PIADS CDT

Spotlight Report 2025

EPSRC Centre for Doctoral Training in

PHOTONIC INTEGRATION AND ADVANCED DATA STORAGE

Engineering and Physical Sciences Research Council

QUEEN'S UNIVERSITY BELFAST

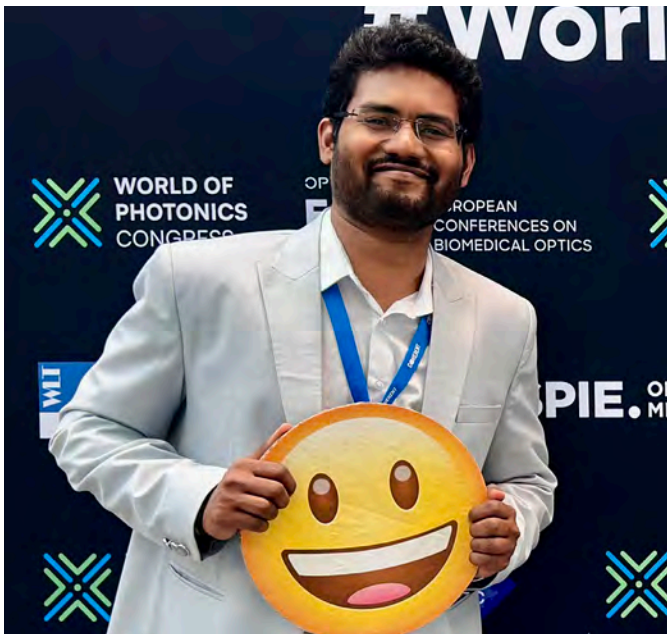
IPIC BRINGING PHOTONICS TO LIFE

University of Glasgow

Taighde Éireann Research Ireland

Contents

Welcome Suraj Kothuri, IPIC Representative, Management Committee



Hello and Welcome! As IPIC Representative for PIADS Management Committee, I am honoured to introduce this year's report—a reflection of the creativity, resilience, and shared purpose that define the PIADS community. Each year, this report reminds us that PIADS is far more than a doctoral training centre—it is a living network of researchers, industry partners, and alumni who are pushing the boundaries of photonics, advanced materials, and data storage technologies together.

PIADS was founded to address the needs of a rapidly evolving, data-driven world by developing highly manufacturable photonic integration technologies while maintaining a strong focus on real-world impact.
The report highlights our key research themes, ranging from semiconductor laser reliability and nanoplasmonics to atomic-scale characterisation and materials innovation. These themes not only capture the technical breadth of our programme but also demonstrate how multidisciplinary collaboration lies at the heart of every breakthrough.

Perhaps the most inspiring aspect of this year's report is the human story behind the science. Our doctoral researchers are not only publishing world-class work but also engaging in outreach, mentoring, and entrepreneurship. Through industrial placements, international conferences, and cross-sector collaborations, they have gained the skills to translate complex research into tangible societal value. The stories featured here—of students presenting at leading global conferences, collaborating with Oxford Instruments Plasma Technology, and contributing to community engagement initiatives—show the profound personal and professional growth nurtured within PIADS. These experiences help shape confident, compassionate scientists who are ready to lead innovation in academia, industry, and beyond.

This year's events, from Winter School and Careers Week to Conclave and Public Engagement workshops reflect the vibrant, inclusive spirit of the CDT. Our commitment to equity, diversity, and inclusion continues to strengthen our community, ensuring every researcher's voice is heard and valued.

As we look ahead, I extend heartfelt thanks to our students, supervisors, administrators, industry partners, and alumni for their dedication and contributions to this report and to PIADS' continuing success. Your collective effort sustains our reputation as a model of collaborative, cross-institutional training excellence.

To every member of the PIADS —thank you for your passion and perseverance. May you continue to question boldly, collaborate deeply, and aim ever higher. The journey ahead is bright, and together, we will keep turning ideas into impact.

What is PIADS?

The Centre for Doctoral Training (CDT) in Photonic Integration and Advanced Data Storage is a partnership between Queen's University Belfast, the University of Glasgow, and the Irish Photonic Integration Centre (IPIC). We aim to tackle some of the challenges created by the increasing quantities of data generated by today's society.

The Centre's focus is on developing highly-manufacturable photonic integration technologies related to the magnetic storage of digital information. However, the development of these technologies will be relevant to a wide spectrum of end-users – from telecommunications to biophotonics, in which optical technologies are applied to living organisms and healthcare.

Established in 2014 (PIADS 1.0) with substantial investment from the Engineering and Physical Sciences Research Council (EPSRC) and both universities and industrial partners, the centre was successfully renewed in 2019 (PIADS 2.0) with investment from Research Ireland, resulting in a vibrant joint EPSRC and Research Ireland funded centre.

It is our aim to provide excellence in postgraduate education and research, combined with industry experience to develop doctoral graduates with the confidence, knowledge and skills to lead and transform the future of photonics.

Our Technical Research Themes

Our Technical Focus

CDT research students are engaged on a range of challenging doctoral research projects across the Centre's five main research themes. All students are jointly supervised by academic staff from the University of Glasgow, Queen's University Belfast and the Irish Photonic Integration Centre.

Themes (A–E) – Live Projects

A. Ultra-Reliable Semiconductor Lasers Operating in Hostile Environments

- Dynamic properties for InGaN/GaN-based distributed feedback laser diodes
- Junction temperature characterisation of oxide aperture VCSELs
- Integrated photonic devices for smart gas sensors

B. Low Cost Planar Lightwave Circuit Platforms Suitable for Volume Manufacture

- Integrated quantum photonic sensors and circuits
- Controlling heat flow at the nanoscale using ferroelectric-based thermal mirrors
- Temporal dynamics of strongly coupled epsilon near-zero plasmonics

C. Novel Nanoplasmonic Devices Capable of Operating in Extreme Environments

- Novel materials synthesis for HAMR plasmonics
- Inter-metallic plasmonic antennas
- Bringing ab-initio design into the lab: design of new plasmonic materials

D. Atomic Scale Analysis Techniques

- Characterising nanoscale thermal transport at functional interfaces
- Heat generation and transport in nanostructured materials
- Reprogrammable micro-magnetic transport

E. Advanced Materials for Magnetic Recording

- Molecule-based magnets
- Novel magnetic states in 3D nano-magnetic systems
- Manipulation and exploitation of the dynamic processes of skyrmions

The PIADS Leadership Team

We are proud to have a strong network of academic partners as part of our PIADS CDT Team, who regularly communicate their research, industrial outputs and collaborative ventures in brilliant ways. We are also aware that much of the activity of our centre would not be made possible without the dedication and creativity of our strong leadership and support team: the directors and people behind the scenes. Below is a short bio on each of these key team members.

Professor Robert Bowman
PIADS CDT Director

Robert's current research is directed towards the development and evaluation of advanced materials for data storage technology in partnership with Seagate Technology. Topics being investigated include: rare earth magnetism, rare-earth-ferromagnetic coupling phenomena, synthetic magnetic multilayers and plasmonic materials to facilitate heat assisted magnetic recording sponsored by industry. He leads a team of 3 PDRAs and 7 PhDs. This is recognised through the award in 2017 of a Seagate Technology/ Royal Academy of Engineering Research Chair.

