**

Sunday 15th June

07:30-08:50	Breakfast
By 10:00	Check out of campus accommodation (unless otherwise arranged)

Technical speakers

Sarah Bohndiek

University of Cambridge/ARIA

Tackling healthcare inequities in early cancer detection

Multispectral imaging represents a new frontier in medical physics that enhances colour vision and enables measurement of local concentrations of key biomarkers. For example, the distinct spectral properties of oxy- and deoxy-haemoglobin can be exploited to infer local blood concentration and oxygenation. The dynamic cellular ecosystem of a growing tumour mass requires a vascular network to obtain oxygen and nutrients, leading to marked changes in vascular structures during the early evolution of cancer that can be exploited for disease detection.

In the first lecture, I will introduce the challenges encountered in improving early cancer detection (linked to SDG3), through the lens of a physicist developing hardware solutions. I will then discuss the potential for photonic sensing and metrology to improve access to cancer care and introduce multispectral imaging as an exciting technology solution in that context. In the second and third lectures, I will introduce two key case studies from my team that demonstrate how to move new technologies along the clinical translational pathway for equitable patient benefit. I will first highlight opportunities to tackle challenges associated with clinical expertise in spotting the earliest signs of cancer in the gastrointestinal tract. I will then highlight the need to overcome biases associated with skin pigmentation in optical devices and approaches to tackle this in cancer diagnostics and more generally.

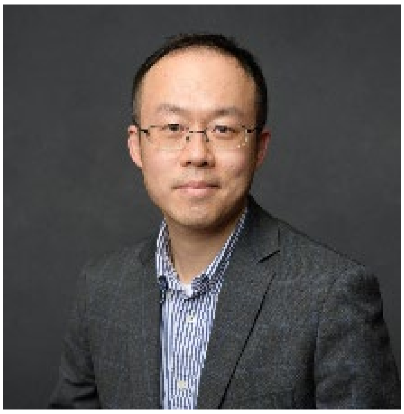
Biography

Sarah Bohndiek is a Professor of Biomedical Physics at the University of Cambridge and has built her team with a focus on pushing the boundaries of optical imaging technology to address the major unmet clinical need for earlier cancer detection. Her team work closely with clinicians enabling first-in-human clinical trials of new technologies emerging from their team. Sarah was elected Fellow of the international optics and photonics society SPIE in 2020 and starting in 2025 will be a co-Director of the OASIS Research and Partnerships Hub, bringing optical and acoustic technologies into the clinic for diagnostic and surgical interventions.

Pivoting from her background in healthcare, Sarah is currently on secondment as a Programme Director with the UK's Advanced Research + Invention Agency, where she co-leads an Opportunity Space on "Scoping our Planet", harnessing the power of photonics for climate monitoring, and is running a programme on creating an early warning system for forecasting climate tipping points.

Jian Jin

Purdue University



Advanced plant phenotyping technologies in digital agriculture

Plant phenotyping technologies have been developing rapidly over the last 2 decades. Plant sensors are becoming more accurate, faster, and easier to use. However, there are still bottleneck issues, including the changing environmental conditions, the plant's diurnal activities, and the complicated G(Genotype) x T(Treatment) x E(Environment) interactions. These issues keep plant phenotyping difficult and limit further application of the sensor technologies in precision agriculture. The plant sensor developers have been working innovatively to develop the next generation sensor technologies to address these issues. In this summer, Dr. Jin will firstly introduce the plant phenotyping facilities and explain why they were built and how they've been successfully used in detecting diseases, nutrients deficiencies, and chemical damages. He will then introduce the most recent plant sensor technologies, such as the 2021 Davidson Prize winner, LeafSpec, a handheld microscope for disease detection, a smartphone-based leaf scanner, and AI technologies for detecting nutrient deficiency and diseases at an earlier time point.

Biography

Dr. Jian Jin is an associate professor from the Department of Agricultural and Biological Engineering at Purdue University. Dr. Jin received his Ph.D. in Agricultural Engineering from Iowa State University in 2009. He earned his M.S. degree in Computer Engineering from Denmark Technical University in 2005 and his B.S. degree in Computer Science from Zhejiang University in 2003. Prior to joining Purdue, Dr. Jin conducted research at DuPont Pioneer (now Corteva). Dr. Jin's major research interest at Purdue is to develop the next generation plant sensor technologies. Dr. Jin is the president and founder of LeafSpec LLC.

Stephanie Loeb

McGill University

Photonics-enabled technologies for water treatment and contaminant detection

Light is both a ubiquitous energy source in the form of solar radiation, and able to transmit at the fastest known speeds. These advantageous properties lead to numerous potential applications for optics, photonics, and photocatalytic materials in environmental engineering. Harnessing solar energy for water treatment is a highly desirable approach to provide safe water in resource limited locations. Current materials tend to have relatively wide bandgaps which are not ideal for solar applications. Nanomaterials exhibiting surface plasmon resonance (SPR) can act as light antennae due to their large absorption cross-sections, creating an opportunity to couple small SPR nanoparticles with photocatalytic semi-conductors to enhance photocatalysis. Likewise, due to their vibrant colours and sensitivity to the local environment, SPR materials have potential applications as colourimetric sensors for the detection of environmental contaminants. SPR, or other optical fluorescent based, sensors are advantageous as they may require no consumable reagents, have a negligible per sample cost, and provide near instantaneous results. A leading-edge approach to contaminant detection in environmental samples, rapid small-scale sensors could improve the ability of researchers to monitor pollutant loading while providing higher quality data with greater spatial and temporal resolution.

Biography

Professor Loeb is currently a Professor in Civil Engineering at McGill University, receiving her PhD in Chemical and Environmental Engineering from Yale University. Her research efforts span the intersection of materials science and environmental engineering, with particular focus on the removal of chemical and biological contaminants in water using sunlight, engineered light sources, and light-activated nanomaterials. Her recent research has aimed to characterize how sunlight inactivates challenging viruses in the environment. She is also interested in the fabrication and design of novel light-activated nanomaterials for sustainable water disinfection and developing improved methods for detecting and quantifying pathogens in the environment.

Justus Ndukaife
Vanderbilt University

Next generation optical nanotweezers for health and environment

The 2018 Physics Nobel Prize recognized optical tweezers for their transformative applications in understanding biological systems. Over the years, optical tweezers have enabled non-invasive trapping, manipulation, and study of biological systems. However, due to the diffraction limit of light, traditional optical tweezers struggle to stably trap nanoscale objects such as nanosized extracellular vesicles and nanoplastics. Recent advancements have led to the development of optical nanotweezers, leveraging diverse physical phenomena, including plasmon resonance, Mie resonance, and optically induced electrohydrodynamics, to overcome this limitation. In these lectures, I will provide an overview of the latest innovations in optical nanotweezer technology and their applications in nanoscale extracellular vesicles, single-molecule studies, and nanoplastics characterization. I will introduce next-generation optical nanotweezers with dramatically enhanced throughput, capable of trapping thousands of individual nanoscale objects within seconds. These advanced optical nanotweezer systems not only enable stable trapping but also facilitate precise characterization of size, shape, and composition of the trapped specimens. The multifunctional, non-invasive nature of these new nanotweezer platforms is expected to unlock new frontiers in understanding extracellular vesicle heterogeneity and drive translational applications in areas such as novel therapeutics, liquid biopsy, and environmental monitoring.

Biography

Prof. Justus Ndukaife is a distinguished researcher, educator, and innovator in Optics and Nanophotonics, with a particular focus on optical nanotweezers. He earned his Ph.D. in Electrical and Computer Engineering from Purdue University, USA. His research explores advanced nanophotonics technologies, including plasmonics, dielectric nanoantennas, and metasurfaces, to develop cutting-edge solutions for single extracellular vesicle analysis, environmental sensing, and enhancing on-chip quantum light sources. Prof. Ndukaife has published impactful research in leading journals such as Nature Nanotechnology, Physical Review Letters, Nature Communications, and ACS Nano. He also holds seven U.S. patents, reflecting his commitment to innovation in nanotechnology. His outstanding contributions have earned him numerous prestigious awards, including the NIH MIRA R35 Outstanding Investigator Award, Office of Naval Research Young Investigator Program (YIP) Award, NSF CAREER Award, Optica Challenge Prize, and the Ivan P. Kaminow Outstanding Early Career Professional Prize, among others.

Greg Rieker

University of Colorado Boulder

Energy and environmental system monitoring via laser-based absorption spectroscopy

Lasers emit pure optical frequencies that enable measurements of light-matter interaction at high accuracy, precision, and stability. In particular, infrared laser absorption by molecular species in the atmosphere, energy, and bio-energy systems can quantitatively determine the state of the system under study. This is useful for a broad range of research and interventions in these systems by enabling the detection, quantification, and localization of molecular species over time. My lecture series will introduce quantitative absorption spectroscopy and discuss its application across a variety of energy and environmental applications. I will conclude with emerging techniques in absorption spectroscopy, including the use of Nobel prize winning frequency comb lasers to study and actively reduce greenhouse gas emissions from energy infrastructure.