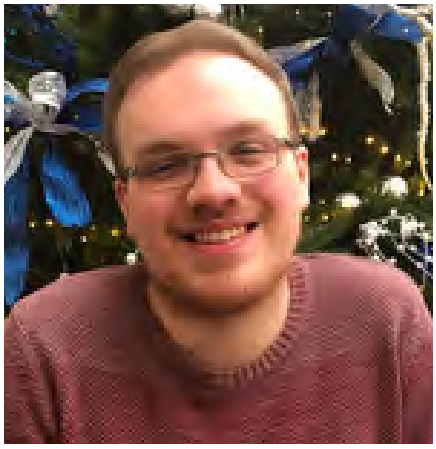
Professor Paul Townsend
PIADS CDT Co-Director

Paul is Head of the Photonics Centre at Tyndall National Institute and Research Professor in the Department of Physics at University College Cork in Ireland. The Photonics Centre comprises nine internationally recognised research teams (around 130 staff and PhD students in total) carrying out R&D and commercialisation activities spanning the areas of semiconductor materials and devices, photonic integration and packaging, through to advanced photonic systems for telecommunications and healthcare applications. Since June 2012 he is also Director of Research Ireland funded Irish Photonic Integration Centre (IPIC).

Professor Marc Sorel
New CDT Co-Director

Professor Marc Sorel, based at the University of Glasgow has previously chaired our Research and Training Committee and had a very active role within the PIADS Management Team. Marc has been engaged in research related to integrated optics, silicon photonics and semiconductor lasers for over 15 years.

Lynda Mahon
PIADS CDT Executive Manager
l.davison@qub.ac.uk
Lynda has worked at QUB for over 18 years. During this time, she has held various positions across the University. In the last seven years she has specialised in Post Graduate Research and Training and previously led the Doctoral Training Programmes within the Arts Humanities and Social Sciences Faculty at QUB (Northern Bridge AHRC and NINE ESRC). Lynda joined the PIADS team in November 2021 and looks forward to seeing the development of the programme.



Adam Barr
PIADS Clerical Officer
a.barr@qub.ac.uk
Adam provides administrative support for the PIADS CDT Programme. Adam first joined Queen's in 2023, previously providing remote support to the School of Pharmacy's CQC College with China Medical University in Shenyang, China. He is also a former student of the university, having completed his Master's in history at Queen's in 2020. In his spare time, Adam enjoys travelling as much as he can and curling up with a good book!

Lisa Campbell
PIADS CDT External Engagement Manager
lisa.campbell@glasgow.ac.uk
Lisa is an accomplished marketing professional with experience gained in Higher Education, Local Government and Social Care. Lisa enjoys supporting the PIADS programme, promoting the research capability of our students and the Centre whilst developing lasting partnerships that meet the demands of industry.

Elisabeth Wintersteller
Training Programme Manager
elisabeth.wintersteller@tyndall.ie
Liz was a highly valued member of the PIADS team and her contribution to the programme at IPIC will be greatly missed. As Training Programme Manager, she played a key role in coordinating and delivering outstanding training activities and events, all of which were consistently well-organised, impactful, and highly regarded by students and colleagues. Drawing on her extensive experience in academia, including roles at the European Molecular Biology Laboratory in Heidelberg and the Medical University of Innsbruck, Liz made a lasting contribution to PIADS and the wider team. We wish her all the best in her new role.

Equality, Diversity & Inclusion at PIADS

The Centre for Doctoral Training in Photonic Integration and Advanced Data Storage embeds equality, diversity, and inclusion (EDI) as a core principle across all programme activities, events, and structures. Delivered in partnership between the University of Glasgow, Queen's University Belfast, and the Irish Photonic Integration Centre, PIADS recognises that excellence in research depends on fostering an inclusive environment in which diverse perspectives can thrive.

EDI considerations are integrated throughout the full doctoral journey—from recruitment and selection, through training, supervision, cohort-building activities, and professional development events. Inclusive recruitment practices, flexible supervision approaches, and tailored reasonable adjustments are embedded within CDT processes to ensure equitable access and participation. Structured peer support and mentoring networks form a core component of the PIADS experience, strengthening belonging and wellbeing across the cohort.

The CDT's research mission—to address challenges arising from the increasing quantities of data generated by modern society—relies on bringing together talents and perspectives from diverse personal, cultural, and disciplinary backgrounds. Fostering an inclusive research culture is therefore fundamental to PIADS' ability to deliver high-impact, innovative research.

Looking ahead, PIADS CDT is committed to the continual review and enhancement of EDI activity across all aspects of the programme. We will continue to embed reflective practice, respond to cohort feedback, and evolve our approach to ensure that all members of the PIADS community are supported to participate fully, progress equitably, and excel.

Spotlight on Oxford Instruments

Since the inception of the Centre for Doctoral Training in Photonic Integration and Advanced Data Storage (PIADS), Oxford Instruments—particularly its plasma technology-focused Bristol facility—has played a central and highly valued role in supporting the CDT's research, training, and industrial engagement activities. Oxford Instruments' Bristol facility specialises in providing advanced etch and deposition process solutions for nanometre-scale features, ultra-thin layers, and the controlled growth of complex nanostructures, and have been a PIADS partner since 2014. These capabilities, built on core technologies in plasma processing, ion beam techniques, and atomic layer deposition and etch, align closely with PIADS' research priorities in cutting-edge photonics, materials science, and data storage.

A hallmark of this partnership has been the long-term involvement of key Oxford Instruments staff, including Rob Gunn and Fraser Anderson, who have worked closely with the CDT since its earliest days and recently retired after many years of dedicated support. Both have been active contributors to PIADS, regularly attending CDT events, serving on the PIADS Steering Board, and participating in the Centre's Industrial Seminar Series and annual conferences. Their insight and guidance have helped shape the CDT's industrial strategy, its alignment with sector needs, and its approach to preparing doctoral researchers for careers in high-technology industries.

Oxford Instruments has also offered substantial career development support to PIADS researchers. The company has contributed to CDT-organised careers panels, networking sessions, and recruitment-focused events. Most recently, Dr Montu Bhuva delivered an online careers talk discussing his professional journey within the company, providing current PIADS researchers with valuable first-hand insights into industrial career pathways, organisational culture, and the evolving skills landscape within advanced manufacturing and nanotechnology sectors. We currently have an EngD student Catalina McLaughlin in placement (you can find out more about her placement on P8)

The partnership between Oxford Instruments and PIADS reflects clear scientific, technical, and commercial benefits. As a UK-based organisation collaborating with EPSRC-supported research institutions, Oxford Instruments places a high priority on accessing a pipeline of scientifically and technically trained personnel. The company typically recruits between two and five PhD-level staff each year to support its business development, and as the business continues to grow, this requirement is expected to potentially double over the next five years. Recruiting individuals who possess not only strong intellectual capability but also the multidisciplinary training needed to address emerging technological challenges is increasingly difficult within the UK skills landscape. PIADS plays a vital role in bridging this gap, providing a reliable source of high-quality, industry-ready doctoral graduates with expertise directly relevant to the company's strategic needs.

The continued collaboration with the CDT until the programme's planned closure in 2028 remains of significant value to Oxford Instruments. The company views PIADS as an important source of future talent, innovation, and research partnership opportunities and looks forward to maintaining strong engagement throughout the remainder of the programme. This enduring relationship exemplifies the impact of sustained industry–academia collaboration on workforce development, technological advancement, and the wider UK photonics and nanotechnology ecosystem.