Biography

Greg Rieker is a Professor and Vogel Family Faculty Fellow in Mechanical Engineering at the University of Colorado Boulder. He leads the Precision Laser Diagnostics Laboratory, which aims to understand and improve energy, industrial, and atmospheric systems through laser-based sensing. In particular, the laboratory has spent a decade adapting Nobel prize winning frequency comb laser technology into robust sensors to address emerging challenges, including detecting methane emissions across hundreds of square miles of oil and gas infrastructure, designing hypersonic propulsion systems, and exploring exoplanet atmospheres. Greg earned a BS from the Missouri University of Science and Technology, and MS and PhD degrees from Stanford University. He has affiliations with the National Renewable Energy Laboratory and the National Institute of Standards and Technology. Greg received the NSF CAREER award, the Peter Werle and Hiroshi Tsuji Early Career Scientist Awards, and the Colorado Governor's Award for High-impact Research. He is a senior member of the National Academy of Inventors, and co-founder and CTO of LongPath Technologies, Inc.

Damien Weidmann

Rutherford Appleton Lab

Photonics is in the air: spectroscopic sensing of the atmosphere

Global change, and its implications, are driven by changes in atmospheric composition. Being the dumping of greenhouse gases into the atmosphere contributing to warming, or release of polluting chemicals degrading air quality, knowing what is injected into the atmosphere and what it becomes is imperative to understand the impact and the fate of a changing atmosphere. And possibly to mitigate and adapt. High resolution spectroscopy describes the interaction of light with molecules in diluted medium, such as the atmosphere. This is the tool of choice for accurate detection, identification, and quantification of atmospheric constituents. As light is involved, photonics plays a critical role in the development of high-performance spectroscopic sensors enabling high quality, ubiquitous monitoring of the atmosphere. These sensors are the sources generating data flows into digital systems that, in turns, produce knowledge and actionable outputs. Over the lectures we will establish the need for, and fundamental principles behind, accurate spectroscopic sensing of the atmosphere. Through two practical examples, the transformative value of photonics-based spectroscopic sensing will be highlighted and presented, as well as where they fit within the overall architecture of an atmospheric measurement system.

Biography

Damien Weidmann heads the Spectroscopy programme of the Space Science and Technology Department of the STFC Rutherford Appleton Laboratory (aka RAL Space). He has been conducting research and development for more than 30 years in molecular spectroscopy and atmospheric sensing, in France, the USA and the UK. He has a particular interest in the development and application of novel high resolution sensing concepts enabled by spectroscopy, covering technologies, algorithms, systems, and mission concepts. DW is also co-founder and chief scientific officer of MIRICO Ltd, a company exploiting high-precision gas sensing for terrestrial applications.

Other speakers

Yann Amouroux

Director Europe, Optica

Biography

Yann Amouroux has been an employee of Optica since July 2018. Their headquarters are in Washington, DC (USA), although he usually works from home in Bristol (UK) if he is not on the road. For the last 20+ years, he has worked for other Societies, such as the Institute of Engineering and Technology (IET), and before that, for many years at the Institute of Physics (IOP). His responsibilities are to represent Optica in the Optics and photonics community in Europe and meet with students, academics, government agencies, and industry professionals in the UK and in numerous European countries.

Leonardo Del Bino

CTO and Co-founder, Akhetonics

Biography

Co-founder and the scientist in Akhetonics. I have been immersed in the world of lasers for my whole career, spanning over 15 years. I started designing lasers to trap ultracold atoms for quantum simulators for my bachelor's and master's at the University of Florence (Italy). My exploration continued, studying all-optical logic gates and memories in my EngD with the CDTAP and postdoc at the National Physical Laboratory and the Max Plank Institute for the Science of Light (Germany). Now, I decided to bring all this knowledge into a ground-breaking company to revolutionize the field of computing.

Natalie Flaherty

Lead Algorithms Engineer, Thales

Biography

Natalie Flaherty is a Lead Algorithms Engineer at Thales Glasgow. She is a chartered mathematician with 17 years of experience in image processing and analysis for defence applications gained at both Thales and Dstl. She completed her Engineering Doctorate in multi-sensor information fusion in 2023 which was sponsored by Thales UK through Heriot-Watt University. She holds a BSc(Hons) degree in Mathematics and Computer Science from the University of Strathclyde and a Masters in Computational Software Techniques in Engineering from Cranfield University. Natalie was previously employed as a Senior Mathematician at Dstl for 10 years.

Martin Lavery

Professor, University of Glasgow

Biography

Prof Lavery is a professor and leader of the Structured Photonics Research Group at the University of Glasgow. His dynamic research group has a track record in investigating fundamental developments in physics and successfully applying them to industry inspired engineering challenges. Since joining the School of Engineering in September 2014, he has successfully attracted over £5m in research funding as Principal Investigator (PI) and is coordinator of the H2020 Future and Emerging Technologies (FET-Open) consortium project named SuperPixels. He has been recognised as a leader in the academic community, having been awarded the 2013 Scopus Young Scientist of the Year for Physical Sciences. In 2018, he became the Mobile World Scholar Gold Medal winner for his accomplishments in high dimensional optical communications. For his contributions to the field of optics he was further awarded the 2019 Royal Academy of Edinburgh Sir Thomas Makdougall Brisbane Medal. He has led a team of world-leading researchers to develop a road map for deploying highspeed network provision for developing countries (Lavery et. al, N. Photon. 12(5), 249-252, 2018) supported by the EPSRC Global Challenges Research Fund.

Jennifer MacDonald

Interim Head of Diversity and Inclusion, Royal Academy of Engineering

Biography

Jennifer MacDonald is a dedicated diversity and inclusion professional and engineer with experience in driving equitable change and developing inclusive STEM initiatives. As the Interim Head of Diversity and Inclusion at the Royal Academy of Engineering she leads the Academy's D&I aim to catalyse a step change in the diversity of the workplace and the prevalence of inclusive cultures across engineering industry. A frequent speaker and advisor, Jennifer continues to champion intersectional inclusion, ensuring all voices are heard and valued in the spaces she helps shape.

Alison McLeod

Director, Photonics Scotland/Technology Scotland

Biography

Alison has more than 20 years of experience working in academic, industrial and consultancy roles. After achieving her PhD in Photonics, she worked as a Research Associate before leaving academia and joining industry in the role of technical sales/account manager in the health physics and photonics sectors. She then moved to a role dedicated to project management and proposal writing for EU funded projects, gaining extensive experience across a wide variety of research topics. In her current role Alison is Director of the Photonics Scotland network at Technology Scotland, a community for all photonics and photonics-enabled organisations in Scotland.

Farnaz Mohsenpour

AED Equality, Diversity and Inclusion, Heriot-Watt University

Biography

Dr Farnaz Mohsenpour is a Chemical Engineering academic at the School of Engineering & Physical Sciences at Heriot-Watt University, where she also serves as the Assistant Executive Dean for Equality, Diversity, and Inclusion (EDI). In this role, she leads the School's EDI strategy and action plan, aligning with the University's Equality Outcomes. Dr Mohsenpour was previously the Head of the Chemical & Process Engineering discipline at Heriot-Watt. She holds a PhD and MSc in Chemical Engineering from Heriot-Watt University and a BEng in Chemical Engineering from Tehran Azad University, Science and Research Branch, Tehran, Iran.

Gordon Robb

Lecturer, University of Strathclyde

Biography

I am a Senior Lecturer in the Department of Physics at the University of Strathclyde. My research interests involve theoretical studies of light-matter interactions. I have been an Associate Editor for Optics Express since 2019.

Adam Sroka

CEO, Hypercube

Biography

Dr Adam Sroka is a Co-founder and CEO at Hypercube Consulting, a firm that helps organisations unlock value from data by delivering enterprise-scale solutions and building high-performing data and analytics teams from the ground up. With over 10 years of experience in data science, machine learning, and artificial intelligence, Adam is a recognised expert and speaker in his field.

Adam's mission is to bridge the gap between technology and business, and to enable data-driven innovation and transformation across various industries. He shares his insights and best practices through his blog, podcast, and tech community events, where he showcases his approaches and systems for effective communication, engineering discipline, and experimentation. Adam is passionate about helping organisations and data professionals maximise their potential and impact with data and AI.