OXFORD INSTRUMENTS

Balancing Industry and Academia During My EngD.
- Catalina McLaughlin

I am currently undertaking a two-year industrial placement as part of my EngD programme with Oxford Instruments at their Bristol Facility, who specialise in compound semiconductor plasma etch and deposition processing equipment. Having completed the first year of the placement, my work has focused on developing, building, and testing a novel real-time in-situ plasma process monitoring device. The goal is to create a predictive diagnostic tool for chamber cleaning that can improve efficiency and reduce defects.

This project has given me valuable experience working in a commercial environment, where designing with the end user in mind is a key focus. Working within the innovation team has allowed me to develop a wide range of skills that I wouldn't be able to gain as easily in an academic setting. Additionally, I've enjoyed having the freedom to lead the project and take responsibility for the research direction, whilst benefiting from the combined support of both my academic supervisor at Queen's and my colleagues at Oxford Instruments.

However, despite being based in industry, I've still had plenty of opportunities to stay connected with the academic community and take part in various engagement events

In February 2025, I attended the 25th Symposium on Applications of Plasma Processes (SAPP XXV) in Štrbské Pleso, Slovakia. The conference was a great experience, giving me the chance to meet other students working in plasma physics and learn more about plasma diagnostics, which is where my work sits. Beyond my immediate field, I got to learn about broader aspects of plasma science, including plasma-chemical reactions and the applications of plasma processing for nanomaterials.

The conference was also a big milestone for me: my first poster presentation at an international conference. The poster focused on the more academically oriented simulation work I did during my first year of research at QUB. Presenting to an international audience and having detailed discussions about my work was both challenging and rewarding. I was honoured and very grateful to receive the Jan D. Skalny's Prize for early-stage researchers and students, which was great recognition of the work I'd put into that initial research phase.

Just after returning from the conference, I took part in the SmartNano event as part of Northern Ireland Science Festival week, hosted at the Yelo site in Carrickfergus. This outreach event gave me the chance to share my personal journey, from A-levels through studying physics at QUB to deciding to pursue an EngD. I really enjoy outreach events because they let me talk about my research to wider audiences in less technical terms. However, more importantly, they give me the opportunity to challenge some of the stereotypes surrounding careers in science, especially for girls who may be considering it as a path. ▶

Finally, in June, I had the chance to attend the annual PIADS Conclave event, which was held at the University of Glasgow. The event brought together a great mix of academic and industry perspectives, with student presentations, a keynote talk, and plenty of opportunities for discussion with industry partners. I particularly enjoyed the industry roundtable session, which offered insights from people at different stages of their careers. Hearing from recent graduates about their experiences entering the job market and from more senior professionals about what they look for when hiring was especially valuable.

Conclave also provided me with the opportunity to present my research to the PIADS community and receive questions and feedback from both academics and industry partners. It was rewarding to see how relevant my work is to both sectors. Despite presenting first on Thursday morning after an evening of ceilidh dancing, I was delighted to co-win the award for Best Five-Minute Student Talk, which was particularly special as it was voted for by peers, academics, and industry attendees alike.

Since Conclave, the summer has been busy. I've been working hard to get more results whilst shifting my focus towards planning and writing a few papers on my work and starting to structure my thesis. With hopefully a few more conferences coming up, my final year is shaping up to be busy and exciting as I work towards completing this chapter of my research journey. The combination of industrial experience, academic work, and community engagement has really shaped my EngD experience and is helping prepare me for my future career. •

"During her 18-month placement at Oxford Instruments, Catalina has been an exemplary spokesperson for the PIADS CDT programme. She has ensured consistent project progress in the face of significant technical barriers, demonstrating a professionalism far beyond her years. Beyond her technical capacity, she has seamlessly integrated into the team, department, and wider company building connections I am confident will be a significant asset for her career to come. Oxford Instruments has benefited significantly from her dedicated research focus, which is supported by Dr Tom Field at Queen's University Belfast. She is now entering the final stage of her project, testing her fully functional mass spectrometer against plasma processing conditions critical to the semiconductor sector."

James Ellis, Innovation Manager, Oxford Instruments

My Industry Placement at the National Institute of Standards and Technology
- Daniel Kuznesof

Thanks to the PIADS placement scheme award I was able to take part in a 3-month industry placement at the National Institute of Standards and Technology (NIST) in the Quantum Nanophotonics Group, in Boulder, CO.

Working alongside Dr Varun Verma we came up with a project focused on the development Superconducting Nanowire Single Photon Detectors in the mid-infrared. Specifically, we looked at a new material platform enabling thicker films for greater tolerances ad higher yield during nanofabrication.

Superconducting Nanowire Single Photon Detectors are one of the most mature and commercially available quantum technologies and have been utilised to enable photonic quantum computing, quantum communications, and quantum sensing. Extending their performance to the mid-infrared is a major challenge but would enhance applications in free-space communications, industrial sensing, astronomy, biomedicine and imaging with single photon sensitivity and high efficiency.

Thanks to the flexibility of the PIADS placement award we were able to tailor the project such that it could be integrated into my PhD thesis which will be chiefly focused the characterisation and application of mid-infrared single photon detectors.

Due to being a project that aligns extremely closely with my PhD research, I was given the opportunity to apply the skills I've developed over the course of my research to rapidly simulate, validate and characterise mid-infrared superconducting single photon detectors. However, thanks to Varun's mentorship and support I was also given the opportunity to learn new techniques focused on material science and development as well as hone my low temperature measurement techniques. Furthermore, I had the chance to contribute to a side project involving the integration of a superconducting 64-pixel thermally coupled line imager array into a monochromator for the purpose of creating a single-photon sensitive spectrometer capable of single-photon detection from the ultraviolet to the long-wavelength infrared.

The opportunity to work as part of a much larger group within a federal institute gave me exposure to many different fields of active research in quantum nanotechnology of commercial interest. I also had the chance to work alongside brilliant people in my field who were all incredibly welcoming during my time short time in Colorado – and provided excellent recommendations for sightseeing and making the most of the Rocky Mountains!

During my placement I was able to take advantage of being in the United States and go to the SPIE Defence and Sensing in Orlando, Florida with over 20 simultaneous conferences and over 10,000 attendees. This was the largest event I have attended and makes me greatly look forward to my next international conference.

I am so grateful for being able to seize the opportunity to do this placement mainly in thanks to the support that PIADS provided me. I really felt this helped me grow in confidence as a researcher and has been an experience I will never forget.

Meta 2025: Torremolinos
- Mark Cunningham

In July of this year, I had the pleasure of giving an invited talk at Meta 2025 in Torremolinos, the 15th International Conference on Metamaterials, Photonic Crystals and Plasmonics.

Throughout my time in PIADS, it has almost been a running joke amongst my fellow PhD students that my work on hyperbolic polaritons, extremely anisotropic excitations that cause light to interact differently with certain materials depending on direction, is niche and difficult to comprehend. It is rare that I get the chance to interact with people that actually know more about the topic than I do!

In any field, a PhD student will have one name that recurrently appears in all their references. In a way, this person, or collection of people, tends to become a mythical Einstein-like figure, who always seems to be a cut ahead of the rest.

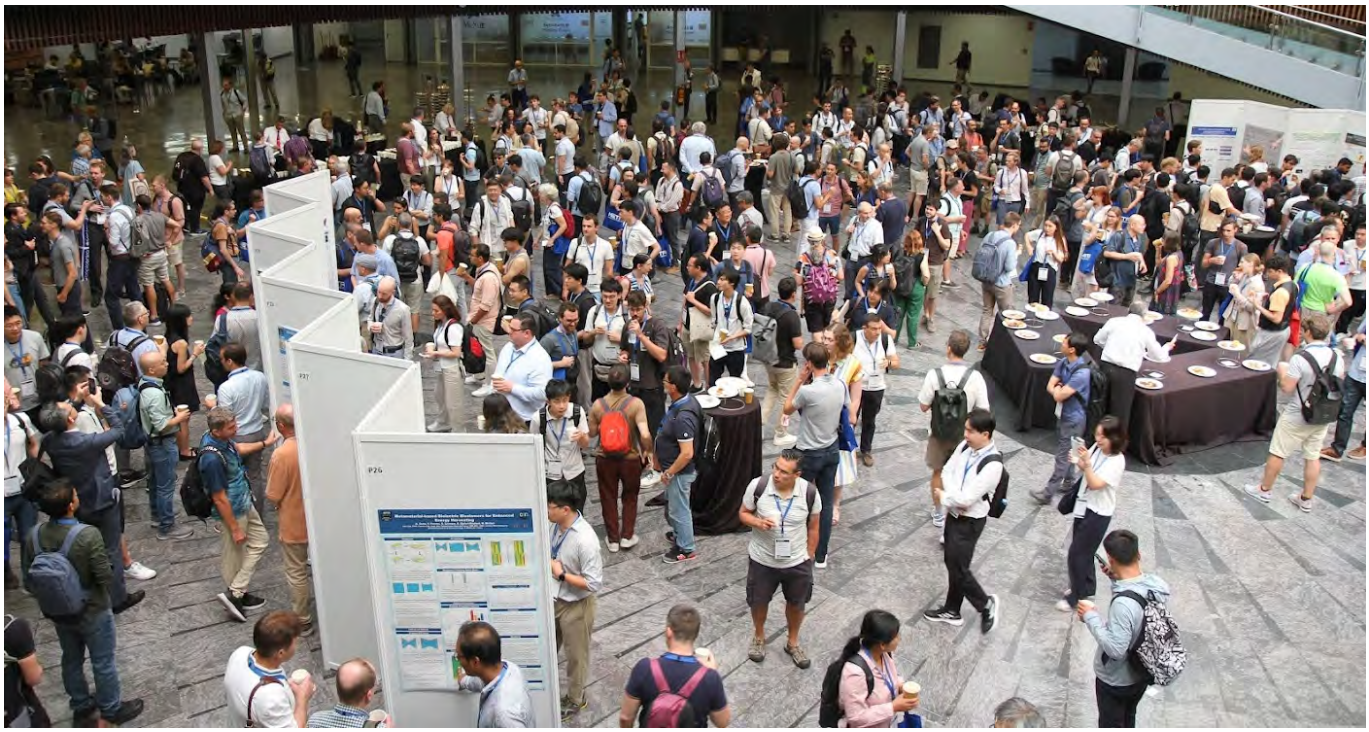
You can imagine my surprise when I ran into the famed Professor Andrea Alú late one evening climbing the notorious Torremolinos beach stairs the night before the conference began! Needless to say, discussing the tunability of polarisation conversion of hyperbolic polaritons with twisted structures with possibly the world's leading expert while the tide rolled in set the bar high for my interactions in the week ahead.

The talks began, with my favourite plenary talk, perhaps the most enjoyable I have ever listened to, delivered by Professor Nader Engheta on "Metastructures that Compute and Optimise", discussing his work on nonlocal metasurfaces enabling vector-matrix multiplication, optimisation and equation solving using various parameters of light. Speaking with him on the potential of anisotropic materials for these applications, although introducing new problems in their polarisation dependence, was incredibly insightful and that brief mentorship in approaching problems is something that will stay with me for the rest of my career.

My audience for my presentation was great (who doesn't love a good animation?) and I finally got to meet members of the Italian research group working on hyperbolic dispersion in the visible spectrum who I'd been following for years and discussed our overlapping interests that evening over tapas.

As any PhD comes to an end, there will be anxieties and confusion on what is best to do next. The guidance from the (many) people I met over this conference and their kindness has had a massive influence on my approach to thesis writing and my next steps. A special shoutout goes to Federico, Nour, Robin and Charlie who made my time in Torremolinos incredibly special.

Fundamentally, it is important to remember that behind all this progress in research and technology there are humans just like you and me who are willing to extend a branch and offer guidance when you need it. The conference also allowed me to appreciate the PIADS community even more, hearing how many people don't get the benefit of the cohort-approach like our CDT. As I wrap up my time here, I'm really glad to have spent the last four years of my life surrounded by these folks.



Reflections on my PhD Journey
- Kaynat Alvi

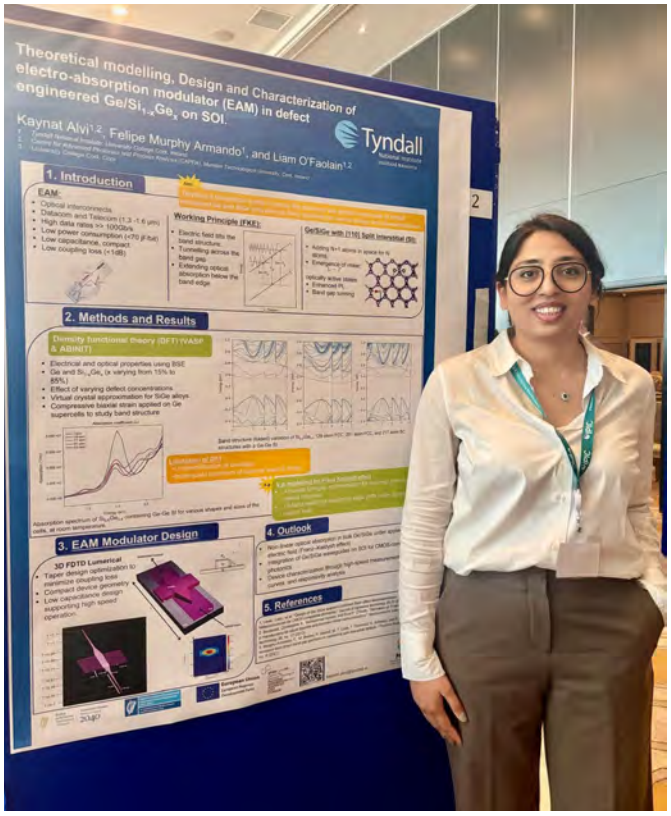
As I move through the second year of my PhD, 2025 has been a year of both challenges and growth, filled with exciting opportunities to expand my research (experimenting, and discovering what it really means to do research) and professional skills.

My research so far focuses on the theoretical investigation of optical properties in defect engineered Ge/SiGe heterostructures for electro-absorption modulators, work aimed at advancing next-generation Group-IV photonic devices. It's an area that beautifully combines physics, materials science, and engineering and I'm continually inspired by how tiny atomic scale changes can influence large scale optical behaviour.