CDT in Applied Photonics Executive

Bill MacPherson

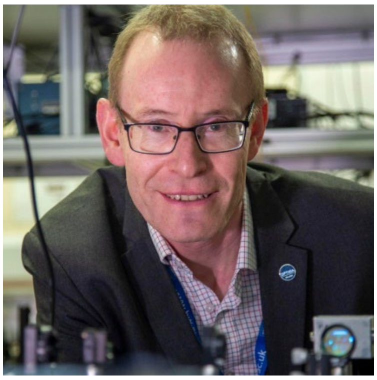
Director

Biography

Bill is a member of the Applied Optics and Photonics research group in the School of Engineering and Physical Sciences at Heriot-Watt University. His research interests are centred around the application of optical and fibre-optic techniques for measurement and instrumentation. This work includes high bandwidth temperature and pressure sensors for aerodynamic measurements, novel fibres for structural monitoring, vibration and acceleration measurement, and studies into potential sensing applications of novel microstructured fibres. Recent work includes monitoring in remote environments, including sub-sea hydrodynamic flow measurement. Current projects include biomedical applications of optical fibre sensors, and condition monitoring in harsh environments.

Derryck Reid

Deputy Director



Biography

I'm an academic specializing in photonics, specifically experiment-led ultrafast laser sources in the context of spectroscopy, metrology, and microscopy.

Gordon Flockhart

Deputy Director

Biography

Gordon M. H. Flockhart graduated with MPhys degree in Optoelectronics and Laser Engineering and a PhD degree in Physics from Heriot-Watt University, Edinburgh, UK, in 1997 and 2003, respectively. He worked in the USA as a Research Physicist (2003-2005) before joining the Department of Electronic and Electrical Engineering (EEE) at the University of Strathclyde, Glasgow, UK in 2008. His research interests are in the areas of photoacoustics and optical sensing. He is the Academic Director of the University of Strathclyde's Engineering Academy, Principal Teaching Fellow in EEE and Deputy Director of the EPSRC Centre for Doctoral Training in Applied Photonics.

Alison Low

Centre Manager

Biography

Alison Low, a Mechanical and Electrical Engineering graduate from Heriot-Watt University, specialising in the energy of buildings, began her career as a conservation lighting designer. She later returned to Heriot-Watt University to set up the FLAME (Flexible Learning Advanced Masters in Energy) MSc program within the School of Engineering and Physical Sciences. Alison's interest in light led her to the role of Centre Manager for the CDT in Applied Photonics, where she has been involved in the bids and management of three successive evolutions of the centre.

Louise Exton

Training Programme Manager

Biography

Louise joined the CDT in Applied Photonics in 2020, first taking on the role as Centre Administrator. Since late 2023, Louise has been the Training Manager for the CDT programme. Prior to joining the university, Louise worked in various roles in energy research and consulting firm, Wood Mackenzie, over 24 years. Louise graduated from Heriot-Watt University in 1991 with a BA Honours in Interpreting and Translating (Russian and German).

Chloé Baines

Centre Administrator

Biography

Chloé joined our team as Centre Administrator in April 2023. She graduated from the University of York with a degree in Theatre: Writing, Directing and Performance; following graduation Chloé applied her love of travel to working as a travel consultant for Trailfinders, and brings her personal and business knowledge of travel to the CDT, coordinating a range of travel for the CDT students. Chloé also manages student admissions to the CDT and an array of other tasks.

Poster schedule and abstracts

All student and early career researchers are required to present a poster, unless otherwise agreed with the CDT office. We will provide pins/tacks to hang posters; all students must hang their own poster and at the end of the school we kindly request that you take your poster away with you.

Monday 9th June, 14:00-17.30

1. Epsilon near zero metasurfaces (ENZ) at visible wavelengths

Iman. R. Alhamdan, S. A. Schulz

In this study, we present the design, fabrication, and characterization of an epsilon-near-zero (ENZ) metasurface that integrates indium tin oxide (ITO), a material with an ENZ optical property which can control antenna resonances. We conducted a finite-difference-time-domain (FDTD) simulations using Lumerical FDTD to analyze the optical response of the design in both reflection and transmission modes. The simulations indicate high efficiency and tunability for the proposed metasurfaces.

2. Simultaneous multi-wavelength mode-locked DFB lasers

Mohanad Al-Rubaiee, Yizhe Fan, Bocheng Yuan, Xiao Sun, John Marsh, Lianping Hou

We present simultaneous multi-wavelength mode-locked DFB lasers, achieving stable pulsed operation at multiple wavelengths within the same monolithic cavity. Unlike conventional designs requiring parallel laser arrays or external combiners, our approach enables multi-wavelength mode-locking with a single electrode, reducing complexity, footprint, and optical losses. The simplified fabrication process, requiring only a single MOVPE step and one etching step, enhances scalability and cost-effectiveness. A saturable absorber (SA) section ensures synchronized passive mode-locking, generating near-transform-limited pulses with high spectral purity. These compact, efficient lasers are well-suited for DWDM, ultrafast photonics, and high-speed optical communication, where synchronized multi-wavelength sources enhance data capacity and optical processing.

3. All you need is a guiding hand: mitigating shortcut bias in deep learning models for medical imaging

Christopher Boland, Owen Anderson, Keith A. Goatman, John Hipwell, Sotirios A. Tsaftaris, Sonia Dahdouh

Deep learning models for medical imaging are prone to learning shortcut solutions that rely on spurious correlations instead of clinically meaningful features, leading to poor generalization to new data. We propose an oracle-guided training scheme that encourages a student model to learn robust features in the presence of shortcuts. Our method regulates prediction confidence across intermediate network layers, significantly reducing shortcut impact. We evaluate our approach on CIFAR10, CheXpert, and ISIC 2017 datasets using ResNet18 and DenseNet121 architectures. Consistently, we outperform a model trained using Empirical Risk Minimization on a dataset containing a shortcut. In several cases, we close the gap on our clean baseline to the point that there is no statistically significant difference in performance. We also address the practical challenge of obtaining a clean oracle model, enhancing the method's real-world applicability.

4. Spatially-decohered channel metasurface for 2D beam steering with a 1D scan

Jemma Elizabeth Callaghan, James Downing, Xianzhong Chen

Beam steering is a valuable function of active metasurfaces with a variety of applications, including in LiDAR, medical imaging, and material topography. However, beam steering at wider angles with active materials is still challenging. Beam steering with active materials over traditional mechanical methods is desirable due to their superior speed, precision, and versatility. By integration of a spatially-multiplexed channel metasurface, full coverage of a 2D large scene can be achieved by a 1D mechanical scan. This concept has scope for integration with a 1D scan using an active optical metasurface in future work.

5. Multipixel THz Arrays for skin cancer diagnostics: technology development

Nishtha Chopra

A compact dual-pixel THz interdigitated antenna was designed to generate two THz beams that traverse low-aberration optics, enabling simultaneous acquisition of sample and reference data in the spectrometer. The low-aberration optical configuration maintained diffraction-limited spatial profiles for both beams, even with off-axis propagation, which was experimentally confirmed through frequency-dependent beam profile measurements. The reliability of the dual-beam spectrometer was assessed by measuring the complex transmission of a thin plastic sheet while deliberately altering the relative humidity in the THz beam path. This setup effectively minimized systematic errors in amplitude and phase by capturing both THz beams under identical conditions.

6. Demonstration of coherent beam combination with a novel control algorithm

Patrick J. Foley, Adam C. Fleming, Ian J. Thomson, M. J. Daniel Esser

Coherent Beam Combination (CBC) is a technique used to overcome the brightness limits of single laser sources by combining multiple sources into a single beam. The work presented here shows the development of an efficient CBC system with the capability for future power scaling. To ensure efficient CBC, a mutual phase relationship must be maintained between each beam. This is achieved through robust phase control algorithms. Two algorithms are considered in this work: the first is a conventional hill-climbing algorithm, while the second is a novel neural network. This new technique has shown higher resistance to noise than the hill-climbing based algorithm, as well as an order of magnitude decrease in time to reach full brightness. Innovative phase control was achieved using fast electro-optic modulators. The neural networks were deployed onto a microcontroller to prove the concept, before moving to a robust, power scalable and high-speed FPGA control system.

7. On-chip integrated CO2 sensor using photonic crystal waveguide

Femy Francis, Ann Harvey, Ned Plackett, Andrea Di Falco

Trace gas monitoring is crucial in challenging industrial environments where conditions can be extreme or hazardous. The conventional optical gas sensors use gas cells with large optical pathlength for sensing, making them bulky and heavy for use. In this project, we introduce a unique approach to develop a CO2 sensor working at 2 μm based on infrared spectroscopy with a footprint of 2 cm x 2 cm. The sensing head of the device includes a Slotted Photonic Crystal Waveguide (SPhCW) – a waveguide geometry with high electric field confinement and slow light which enhances the light-analyte interaction at the slotted region. Fabricated on a Silicon on Insulator (SOI) platform, the device is designed to achieve a group index (ng) of 25 with a bandwidth of 8 nm centred around 2004 nm - the absorption line of CO2. The devices are fibre coupled using tapered SMF-28 fibres to overcome the mode mismatch.