This year brought some incredible opportunities to learn and connect as I attended two major international training programs that significantly strengthened different aspects of my research. The first was the CECAM Flagship School "Automate ab initio workflows with Jobflow and Atomate2" held at CECAM-HQ Lausanne, Switzerland, a remarkable four day program that deepened my expertise in automating density functional theory (DFT) workflows. The skills gained have been directly valuable for my ongoing theoretical simulations. The second was a completely different yet equally impactful experience: the 25th Annual J.A. Woollam Spectroscopic Ellipsometry Workshop at the University of Glasgow. This workshop offered an excellent platform to explore advanced ellipsometry techniques, recent developments in optical characterisation, and discussions with leading experts in the field. The insights acquired are proving instrumental for my collaborative work on thin-film optical materials. I was also delighted to present a poster at the Photonics Ireland Conference 2025, where I shared my recent results on defect-enhanced Ge/SiGe systems. It was a fantastic opportunity to connect with researchers and industry professionals, exchange ideas, and receive constructive feedback on my work.

Beyond the lab and simulations, I have been deeply committed to community engagement as I continued my leadership and outreach activities as President of the SPIE/OPTICA Tyndall–UCC Student Chapter. This year, we successfully organised the "Guided by Light" Student Conference, jointly hosted by the student chapters of UCD, TUD, and Tyndall. The conference brought together students, researchers, and professionals across Ireland, featuring engaging talks, student presentations, and an interactive panel discussion that sparked lively debate and creativity.

Looking back, 2025 has been a year of growth, collaboration, and discovery. Each experience, whether in research, training, or leadership, has added a new dimension to my understanding of photonics and strengthened the foundation for the next steps of my PhD journey.



A Year of Growth: Advancing Research Skills and Public Engagement
- Ethan Crawford

Since beginning my research project full time and joining the PIADS CDT, I've had the opportunity to attend numerous conferences, workshops, and schools that have further developed my skills. Recently I have begun to present my work as a poster at two conferences so far, these being PIADS Conclave and more recently PSI-K 2025. PSI-K is a major conference, primarily revolving around electronic structure theory. It was hosted in Lausanne, Switzerland with an insane number of attendees. During my week at the conference, I learned a lot from the speakers, panel sessions and insightful discussions with other PhD students. Having had the privilege to travel for a lot of conference this year, I am aiming to present a talk at conference this academic year and begin to develop that skillset.

Being a student at Queen's University Belfast, I have been presented with a lot of opportunities for taking part in outreach activities. During my time as an undergraduate student I had never helped at these events but decided to step out of my comfort zone and try it. I realised quite quickly that I had a passion for science outreach and began to throw myself at any opportunity offered. Recently there was a public engagement workshop hosted by the Leadership in Public Engagement Fellow, which was both helpful and motivational. Since that workshop I have met with the Public Engagement Fellow to brainstorm and plan an event, hoping to run around March 2026. Ultimately, this past year has been highly rewarding, not only in strengthening my technical research skills, but also in enhancing my ability to communicate science effectively to both general audiences and experts.

International Conference Attendance
- Suraj Kothuri

I actively participated in two significant international academic events in June, 2025. These events contributed significantly to my research development and professional engagement in my field of research.

I attended a one-week international 'Summer School in Biophotonics - 2025' , which offered an intensive and well-structured programme covering a wide range of theoretical and applied topics in Biophotonics. The school featured a comprehensive series of lectures and invited talks delivered by leading researchers who have made substantial contributions to the field. The programme provided valuable exposure to current research trends, experimental techniques, and emerging applications. An important aspect of the summer school was the strong international presence of research students from diverse academic backgrounds and institutions across the world, creating a highly interdisciplinary environment. Daily poster presentation sessions and informal discussions facilitated in-depth scientific exchange, enabling participants to discuss ongoing research, explore methodological approaches, and identify potential avenues for future collaboration and commercialisation were big takeaways for me. The interactive and social nature of the programme significantly enhanced networking opportunities and fostered meaningful academic connections.

In addition, I participated in the European Conference on Biomedical Optics (ECBO) held in Munich, Germany as part of larger conference ''World of Photonics Congress 2025' organised by Optica and SPIE. At this conference, I presented an oral talk based on my current research work, which provided an excellent platform to disseminate my findings to an international scientific audience. The conference brought together leading experts, early-career researchers, and industry professionals working at the forefront of biomedical optics and photonics. Presenting at ECBO enabled constructive technical discussions, critical feedback, and direct engagement with established researchers whose work closely aligns with my own. These interactions offered valuable insights into the broader impact of my research and helped refine future research directions.

Participation in these events significantly strengthened my academic profile, expanded my professional network, and contributed positively to my ongoing research activities.

Conference Review: My OPIC 2025 Experience - Qixuan Chen

In April 2025, I had the incredible opportunity to attend OPIC 2025 (Optics and Photonics International Congress) in Yokohama, Japan, which is one of the largest international events in the field, bringing together researchers and industry professionals from around the world to exchange ideas on the latest advances in optics and photonics. For me, it was both an inspiring academic experience and a memorable personal journey.

One of the highlights at OPIC 2025 was my supervisor's invited talk titled "Optical Wireless Power Transmission: Opportunities, Challenges and Progress". He began by introducing the motivation behind optical wireless power transmission (OWPT): the need for a safer, more efficient, and more flexible way to deliver energy without physical connections. Unlike traditional inductive or radio-frequency methods, OWPT relies on tightly focused laser beams to transfer power with high spatial precision, making it ideal for powering remote sensors, drones, or even future space systems.

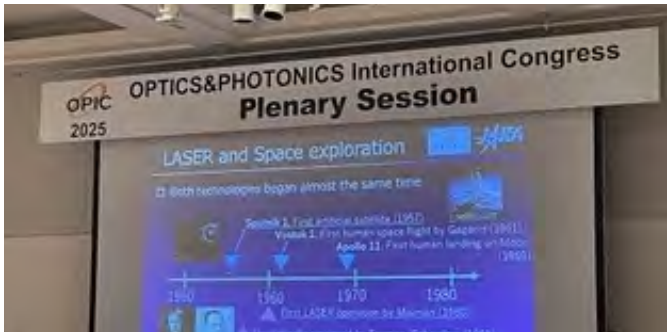
He then compared GaAs-based short-wavelength lasers with InP-based long-wavelength lasers, highlighting how each material platform presents its own advantages and trade-offs. GaAs lasers achieve higher wall-plug efficiency, which makes them well-suited for compact, high-performance transmitters. In contrast, InP systems offer better eye-safety margins but suffer from intrinsic loss mechanisms such as Auger recombination and carrier leakage. These factors reduce overall efficiency, posing a significant challenge to the advancement of high-power optical systems.

My own research focuses on semiconductor multi-quantum-well lasers for Heat-Assisted Magnetic Recording (HAMR). Although OWPT and HAMR target very different applications, both face a fundamental challenge: how to maximise energy efficiency while maintaining thermal stability. OWPT seeks to transfer power safely and effectively over long distances, whereas HAMR relies on lasers to maintain stable optical output and wavelength at high temperatures and with minimal power consumption, all to enhance magnetic recording density. Both applications demand a deeper understanding of carrier dynamics, recombination processes, and thermal effects within semiconductor materials.