8. Title - TBC

William Gash

Abstract - TBC

9. Novel means of salt concentration prediction and mapping on metallic surfaces using shortwave-infrared hyperspectral imaging

Aoife Keane, Antonio Di Buono, Neil Cockbain, Robert Bernard, Paul Murray, Jaime Zabalza

This preliminary work shows the potential application of hyperspectral imaging (HSI) to quantify salt concentrations on a metallic surface. Salt build-up on metals can accelerate corrosion processes on the surface – in particular, pitting corrosion. Higher concentrations of salt are linked to higher corrosion rates. In this work, magnesium chloride ($MgCl_2$) salt solution is applied to aluminium coupons in concentrations ranging from 0 – 77.7μg/cm2. These coupons are imaged using a hyperspectral sensor in the shortwave-infrared (SWIR) range [900 – 2500 nm] in 272 spectral bands. The actual salt concentration on the surface of the aluminium coupons is measured using a soluble salt tester (SST). Spectral angle mapper (SAM) values are calculated for each pixel in the image in relation to a reference $MgCl_2$ spectrum collected using the same system. By using a novel thresholding algorithm based on these SAM values, we are able to predict the salt concentration on the surface with our model achieving an R2 value of 0.905. We are also able to visualise the spatial distribution of the $MgCl_2$ in a way that outperforms an RGB imaging system and is not possible with the SST. This work is beneficial as it provides a non-contact solution for salt concentration measurement and offers the potential for many measurements across a large surface, reducing the risk of overlooking an area of high salt concentration which can be associated with localised surface measurements.

10. Fabrication and testing of thick silicon nitride devices for third order non-linear applications

Cosmin Suciu, Natale Pruiti, Marc Sorel

Silicon nitride has been well established in literature for on-chip third order non-linear applications, such as supercontinuum generation (SCG) and frequency comb generation.

To achieve good non-linear performance, an anomalous group velocity dispersion (GVD) is required, which is achieved using thick layers of the material. However, when thick enough films are deposited on a silicon substrate with an oxide layer, the resulting tensile stress on the film is enough to cause cracks.

The main focus of this work was the fabrication process development and loss testing of thick silicon nitride non-linear devices. Two approaches were taken to combat the high stress: using stress release structures or using a sapphire substrate.

11. The diagnostic potential of spectroscopic analysis of bile for assessing liver viability in transplantation

Shannon Thompson

Abstract – TBC

12. Image-scanning optical coherence tomography

Dorian R. Urban, Miguel A. Preciado, Pavel Novak, Tom Vettenburg

Abstract - TBC

13. Advancing Metrology for Enhanced Placement Precision in Flip-Chip Integration for Silicon Photonics in Data Centers

Opeyemi Akanbi, Shankar Acharya, Yingjie Zhang, Wei Guo

The demand for high-speed, low-power optical interconnects in data centers has driven the advancement of silicon photonics technology. Flip-chip integration has emerged as a key approach for hybrid integration of active and passive photonic components. However, achieving high-precision placement during flip-chip bonding remains a significant challenge, directly impacting optical coupling efficiency, thermal performance, and overall system reliability. This study explores advanced metrology techniques to enhance placement precision in flip-chip bonding of III-V components onto silicon photonic circuits.

14. Context driven few shot learning for sparse video classification in nuclear decommissioning inspection

Brandon Calder, Paul Murray, Gareth Myers

In industrial inspection there is a key challenge to detection and classification of defects from video data. Typically, anomaly detection is adopted as defect classes are sparsely represented with high overlapping class variance. To overcome this transformers' 'context' learning can be leveraged to allow higher frequency classes to support classification on few or one shot examples through structured sequence presentation. By leveraging the innate properties of a standard sequence to sequence transformer computational complexity is reduced whilst permitting versatility to optimise performance through various training sequence generation techniques and label challenges. This allows for classification training under the few shot regime and under a 'natural' training regime with dual weight and context learning for classes of a wide frequency distribution to support inline training and inferencing at the point of implementation.

15. Title - TBC

William Carter

Abstract - TBC

16. Phase control of supercontinuum pulses for high axial resolution optical coherence tomography

Eugene Fouche, Gurthwin Bosman, Pieter Neethling

Optical coherence tomography (OCT) is an interferometric imaging technique that is used to image 2D or 3D samples (especially biomedical ones) non-destructively, with micrometer resolution and millimeter penetration depths. The lateral resolution of an OCT setup is determined by the optics, while the axial resolution is determined by the bandwidth of the illumination source. A greater bandwidth leads to an improvement in the axial resolution. High-resolution OCT setups use illumination sources with large bandwidths such as femtosecond lasers to achieve high axial resolution. However, the resolution of the setup is still limited by the bandwidth of the source.

Our laboratory has a Ti-Saph femtosecond laser and a 1D spatial light modulator (1D-SLM) with which we can create temporally structured pulses to overcome the resolution limit set by the inverse bandwidth of the source. This poster will present simulations and experimental results from a number of proposed schemes to demonstrate how we can use temporally structured pulses to resolve features that are smaller than the axial resolution limit.

17. Explosives sensing at stand-off with quantum cascade laser dual-comb spectroscopy

Andrew Gardner, Vasili Savitski

Dual-comb spectroscopy is a unique spectroscopic method that has been in development for two decades. Recent developments in quantum cascade lasers have allowed frequency combs to access the midinfrared. This has opened the door to fast, sensitive, and accurate measurements of the 'fingerprint region' for dual comb spectrometers. The combination of these features make this technology attractive to areas requiring fast and accurate sensing of low concentration samples, such as trace explosives detection.

18. Digital twin of high-speed optical sampling systems: dynamic instantaneous scan rate and resolution in Optical Sampling by Cavity Tuning (OSCAT)

Kirill Kabelev, Ana Filipa do Carmo Ribeiro, Tiago Gomes, Maria Ana Cataluna

Optical Sampling by Laser Cavity Tuning (OSCAT) has shown promise for a range of sensing applications. The time delay for a sine-driven OSCAT has been modelled analytically with various approximations, which reflected the capability of the laser technology at the time. Indeed, as the repetition rate (rep rate) modulation was carried out via piezo mirrors in lasers with repetition rates of ~ 100s of MHz, both modulation speed and the maximum rep rate tunability were very limited. The recent emergence of higher rep rate lasers which can be widely and rapidly tuned, has led to the demonstration of high-speed OSCAT, for which an accurate theoretical framework is needed. We present a new theoretical framework for OSCAT, with both numerical modelling and analytical equations, which match experimental results. This produced new insights into the function of time delay, as well as scan resolution and scan rate. We found that the instantaneous scan rate can vary by orders of magnitude within a single scan, a surprising effect not observed so far in the literature. We derived expressions for the scan resolution for OSCAT, the scan range, and the scan rate, and found trade-offs between improved resolution, and larger scan range or scan rate.

19. Orbital angular momentum light in complex media: propagation, preservation, and applications

Fatima Khanom, Nawal Mohamed, Diana Galiakhmetova, Igor Meglinski, Anton Sdobnov, Ivan Lopushenko, Alexander Dororin, Alexander Bykov, Edik Rafailov

My research explores the applications of orbital angular momentum (OAM) in advanced optical sensing technologies that directly address multiple UN Sustainable Development Goals. By exploiting OAM's unique properties of microscopic penetration and phase preservation in scattering media, we are developing novel photonic sensing techniques for ocular imaging and cancer detection that support Good Health and Well-being.

Our work demonstrates that OAM-based imaging systems can detect early-stage ocular abnormalities with significantly improved sensitivity compared to conventional techniques, particularly valuable in resource-limited settings. Additionally, we have developed an OAM spectroscopic platform for non-invasive cancer detection that analyses scattered light phase shifts to differentiate between healthy and cancerous tissues.

This research intersects with the summer school's focus areas, particularly relating to optical diagnostics in medicine (highlighted by Sarah Bohndiek's cancer imaging technologies) and optical nano tweezers (Justus Ndukaife's research area). The metrology aspects of our work involve precise quantification of phase changes in biological samples, offering potential for standardised diagnostic protocols.

20. Cracking sensitivity of L-PBF CM247LC to various layer thicknesses

Satyendra Kutiyal, Ravi Aswathanarayanaswamy, Andrew Moore, Andrew Farndell, N Jones

Abstract - TBC

21. The color of time: detecting glioma IDH mutation status in MRI through pseudo-colored transfer learning

Hamish MacKinnon

Background: Glioma is the most common brain cancer and is conventionally diagnosed with MR imaging. Its prognosis and treatment depend on the tumor genetic subtype. However, tumor genotyping is invasive, requiring a sample of tumor tissue; a noninvasive method to determine glioma subtype from an image would be a valuable addition to the oncology toolbox. Necessary restrictions on access to clinical data make developing medical applications challenging. Radiogenomics is especially challenging since it requires paired imaging and genotype data.

Aims: We investigate whether classification models, pre-trained on natural scene images before being finetuned on MR images to determine glioma subtype, can outperform models trained from scratch on larger private medical datasets. We investigate the most effective way of applying the MR sequences to the color model.