Apart from my supervisor's talk, I was deeply impressed by the diversity of topics at OPIC 2025. The sessions ranged from ultra-intense mid-infrared lasers for attosecond X-ray generation to multi-petawatt systems exploring strong-field quantum electrodynamics, showing how far laser science has advanced in pushing physical limits. I also attended several tutorial sessions introducing deep-UV AlGaN laser diodes and quantum-cascade terahertz sources, where the speakers discussed how these cutting-edge technologies are finding applications in sterilisation, sensing and imaging. Another talk that caught my attention focused on silicon photonics and quantum circuits, explaining how optical chips can now integrate with machine learning to manipulate light at the quantum level.

If there was one small regret from this trip, it was that I couldn't visit The University of Electro-Communications, which has close collaboration with our research group, due to Japan's national holiday schedule. However, this gave me the chance to spend two extra days exploring Yokohama, a city full of charm and energy. I visited the harbour area, enjoyed the night view from the giant Ferris wheel, and even took a short trip to Kamakura, where I stopped by the famous filming locations of Slam Dunk, one of my favourite anime series. I also immersed myself in the local cuisine, trying traditional dishes like Hakata ramen, tempura and sukiyaki.

Overall, attending OPIC 2025 gave me the opportunity to exchange ideas with researchers and fellow PhD students from around the world, gain deeper insights into the latest trends of laser and photonic technologies and discover Japan's unique culture. Together, these experiences made it a truly unforgettable and inspiring journey.



2025 Conference Reviews
- Ibrahim Arsy

During my EngD study, I have participated actively in several international conferences and technical courses to enhance my scientific knowledge and reinforce my professional development. These include:

- Surfaces, Interfaces and Coatings Technologies International Conference 2025, Albufeira, Portugal.
- The 11th Surface Plasmon Photonics International Conference 2025, Tokyo, Japan
- Conference on Condensed Matter Physics and Quantum Materials, 2025, Bristol, England
- Heterogeneous Integration Course, Ireland, 2025.
- 2D Materials Conference, Europe, 2025.

Each of these events provided great insight into scientific aspects that relate to my project: the mechanism of surface bonding between dissimilar materials, some new plasmonic nanostructures, the physical meaning of saddle points in the electronic band structures, and two-dimensional materials for advanced device integration. These topics constitute the conceptual basis on which my work stands, and the attendance of these conferences allowed me to better understand the problems at a theoretical and practical level in those fields.

Beyond mere technical learning, these experiences helped me to develop a more holistic view of current research trends and how fundamental materials science was being translated into real-world technologies. Interacting with international researchers and industry professionals gave me a clearer sense of how my project contributes to wider scientific and industrial objectives. I was also able to identify potential directions for future collaboration and areas where my current methodologies could be refined.

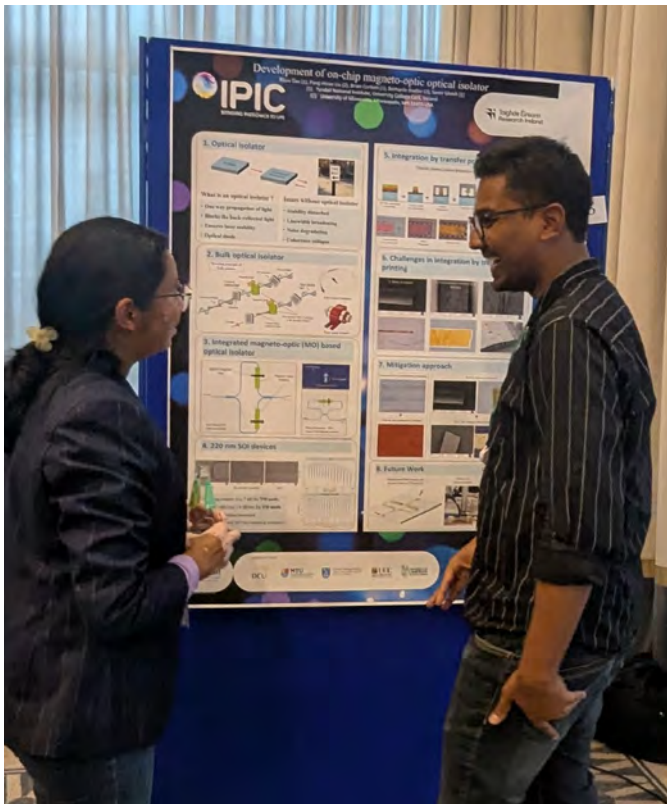
These conferences also helped in enhancing a few professional skills necessary for an EngD researcher. I gained confidence in presenting and discussing my ideas with people from different backgrounds, which enhanced both my technical communication and networking skills. Keynote speakers and Q&A sessions helped enhance my critical thinking, which enabled me to ask more focused questions while assessing how the different experimental approaches would apply to my work. These experiences have, in the end, enhanced my capability for handling my project independently. They taught me how to plan my experimental design more effectively, select relevant characterisation techniques, and define what data are most important to be measured in order to reach my research objectives. In addition to deepening my technical knowledge, these conferences have given me a greater sense of direction in research, more professional confidence, and motivation to make meaningful contributions to the field.

Conference Round-up of 2025
- Risov Das

Hi, I am Risov Das, a 3rd year PIADS PhD student in Tyndall national Institute and also part of IPIC. I am working in the field of photonics, on an on-chip integrated optical isolator realised by micro-transfer printing. An optical isolator is a very important and irreplaceable device in the photonic integrated circuit which blocks the back reflected or scattered light from entering into any device like a laser. So far, I have done simulations, fabrication of devices and process development of the transfer printing of magneto-optic thin film to achieve the final device. I'm now doing the final device fabrication run.

This year I participated in many research relatedn activities. It started with the PIADS Conclave 2025 held in the University of Glasgow. At Conclave I presented my work through a 10 mins talk where I mainly focused on the challenges of transfer printing integration of magneto-optic thin film and how we solve the problems. I also designed the template of the poster presentation.

The next event that I actively participated in was the Photonics Ireland Conference 2025 held in Cork, Ireland. It was a nice conference in the field of photonics in Ireland with more than 250 attendees. I presented my work there in the form of poster presentation, emphasising the importance of heterogeneous integration by micro-transfer printing. I interacted with researchers, PhD students and industry experts which was helpful. The conference was full of interesting talks from some keynote speakers.



The next event that I engaged in was Tyndall Internal Conference 2025. There also I presented my work as poster presentation to mainly Tyndall researchers. The exchange of ideas by presenting work in front of a diverse group of people proved to be very helpful. Also, I did two Education and Public Engagement (EPE) activities – where I interacted with the public and school kids showcasing the application of photonics in a simple form which is full of fun.

Lastly, I would like to say that this year was full of research activities, although I was very busy in carrying out my own research project which went through lots of challenges, I kept myself engaged in presenting my work and explaining the novelty of the process and the importance of micro-transfer printing.