Methods: The T1, contrast enhanced T1, T2 and FLAIR sequences (defined by their different repetition, echo, and inversion times) are used as inputs to the color channels, allowing the use of preexisting natural scene models. A hyperparameter search determined the optimum parameters. Two pretrained CNN models (VGG16 and ResNext) were finetuned and compared across 24 psudo-color permutations and 4 gray monocolor configurations to explore effects on performance from combinations of MR sequence and color channel.

Results: Our best model exceeds the baseline from literature, achieving 88.1% accuracy, 0.935 AUC and 0.819 F1 score on a held out test set.

Conclusions: Classification of genetic markers in volumetric images can be undertaken effectively and efficiently with models pretrained on 2D natural scene images finetuned for the imaging genomics task. Crafting a custom 3D volumetric model from scratch is not always necessary.

22. Measurement of cattle emissions and their unprecedented impact on the climate crisis

Cameron Mein, Michael Lengden, Tom Gardiner, Ian Armstrong

Climate change is a pressing global challenge [1, 4]. Substantial efforts are in place to strive for a zero-net carbon future. Within the last 60 years there has been an unprecedented increase in the human population and in turn a surge in livestock populations as a result. A significant proportion of global anthropogenic greenhouse gas emissions are from livestock, with 50% and 26% of the total annual emissions contributed from methane and carbon dioxide, respectively. Beef and dairy cattle alone contributing 74% of all emissions from livestock [2]. The monitoring and measurement of the enteric emissions from cattle is a significant challenge, resulting in large measurement uncertainty and in a potentially significant underestimation of the emissions from the agricultural sector.

To improve the accuracy of these measurements requires a system that is robust enough to survive the challenging environment while providing the sensitivity required for trace gas measurements. As tunable Diode Laser Spectroscopy is a gas specific in-situ measurement technique with minimal drift, capable of long term operation in hostile environments, it is suited to monitoring agricultural processes [3]. The use of the high sensitivity of Wavelength Modulation Spectroscopy allows for the detection in the region of parts per million. Absorption features were identified at 1997 nm for CO2 and 1650 nm for CH4 that are suitable for monitoring enteric emissions from cattle.

Having such a high resolution will improve the measurement uncertainty for the contributions of individual cattle, this can then be scaled to contributions provided by entire farms. Giving agricultural researchers a better picture of the contributions of cattle on the environment, allowing for the alteration of feed and other methods of reducing CO2 and CH4 production.

[1] Valerie Masson-Delmotte et al. "Climate change 2021: the physical science basis". In: Cambridge University Press Cambridge, UK 2.1 (2021), p. 2391.

[2] Hongpeng Guo et al. "Greenhouse Gas Emissions from Beef Cattle Breeding Based on the Ecological Cycle Model". In: Int J Environ Res Public Health 19.15 (Aug. 2022). Place: Switzerland.

[3] J Hodgkinson and RP Tatam. "Optical gas sensing: a review." In: Measurement Science and Technology Volume 24.1 (2013).

[4] Patrick Moriarty and Damon Honnery. "The risk of catastrophic climate change: Future energy implications." In: Futures 128 (2021), p. 102728. issn: 0016-3287. doi: https://doi.org/10.1016/j.futures.2021.102728. url: https://www.sciencedirect.com/science/article/pii/S0016328721000379.

23. An overview of the UPLiFT project and preliminary energetics modelling of candidate gain media for an IFE laser driver

Rajan Mistry, Aaron Callaghan, Thaddeus Allison, Luke McHugh, Paul Mason

Following the first experimental demonstration of ignition at the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory in California in 2022, there has been renewed interest in the energy and efficiency scaling of high energy diode pumped solid-state lasers for application to inertial fusion energy (IFE). In 2024 the UK Programme for Laser Inertial Fusion Technology for Energy (UPLiFT) commenced at the STFC Central Laser Facility (CLF). One aspect of this project involves the development of a prototype laser whose architecture can be scaled to meet the requirements of a future laser-driven IFE power plant. In this work, energetics modelling of gain media candidates for the prototype are compared and evaluated against the requirements of an IFE laser driver.

24. Orbital angular momentum beams in turbid media for high-precision diagnostics

Nawal Mohamed, Fatima Khanom, Diana Galiakhmetova, Anton Sdobnov, Ivan Lopushenko, Alexander Bykov, Edik Rafailov, Igor Meglinski

We explore the interaction between structured light, particularly Laguerre-Gaussian (LG) beams This study examines the propagation and phase stability of Laguerre-Gaussian (LG) and Conical Refraction (CR) beams in scattering media using an off-axis holographic phase retrieval approach. We analyse the intensity and phase distributions of these beams after transmission through transparent and tissue-like scattering media, highlighting differences in phase stability and intensity retention. The results demonstrate the robustness of structured light for detecting subtle refractive index changes in biological tissues, with potential applications in non-invasive cancer detection and early diagnosis through high-precision tissue characterisation.

25. Title - TBC

Valeria Pais Malacalza

Abstract - TBC

26. Holographic metasurfaces for augmented reality and sensing

Shiju Prasad, Andrea Di Falco, Graham Turnbull, Andrew Grant

Photonic metasurfaces are nano-structured films that can be designed to exhibit tailored light scattering. The phase, amplitude, polarisation, and propagation of direction of the reflected and transmitted light can be controlled virtually at will. When used to record holographic information, photonic metasurfaces present many advantages over standard computer-generated holographic devices, mostly related to their ultrathin form factor (a thousand times thinner than conventional diffraction optical elements) and subwavelength dimension of the pixels. Moreover, holographic metasurfaces can be realised in flexible and conformable substrates, which makes them the ideal platform for out of the lab implementation.

27. Miniaturized optical frequency comb development for space optical clocks

Katharina Rostan, Markus Weller, Oliver Mandel, Alexander Sell, Hanna Ostapenko, Derryck T. Reid, Tobias Lamour, Claus Braxmaier

As of today, two femtosecond laser systems have been demonstrated in space. Both systems were based on Er:fibre laser technology. However, fibre based frequency combs suffer from numerous drawbacks, such as radiation sensitivity, system size and complex comb mode accessibility. This dissertation aims to develop a diode pumped solid-state based laser system utilising Kerr-lens modelocking specifically developed for space applications. The crystal-based laser system benefits from a smaller volume in which the nonlinear process is driven compared to distributed nonlinear fibresystems.

28. Modelling of passively Q-switched lasers using the Runge-Kutta method

Sean Quinn

Deep-UV lasers are used in photonic sensing and metrology applications through Raman spectroscopy. This area of the spectrum can be accessed through nonlinear up conversion which is reliant on the high peak powers offered by Q-switched lasers. By modelling passively q-switched lasers experimentally reported in literature for nonlinear up conversion towards the deep UV, I will show how relatively simple numerical models can be used to simulate and rapidly optimise complex systems.

29. Title - TBC

Mateusz Trabszo

Abstract - TBC

30. Towards high-efficiency visible metalenses: engineering zirconium-based metasurfaces for full phase coverage

Zaka Ullah, Andrea Di Falco

The simulations of low-loss visible metalenses based on synthetic materials are presented in this poster. Specifically, we explore a sandwiched metalens design utilizing zirconium to achieve a 360-degree phase profile. By meticulously optimizing the effective refractive index of the environment surrounding the zirconium pillars, a full 2π phase library has been realized through the manipulation of pillar radii. This approach enables precise control over the wavefront, promising high-efficiency and low-loss focusing on the visible spectrum. The results demonstrate the potential of carefully designed metamaterials for advanced optical components, paving the way for compact and high-performance imaging and light manipulation devices.

Friday 13th June, 15.00-17.30

1. Design and Fabrication of GaN LC-DFB laser

Shuqiao Cai, Finlay Walton, Daehyun Kim, Scott Watson

The studies on Gallium Nitride (GaN) and its applications in optoelectronics have started to bloom since Nakamura successfully fabricated the first violet laser, and the recent research in GaN laser has enabled the development of some next-generation applications in navigation and wireless communications. One particularly interesting application is to be used for atomic clock cooling for [5s2S1/2-5p2P1/2] strontium ion optical clocks at 422 nm. [1] In order to fabricate such a device to meet the target requirements in linewidth, wavelength and power, a lateral coupled distributed feedback(LC-DFB) GaN laser diode were designed and modelled using commercial software, and fabrication steps were tested to overcome the challenges.

2. Towards freeform micro-lenses fabricated using ultrafast laser assisted etching and CO2 laser polishing

Alastair Clarke, Aurélien Benoît, Robert R. Thomson, Paul Blair

By tuning the energy deposition, a single CO2 laser system can be used to both ablate glass and polish it, resulting in smooth optical surfaces. However, structures that go deep into the glass with steep features can be complicated to manufacture with this ablative approach to machining micro-optics. We aim to overcome this limitation using Ultrafast Laser-Assisted Etching (ULAE) to create freeform silica structures, which can then be polished using a CO2 laser.

ULAE is an emerging fabrication technique for producing high-precision, three-dimensional micro-optics. It utilises ultrafast laser pulses to induce localised modifications within the volume of the machined material. When exposed to aqueous KOH, these laser-induced modifications are preferentially etched away, leaving behind the inscribed structure. To maintain consistent light-matter interaction throughout the depth of the substrate, a spatial-light modulator (SLM) is used to adjust the phase front of the pulses, compensating for the spherical aberrations induced at the silica–air interface.

We optimised the translation speed, laser repetition rate, pulse energy and SLM phase masks for the fabrication of hemispherical lenses, with a radius of curvature of 700 µm inscribed at depths of up to 750 µm beneath the sample surface. After etching, the surface profile of the lenses exhibits a surface roughness of 160 nm.

3. Novel DIC methods for optimisation of thermal mechanical simulations of electronics packaged for harsh environments

Natasha Crossley, Jin-Hyun Yu, Vitor Marques, Paul Stewart, Yuhang Chen

This project aims to develop the use of non-contact optical form metrology to study the material properties of electronic structures. A methodology to use digital image correlation (DIC) to measure thermal expansion coefficients is assessed and proven to be equivalent to standard measurement methods. Finite element simulations of electronic materials have been developed in combination with material data collected using DIC methods.

4. Computational optimization of multipass enhanced photoacoustic sensing

Kamalpreet Gill, Adam Polak, Michael Lengden

Recent advancements in photoacoustic spectroscopy have sparked a great interest in the technique for highly sensitive trace gas detection, attributed to the development of innovative integrated resonator designs, alongside improved manufacturing techniques. Previous studies have showcased various resonant cell designs, targeting longitudinal, azimuthal, or radial modes. Notably, exciting azimuthal modes has shown a distinct advantage with significantly higher Q-factors compared to longitudinal modes. This paper describes the design of an acoustically resonant cell, engineered specifically to excite azimuthal resonances, with the aim of enhancing its sensitivity through a multi-pass optical excitation. Multipass-enhanced photoacoustic sensing plays a pivotal role in overcoming limitations in sensitivity and detectivity, but its true potential can only be accessed by strategic design of the optical and acoustic signal intensification.

To realize these objectives, the optical design and analysis of a multi-pass cell with two spherical concave mirrors are conducted through a MATLAB-based algorithm. This algorithm enables the adjustment of critical parameters such as distance between the mirrors, incident beam position, and incident angles, resulting in the generation of diverse patterns on the mirrors. These patterns play a crucial role in simulating the optical path and analysing the distribution of light spots as the laser beam traverses the photoacoustic cell multiple times. Subsequently, COMSOL simulations refine the azimuthal cell design, ensuring compatibility with the mirror distance. The spot distribution on the azimuthal cell within the COMSOL simulation facilitates the assessment of acoustic pressure profiles and aids in determining optimal microphone placement locations for enhanced signal detection. This study aims to optimize the geometry and dimensions of azimuthal photoacoustic cells within Herriot-type multi-pass configurations, with the objective of achieving maximal signal amplification through the optimal pairing with optical multipass spot distribution. Through exploration and optimization, we aim to identify parameters that maximize signal fidelity and sensitivity in photoacoustic gas detection. Given the plethora of available geometries, there is a risk of selecting suboptimal configurations. To address this, we utilize Design of Experiment (DoE) methodology to identify the optimal configuration of multipass spot pattern and photoacoustic azimuthal cell geometry.

5. Simplifying multiphoton microscopy, reducing the complexity of laser sources for biological research

Brendan Hall, Alan Kemp, Ian MacGillivray

Multiphoton microscopy is a powerful biomedical imaging technique used for research into dementia, by generating two essential wavelengths, 1300nm and 1700nm, from a single system we aim to enhance the overall system efficiency and reduce the cost of expensive technology. Nonlinear wavelength conversion techniques like optical parametric generation, amplification, and second harmonic generation are utilised in the novel and compact system for generation of 1300nm and 1700nm.

6. 3D printed photoacoustic cells for dual gas detection

Euan Martin, Micheal Lengden

Gas sensing and measurement techniques with lasers now offer consumers and researchers the ability to monitor a wide range of industrial gases at various concentration. Photoacoustic spectroscopy utilises the energy released from the absorption of light as an acoustic wave and often incorporates an acoustic resonator to improve signal strength. This work discusses the development of a single photoacoustic cell with two longitudinal resonators at different frequencies to allow the simultaneous detection of gases. In particular, the requirement of an acoustic isolator is discussed, and the design, test and validation of various designs are given. Finally, the performance of a dual resonator photoacoustic cell with an acoustic isolator included is presented.

7. Optical sensing of electronic interactions in two-dimensional semiconductors using a novel cryogenic twisting device

Kieran McGovern, Antoine Borel, Mauro Brotons-Gisbert, Jack Barraclough, Alex Ward, Brian Gerardot

Twisting layers of 2D materials creates a long-range periodic pattern called a moiré superlattice. This can create flat electronic bands leading to emergent phases of matter including superconductivity and exotic magnetism. The emergent phase diagrams are highly dependent on the moiré period, which is controlled by the relative twist. A hexapod positioner has been designed to tune in situ the relative twist angle between two sheets of atoms in a cryogenic environment, enabling the emergent phases to be characterised by optical spectroscopy or transport.

8. Low size weight and power solutions to alignment issues in free space optical communications

Martin Monaghan, Gerald Bonner, Gordon Flockhart, Craig Michie

Free space optical communications are emerging as an alternative to radio as the RF spectrum becomes increasingly congested and unavailable. Secure communications at far higher data rates than radio are theoretically possible in the optical domain, however this is achieved at the expense of significant scattering, attenuation and misalignment failures which necessitate advanced beam steering techniques. For communications between lightweight aerial platforms such as drones, constraints on the size, weight and power of beam steering systems become prohibitive. Developing beam steering systems which are light, compact and efficient is the key to unlocking optical communications on mobile platforms. Progress in pointing and tracking of moving platforms and efficient receiver alignment techniques are demonstrated, along with a discussion of source design for efficient communications protocols.

9. Enhancing IM-DD MDM FSO systems through deep learning-based turbulence prediction

Kuo Wang, Mikael Mazur, Martin P.J. Lavery

Atmospheric turbulence poses substantial challenges to free-space optical (FSO) system, causing signal attenuation and, in severe cases known as "deep fading," interrupting connections and leading to significant data loss. An Intensity Modulation with Direct Detection (IM-DD) approach leverages inter-channel crosstalk intensity in mode division multiplexing (MDM) as an indicator of environmental conditions. A combination of Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks is used to predict turbulence intensity and movement rate. This technique could assess channel quality and predict the frequency and duration of deep fading events, enhancing FSO system performance.

10. A study of gain media for a laser driver for fusion

Agnes Wojtusiak, Rajan Mistry, Luke McHugh, Paul Mason, Thomas Butcher, Christopher Spindloe, Robbie Scott, John Collier

In 2024, STFC's Central Laser Facility began the UPLiFT project, further establishing the UK's effort on development of laser inertial fusion energy. UPLiFT focuses on three key areas: implosion capsule targets, high-gain physics, and the laser driver.

I will present an overview of the UPLiFT project, with a particular focus on the development of a laser driver prototype, capable of delivering a beamline that meets the required specification. I will provide a summary of our findings to date, including an evaluation of the suitability of a wide range of solid state gain media to meet the required criteria.

11. CDT Y1 Group 2 – title TBC

Authors - TBC

Abstract – TBC

12. CDT Y1 Group 2 – title TBC

Authors - TBC

Abstract - TBC

13. Millimetre-depth resolution single-photon imaging at mid infrared wavelengths with superconducting detectors

Daniel Kuznesof, Noureldin Amer, Robert Hadfield

Mid-infrared (MIR) detection approaching the single photon limit has become increasingly accessible, enabling applications in free-space communications, industrial sensing, and biomedical fields. Conducting mid-infrared true photon counting measurements such as Light Detection and Ranging (Lidar) has been extremely challenging and limited to a variety of factors: atmospheric absorption, detector's wavelength-compatibility, system detection efficiency (SDE), laser source, depth resolution and more. We demonstrated single-pixel scanning LiDAR at Mid-infrared wavelength with sub-millimetre depth resolution in the single photon regime, enabled by a differential impedance- matched tungsten silicide (WSi) superconducting nanowire single-photon detector (SNSPD) and a unique optical parametric oscillator (OPO) laser source. The detector's exceptional timing performance is demonstrated by resolving sub-millimetre depth features of a target positioned 100 mm from the transceiver. A study of the timing jitter and wavelength dependent photoresponse is also presented. We used a high-speed, low electronic jitter time tagging electronics referenced to a photodetector to allow meticulous jitter measurements. The photon-counting MIR LiDAR system showed features extremely wide broadband operation, high timing performance, and single photon sensitivity, and may enable single photon MIR LIDAR for commercial application.