Reflection on my PhD Journey and Conference Review - Annisa Sugiarti

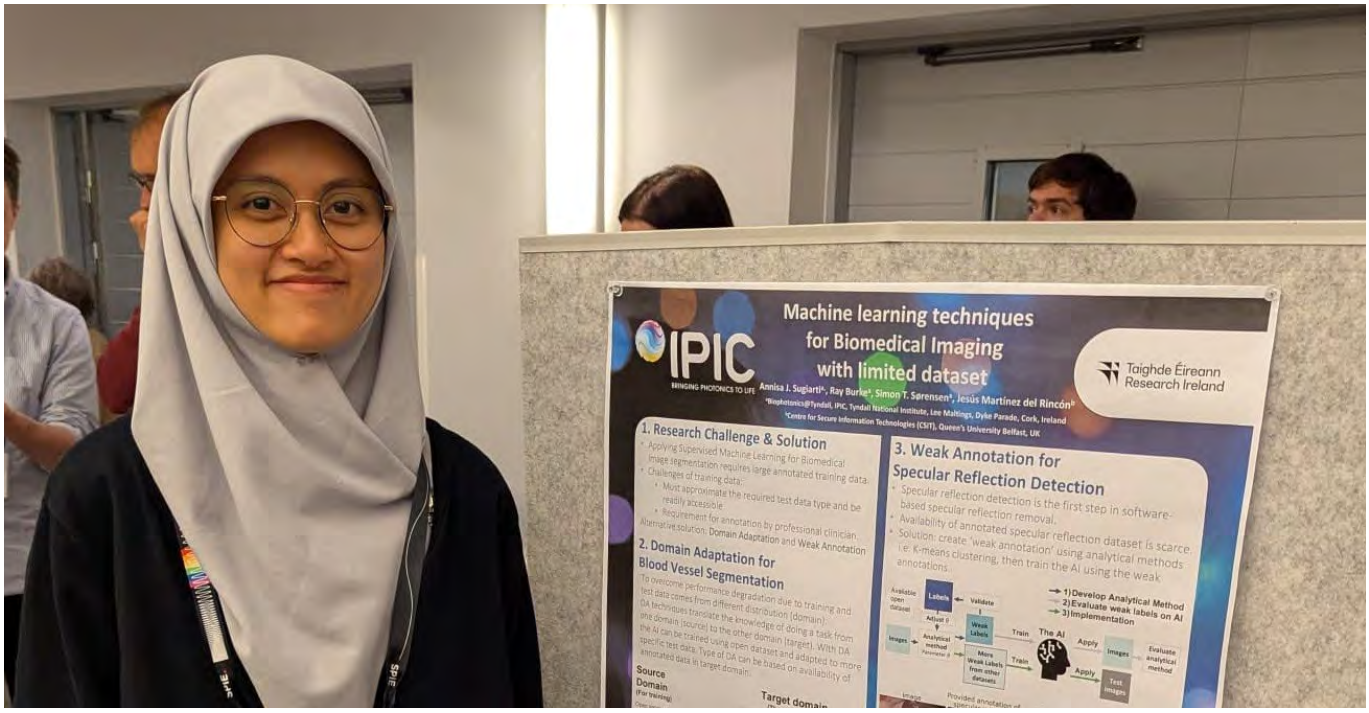
My PhD project is an intersection between two different fields, the emerging area of artificial intelligence (AI) and that of medical imaging which is always essential for healthcare improvement. Specifically, it addresses the issue of the requirement of a large amount of data with good quality to train AI models. This is to ensure that the AI, which will be used to improve the quality of images from a microcamera for endoscopy and to detect biologically important features, will provide useful and trustworthy results to the clinicians.

Sometimes I question myself, how well-accepted AI is in biomedical imaging and how to catch up with the fast-developing computer science field which I am new in. Fortunately, I got the answers through getting the chanceto attend a summer school and two conferences. In the Biophotonics Summer School on 7th-15th June in Sweden, I presented a poster titled "Machine Learning Techniques for Biomedical Imaging with Limited Dataset". Then, I attended my first conference which is the Irish Machine Vision and Image Processing (IMVIP 2025) on 1st-3rd September in Derry, UK where I presented the topic "Retraining is All You Need: Few-shots Fine-Tuning for Cross-modality Domain Adaptation in Medical Imaging". After that I also attended Innovative Medical image Processing with AI-driven preCision Technologies (IMPACT), part of International Conference on Image Analysis and Processing (ICIAP 2025) on 15th September in Rome. The last conference was held in hybrid mode, and I got the chance to present my topic about "Automated Specular Reflection Detection Using Weak Annotation for Deep Learning Training" online. Attending these events allow me not only to get feedback from the wider community, but also to see how the research to apply AI in medical imaging grows within different research groups.

In the Biophotonics summer school, we had a series of lectures from different experts working on different biophotonic techniques. I was quite surprised that many AI applications for biophotonics have been included by some of the experts within their research group. Some student posters also showcased similar AI applications. The presented applications ranged from feature detection to classification of tissue health. These gave me views on how wide and deep research into AI applications has expanded outside the computer science field towards biophotonics and biomedical fields. The poster session also gave me a chance to practice on how to not only present, but also to convince the wider community the usefulness of my research of using AI for biomedical imaging field.

On the other hand, in the other two conferences which were more focused on the AI itself, I met different groups developing different AI models and techniques to improve AI applications in medical images. Issues such as training dataset availability and making the AI to be not a mere "black box" but more explainable to the clinicians were also addressed. These conferences indeed gave me not only more technical feedback on my work, but also more inspirations towards newer AI models and techniques that might be applied to my own project.

Communicating with the different research communities answers my own doubts about my project and inspires me to improve my technical and transferable skills. I truly appreciate all the support I have on my PhD and making it possible for me to attend all these events.



Micro transfer printing course
- Giacomo Graziano

In September I attended a specialised course on Micro-Transfer Printing (MTP) held at the Tyndall National Institute in Cork, as part of the PIADS training programme. I joined the course with the goal of exploring emerging technologies and assessing potential avenues for collaboration or integration with my ongoing research projects. Given the rapid development of advanced semiconductor manufacturing methods, I considered this course an excellent opportunity to gain insight into this promising and versatile technique in the field.

The course provided a comprehensive overview of the principles and applications of micro-transfer printing, a technique that enables the precise transfer of micro-scale devices from one substrate to another. This process offers new possibilities for heterogeneous integration, allowing the combination of different materials and functionalities that would be difficult or impossible to achieve through conventional fabrication methods. The instructors presented the underlying concepts in a clear and structured way, combining theoretical lectures with practical examples drawn from real industrial and academic applications.

One of the most valuable parts of the course was the in-depth exploration of the technology, which focused on the fundamental mechanisms and building blocks of the MTP process. Rather than a purely hands-on session, this segment provided a detailed theoretical understanding of how the technique operates at its core — from the physics of adhesion and release to the principles governing alignment accuracy and transfer fidelity. We examined the interplay between material properties, process parameters, and device geometry, gaining a clearer picture of what enables MTP to achieve such precision and versatility. This analytical perspective offered a strong foundation for appreciating how the method can be tailored to different integration challenges and applications.

The course also featured lab demonstrations at the Tyndall Institute, which offered a first-hand look at the specialised equipment used for MTP. Observing the process in action gave me a much clearer understanding of its precision and the complexity behind achieving reproducible, high-yield results. These demonstrations complemented the theoretical sessions effectively, bridging the gap between conceptual understanding and real-world implementation. Seeing the automatic transfer of such small devices at such a high speed and with so much accuracy was remarkable. Technology in action is fantastic! And that is why doing an EngD and bringing your own idea to life is so motivating!

Another key component of the course was the presentation of case studies showcasing how micro-transfer printing is being utilised in areas such as photonics, flexible electronics, and advanced packaging. These examples highlighted the versatility of technology and its potential to revolutionize device integration across multiple domains. For my own work, these discussions sparked ideas about how similar techniques could be applied or adapted to enhance the performance and design flexibility of vertical-cavity surface-emitting lasers (VCSELs) and related optoelectronic structures.