14. Multi metasurface components to enhance optical metrology systems

Devika Anil Ayyanchira, Andew Henning, Haydn Martin, Xiang Jane Jiang

By enabling lightweight, ultra-compact designs, photonic metasurfaces—which are made up of nanostructures that can control the phase, polarization, and amplitude of light—have entirely transformed optical systems. While single metasurface-based optical sensors have shown amazing effectiveness in integrating functionality and lowering system bulk, utilizing multiple metasurface components offers unexplored promise for improved optical metrology. This method overcomes constraints like chromatic aberration and permits more complex optical transformations by utilizing wavefront engineering and sequential phase modulation over multiple metasurfaces. In order to enable accurate, high-resolution measurements in manufacturing metrology, the study investigates unique metasurface designs that maximize light-field evolution through free-space propagation. Complex light field interactions are made possible by the integration of multiple metasurfaces, opening the door for revolutionary advancements in optical sensing.

15. Spectroscopy without spectrometers

Edward Appleton, Soraya Caixeiro, Graham D. Bruce

Optical spectroscopy is an invaluable tool. From its uses in clinical diagnostics to detect cancers to its uses in food analysis to assess food quality and even authenticate whiskies, it has many applications in both research and industry. At the heart of all these applications and measurements is the optical spectrometer. While there are many designs of spectrometers, most commercial spectrometers share the common weaknesses of being expensive, fragile, and do not allow for widefield hyperspectral imaging.

While there is existing work to replicate spectrometers with tuneable filters, such as the use of Acousto-Optical Tuneable Filters (AOTF) in the Mars rover as a spectrometer, these still have problems. Despite tuneable filters enabling hyperspectral imaging and sometimes being less fragile they are often as expensive as optical spectrometers, are slower and are less efficient, discarding most incident light.

In many of the applications of a spectrometer, knowledge of the full spectrum is not necessary. Instead, we look to retrieve key information about the spectrum using compressive optical filters that reduce the key information from the spectrum into a few intensity measurements. This has the potential to solve many of the key problems with optical spectrometers, as optical filters are less expensive, less fragile, and can easily be added to an imaging setup to allow widefield hyperspectral imaging.

While the simplest form of compressive filtering, i.e. using simple bandpass filters in spectral regions of interest, is widely known, there are significant opportunities in using more complex filters. Using two compressive filters on spectra consisting of a single peak, we have shown that it is possible to retrieve the wavelength and an estimate of the breadth of this peak.

Here, we will demonstrate two applications of compressive filtering. Firstly, in the hyperspectral imaging of disk nanolasers, which can be added to biological samples and then used in combination with hyperspectral imaging to track their passage through the biological samples. Current limitations in this are that due to the requirements of rapid hyperspectral imaging the resolution of the images is reduced. Since the disks have a narrow-linewidth emission spectra our compressive filters could be used to retrieve rapid hyperspectral images without the resolution trade off. Secondly, we demonstrate compressive filtering in identifying the composition of individual microplastic particles, including separating similar plastics.

16. Title – TBC

Keyvan Azimi Asrari

Abstract - TBC

17. Laser machining of micro-channels in hollow-core optical fibers for improved gas exchange

Andres M. Bioni V., Timothy Lee, Thomas W. Kelly, Martynas Beresna, Ian A. Davidson, Radan Slav´ık, Natalie V. Wheeler

Hollow-core optical fibres (HCFs) are a promising platform for diverse applications including telecommunications, laser power delivery, and sensing. To maximize optical performance of HCFs, control of gas composition and pressure within the core is advantageous. Furthermore, HCFs can enable high-sensitivity gas detection through enhancing the gas-light interaction length. Yet, conventional fibre gas filling approaches rely on fibers end filling, which gives an impractically slow response for long lengths as filling time scales quadratically with length [1]. Introducing micro-channels by laser-assisted micro-processing the fibre side allows gas to enter at multiple points [2].

Here, we demonstrate femtosecond laser ablation of micro-channels in a visible wavelength guiding antiresonant hollow core fiber designed for Raman gas sensing (Fig. 1(a, b)) [3]. However, HCFs for the visible spectrum have reduced scale as compared to their near-IR counterparts. This Raman fiber has a 410 nm membrane thickness, 28 μm core diameter, capillary inner diameter of 8.8 μm, and 274 μm jacket diameter. The inter-capillary gap of only 2.9 μm requires micron-level ablation precision to avoid damaging the microstructure, while the 112 μm jacket thickness requires rapid ablation speed to be practically scalable. To solve these issues, we developed a novel, multi-step ablation technique combining two distinct modification regimes: High pulse density (10,000 pulses/mm) with low pulse energy (0.5-1 μJ) for rapid ablation over large depth (~20 μm) but with severe debris accumulation, followed by low pulse density scan (500 pulses/mm) with high pulse energy (5 μJ) for efficient debris removal. Combining both methods as a hybrid approach allows fast ablation, debris self-cleaning, and high precision.

[1] P. Jaworski, "A review of antiresonant hollow-core fiber-assisted spectroscopy of gases," Sensors 21(16), 5640 (2021).

[2] P. Kozioł et al., "Fabrication of microchannels in a nodeless antiresonant hollow-core fiber using femtosecond laser pulses," Sensors 21(22), 7591 (2021).

[3] T. W. Kelly et al., "Improved Visible-guiding Anti-resonant Hollow-Core Fiber for Gas-phase Raman Spectroscopy," in Conference on Lasers and Electro-Optics/Europe and European Quantum Electronics Conference (Optica Publishing Group, 2023), ch 10 3.

18. Multifunctional multiplexing based on optical metasurfaces

Hangyu Li, Dawei Tang, Andrew Henning, Jane Jiang

This study designs a metasurface with both light focusing and quarter-wave plate functionality, using FDTD simulations to optimize structural parameters. The design combines geometric phase and transmission phase control to achieve precise polarization conversion and high transmission efficiency. This work provides new strategies for polarization control and optical focusing.

19. Closed loop stabilisation of a Michelson interferometer for high speed vibration measurement

Jian Liu, Michalis Voudaskas, Stefanus Wijaya

Abstract - TBC

20. Title - TBC

Yifan Liu

Abstract - TBC

21. Intermodal nonlinear optics in thin-film LNOI for tunable mid-infrared generation

Anna Pennoni, Valerio Vitali, Ilaria Cristiani, Cosimo Lacava

We demonstrate mid-infrared wavelength generation in thin-film lithium niobate on insulator (LNOI) waveguides using intermodal four-wave mixing (FWM). Phase matching is achieved through waveguide geometry and material dispersion, avoiding the need for domain poling. The proposed rib waveguide supports a degenerate FWM process with pump waves in the C- and L-bands, generating idler wavelengths tunable from 2.85 μm to 3.02 μm. Simulations show efficient phase matching and modal overlap, with a minimum conversion efficiency of 0.87 dB for a 1 m waveguide and 10 W pump power. These results confirm the potential of this approach for compact and scalable nonlinear photonic systems.

22. Nanoplasmonic tongues for chemical fingerprinting: from whisky analysis to real-time water quality monitoring and beyond

Mirinal Rayyapa, Justin R. Sperling, Baptiste Poursat, William J. Peveler, Caroline Gauchotte-Lindsay, Alasdair W. Clark

This work presents the development of a nanoplasmonic "tongue" technology by demonstrating its versatility in chemical mixture identification. Initially developed for differentiating whiskies via bimetallic nano-arrays with multiplexed surface chemistries, the platform's sensitivity and reusability are highlighted. This foundation has been extended to address a critical global challenge: real-time water quality monitoring. By employing an array of chemically-tailored plasmonic metasurfaces as a "nano-tastebud" sensor, we achieved highly accurate differentiation between untreated influent and treated effluent water, with over 95% accuracy. Chemometric analysis guided the sensor optimization, enabling the detection of compositional changes in distributed water systems. This adaptable technology, requiring no component isolation, showed promise for integration into water treatment facilities by providing early anomaly detection. Ultimately, this work paves the way for portable, cost-effective nanoplasmonic sensors with broad applications in environmental monitoring, food safety, and security thereby offering a holistic assessment of complex mixtures in real-time.

23. Detecting light with passive waveguide architectures

Christoph Stockinger, Jörg S. Eismann, Natale Pruiti, Marc Sorel and Peter Banzer

Phase is an intrinsic property of light, and thus a crucial parameter across numerous applications in modern optics. Various methods exist for measuring the phase of light, each presenting challenges, and limitations—from the mechanical stability requirements of free-space interferometers to the computational complexity usually associated with methods based on spatial light modulators. We present a passive photonic integrated circuit to spatially probe phase and intensity distributions of free-space light beams. Phase information is encoded into intensity through a set of passive on-chip interferometers, allowing conventional detectors to retrieve the phase profile of light through single-shot intensity measurements. Furthermore, we use silicon nitride as material platform for the waveguide architecture, facilitating broadband utilization in the visible spectral range. This approach for fast, broadband, and spatially resolved measurement of intensity and phase enables a wide variety of potential applications, ranging from microscopy to free-space optical communication.

Hackathon Groups (TBC)

Group 1	Group 2	Group 3

Group 4	Group 5	Group 6

Group 7	Group 8	Group 9

Group 10

Summer School Attendee List

First name	Surname	Institution
Opeyemi	Akanbi	University of Massachusetts Lowell
Iman	Alhamdan	University of St Andrews
Mohanad	Al-Rubaiee	University of Glasgow
Noureldin	Amer	University of Glasgow
Devika	Anil Ayyanchira	University of Huddersfield
Edward	Appleton	University of St Andrews
Keyvan	Azimi Asrari	Pavia University
Andres	Biondi	University of Southampton
Christopher	Boland	University of Edinburgh
Shuqiao	Cai	University of Glasgow
Brandon	Calder	University of Strathclyde
Jemma Elizabeth	Callaghan	Heriot-Watt University
Will	Carter	Heriot-Watt University
Nishtha	Chopra	University of Warwick
Alastair	Clarke	Heriot-Watt University
Natasha	Crossley	Heriot-Watt University
Paddy	Foley	Heriot-Watt University
Eugene	Fouche	Stellenbosch University
Femy	Francis	University of St Andrews
Andrew	Gardner	University of Strathclyde
William	Gash	Heriot-Watt University
Sebastian	Gaume	University of Edinburgh
Kamalpreet	Gill	University of Strathclyde
Brendan	Hall	University of Strathclyde
Kirill	Kabelev	Heriot-Watt University
Aoife	Keane	University of Strathclyde
Fatima	Khanom	Aston University
Satyendra	Kutiyal	Heriot-Watt University
George	Lansdown	University of Edinburgh
Hangyu	Li	University of Huddersfield
Jian	Liu	University of Dundee
Yi	Liu	University of Edinburgh
Yifan	Liu	University of Aberdeen
Hamish	MacKinnon	University of St Andrews
Euan	Martin	University of Strathclyde
Kieran	McGovern	Heriot-Watt University
Cameron	Mein	University of Strathclyde
Raj	Mistry	Heriot-Watt University
Nawal	Mohamed	Aston University
Martin	Monaghan	University of Strathclyde
Valeria	Pais Malacalza	University of Glasgow
Anna	Pennoni	University of Pavia
Joanna	Pietras	University of Strathclyde

First name	Surname	Institution
Ned	Plackett	AWE
Shiju	Prasad	University of St Andrews
Sean	Quinn	University of Strathclyde
Mirinal	Rayappa	University of Glasgow
Katharina	Rostan	Ulm University/Airbus Defence and Space
Sébastien	Roux	Heriot-Watt University
James	Smith	AWE
Christoph	Stockinger	University of Graz
Cosmin	Suciu	University of Glasgow
Shannon	Thompson	University of Edinburgh
Mateusz	Trabszo	University of Edinburgh
Zaka	Ullah	University of St Andrews
Dorian	Urban	University of Dundee
Michael	Voudaskas	University of Edinburgh
Kuo	Wang	University of Glasgow
Stefanus	Wijaya	University of St Andrews
Agnes	Wojtusiak	Heriot-Watt University
Zhaokang	Zhou	University of Edinburgh

General information

Getting to the University of Stirling

Please find an interactive map of the University of Stirling campus for reference here and more information on transport connections on the university website here.

By car

To drive to the University of Stirling from the East, South or West, take the M9 to Junction 11. At the junction, there is a roundabout which marks the end of the M9. From here you should take the exit for Bridge of Allan, follow the road through the town itself, and after about two hundred metres you will find the University entrance on the left.

From the North take the A9 to the same roundabout and follow the same route through Bridge of Allan as above.

Parking

You should provide your car registration to us in advance of the summer school to ensure that parking fees are waived for your vehicle. If you are hiring a car and do not know the number plate yet, please provide your registration number plate when you check in to your accommodation to avoid any parking charges. Park in a designated parking space.

By train

There are direct train services from most cities in Scotland. If in doubt, check the Trainline website to find the most direct route for you.

By air

The closest airports to the University of Stirling are either Edinburgh Airport (EDI) or Glasgow Airport (GLA). To get to the university from the airport, you can travel:

- By car: It is an approximately 45-minute drive to the University of Stirling from Edinburgh Airport or approximately 1 hour from Glasgow Airport
- By public transport:
    - If arriving at Edinburgh, you can get the Citylink 909 bus service to the University of Stirling. This runs every hour until 20:20 from bus stop D and take approximately 1 hour.
    - If arriving at Glasgow, you can get the 500 Glasgow Express bus into Glasgow city centre, get on a train from Glasgow Queen Street to Stirling and then get the Unilink shuttle bus from Stirling train station to the University of Stirling.
- By taxi: the University of Stirling recommend Stirling Taxis. This is the costliest option, with one-way fares often costing upwards of £60.

By bus

Stirling is served by bus connections from all major cities in Scotland. Below are a few recommendations for the quickest bus routes to the University of Stirling.

- From Edinburgh, you can catch the Citylink 909 bus service to the University of Stirling from Edinburgh Maybury which takes approximately 1 hour 30 minutes.
- From Glasgow, you can catch the Megabus PM8 to central Stirling and then catch the Unilink bus to get to the university, which will take approximately 1 hour 20 minutes.
- From Stirling city centre, you can catch the Unilink bus every 10 minutes, which takes approximately 20 minutes from Stirling train station.

Accommodation

All attendees will be housed in Willow Court (https://www.stir.ac.uk/student-life/accommodation/find-your-residence/willow-court-standard-flats/) unless otherwise arranged.

An example of the type of room you will be staying in is pictured below. This room will be situated in a shared flat with 7-12 other attendees. You will be informed of your flatmates in advance, please get in touch if there are any issues with this. You will also have access to a communal kitchen and living space in your flat should you wish to use it.

The accommodation will have towels and linen provided; with a laundry facility onsite should you require it (please note, there is an additional charge for this).

Accommodation check-in and key collection will take place as soon as you arrive at the summer school in the afternoon of Saturday 7th June at the Willow Court reception. If you misplace your key throughout the week, you should go to the reception desk in the Willow Court accommodation block for a replacement (please note, there may be a charge for lost/damaged keys).

More details on the Willow Court accommodation block can be found here.

Catering and dining locations

Breakfast, lunch, and dinner are included and will be served in Haldanes, Campus Central (https://www.stir.ac.uk/student-life/campus-facilities/eating-drinking/haldanes/) unless otherwise stated.

There will be two breaks per day, one mid-morning and one mid-afternoon for tea, coffee, and light refreshments.

Pre-disclosed dietary requirements will be taken into consideration.

Quiet room

During the summer school we will have a quiet room available for anyone who simply wishes to 'take a break', recharge or decompress. This room should be used for this purpose only (should you need a room for any other purpose, please contact the CDT office (see below)).

Please note that both Chloé and Louise are qualified mental health first aiders, should you need any advice.

Contacting the CDT during the summer school

During the summer school the CDT office will be contactable as usual via cdtphotonics@hw.ac.uk. We will also be available in Room TBC on the University of Stirling campus.

SUSSP81 WhatsApp channel

During the summer school follow our WhatsApp channel (TBC nearer the event) via which we will be able to update you on any important information or last-minute changes to the programme.

Expenses

During the summer school we will be able to reimburse any pre-agreed speaker or bursary-attendee travel expenses. Please present your receipts to the CDT office team during the summer school to start this process. Further information will be provided on this in due course.

Prizes

There will be prizes for best posters - first, second and third place, and for the winning Hackathon team.

Wi-Fi

Wi-Fi can be accessed at the University of Stirling via your Eduroam login. If you do not have an Eduroam login, please use the University of Stirling Guest Wi-Fi.

Accessing Guest Wi-Fi (non Eduroam users):

> The University of Stirling provides a free Wi-Fi service for guests and visitors to Stirling campus. To join our free Wi-Fi network, follow these easy steps:
>
> 1. Connect to 'BT UoS Guest Wi-Fi
> 2. Open your web browser
> 3. 3. Click 'Get online'

Further details can be found here.

Gym access

You can use your accommodation key card to access the University of Stirling gym facilities. The Stirling Sports app will provide you with more details regarding gym and swimming pool opening times and the facilities available to you.

More details on the University of Stirling gym facilities can be found here.

Library access

Library access, if required, can be pre-arranged with the University of Stirling. Please ensure you let us know before the start of the summer school if you will need access to the library during your stay.

Emergencies

In an emergency, please check University of Stirling procedures here.

Medical assistance

There is a medical centre on campus: https://www.stir.ac.uk/student-life/campus-facilities/medical-centre/, additionally there is a pharmacy on campus should you need it: https://rightmedicinepharmacy.co.uk/branch/stirling-uni/

Information about healthcare for international students can be found on the University of Stirling website: https://www.stir.ac.uk/student-life/welcome/international-students/healthcare/