Beyond the technical content, the course was a great networking opportunity. I had the chance to engage with researchers, engineers, and industry representatives who are actively working on MTP development and applications. These interactions opened the door to potential collaborations and provided valuable perspectives on current trends and future directions in the field.

Overall, attending the Micro-Transfer Printing course was an invaluable experience, both in terms of professional development and research inspiration. It deepened my understanding of a cutting-edge fabrication technique and highlighted its relevance to next-generation photonic and electronic devices. I am grateful to have had this opportunity through the PIADS programme and look forward to exploring possible future projects that build on this exciting technology.

My first publication
- Fariba Jamali

As part of my PhD research within the PIADS programme, I successfully published a journal article entitled "SOA-based optical burst power equalisation for high-speed next generation passive optical networks" in Optics Express, a leading peer-reviewed journal in the field of photonics. This publication represents a significant milestone in my doctoral journey and provided invaluable experience in conducting, documenting, and disseminating high-impact research.

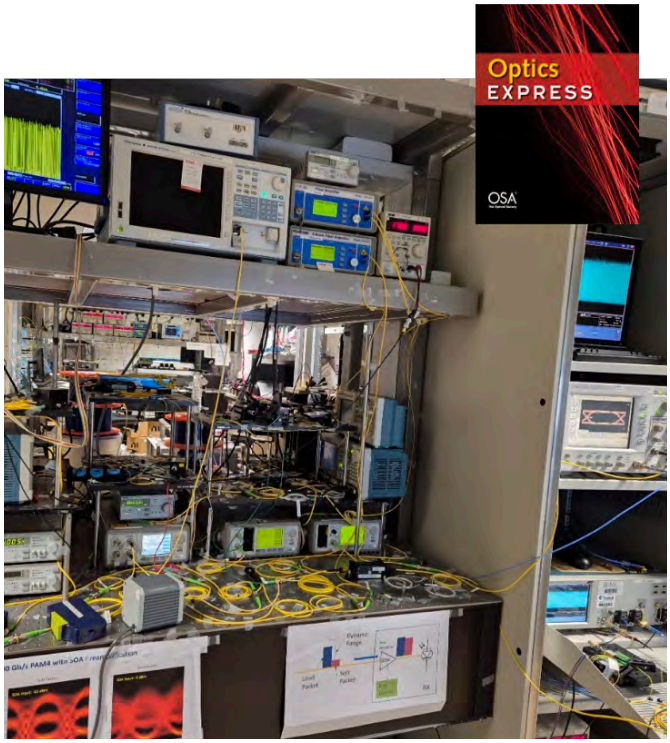
The paper addresses a critical challenge in next-generation passive optical networks (PONs): managing large burst-mode power variations at high data rates. Specifically, the work proposes and experimentally validates two novel semiconductor optical amplifier (SOA)-based optical power equalisation techniques to extend the upstream dynamic range of a 100 Gb/s PAM4 PON system. By shifting burst power equalisation from the electrical to the optical domain, the research demonstrates a reduction in receiver complexity while achieving a wide dynamic range compliant with emerging 50G PON standards. This work builds upon my earlier conference contribution and extends it by addressing burst-mode operation, fibre dispersion, and low-gain receiver constraints.

Preparing this journal article was a highly rewarding process. It required careful experimental design, extensive measurements, and rigorous data analysis to convincingly demonstrate system performance under realistic PON conditions. One of the main challenges was ensuring clarity and completeness in describing a complex experimental setup and control methodology while maintaining a concise narrative suitable for a high-impact journal. This process strengthened my technical writing skills and my ability to present results in a structured and critical manner.

The peer-review process was particularly educational. The reviewers' comments prompted deeper analysis of the SOA behavior, clearer justification of design choices, and improved discussion of practical implementation considerations. Addressing these comments enhanced both the technical quality of the paper and my understanding of how to position research contributions within the broader scientific context. Through this process, I developed resilience and learned how to respond constructively to critical feedback which is an essential skill for an academic researcher.

This publication has also contributed directly to my professional development. It has improved my confidence in communicating complex ideas, reinforced my expertise in optical access networks, and strengthened my academic profile within the photonics community. Furthermore, the work aligns closely with our group objectives by combining fundamental photonic device behavior with system-level innovation and practical relevance.

Overall, the experience of publishing this journal paper has been instrumental in advancing my PhD research and training. It has reinforced the importance of rigorous experimentation, critical self-review, and effective scientific communication, all of which are essential as I progress toward completing my doctorate and pursuing a research-oriented career.



Update on my research – Winner of Best Poster Presentation at Photonics Ireland and runner up at the Tyndall Internal Conference

- Jordan Walsh

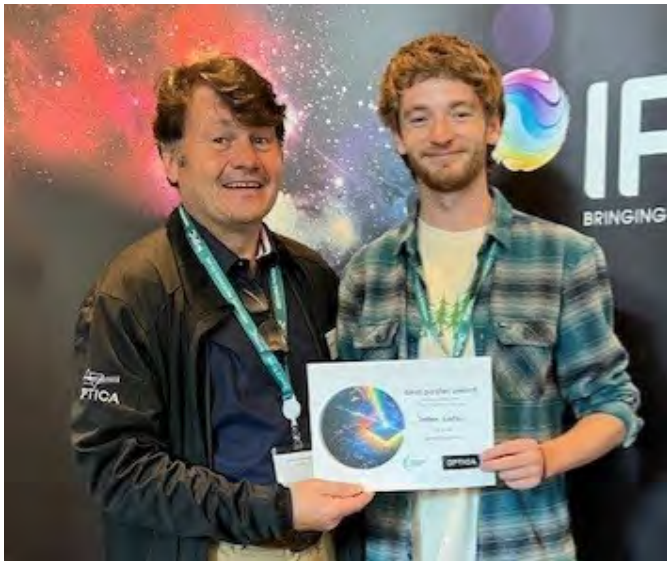
The theoretical aspects of my work for the last year have been focussed on optimising quantum well (QW) structures for use in Integrated Photonics, and to setup a framework for the design of photonic devices throughout the remainder of my PhD project.

We've taken a classical machine learning approach to inverse design by using Genetic Algorithms. By treating multi-layer QW heterostructures as parameterised entities, we can encode information about the structure into "chromosomes" which together fully describe the QW (For example, we may consider the thickness and specific (qua)ternary composition for each layer of material in the heterostructure, including the QW barriers). This allows for the use of biological inspired evolutionary operations (for example: crossover, mutation, migration) to generate new entities based on an existing population of solutions. Entities are evaluated using some merit of "fitness", and higher fitness solutions are given priority in the evolutionary process ("Survival of the fittest"). The idea of fitness is powerful, and allows us to perform inverse design. The fitness function can be designed to target specific qualities of a QW material which we may want to take advantage of (For example; bandgap, absorption, etc.) when designing photonic devices and photonic integrated circuits (PICs). Entities evolve in the population, with many new solutions being produced in each generation, and over time the population converges to a set of unique solutions which maximise our fitness function.

In particular, I have focussed on developing a fitness function which will solve for materials which efficiently take advantage of quantum well intermixing (QWI) in a collaboration with the Photonic Theory Group (Chris Broderick, Tommy Murphy). QWI is an experimental technique which we can do selectively on areas of a wafer and works by diffusing atomic species in the QW. The result of QWI is an altered bandgap, allowing for the creation of active and passive regions on chip. Using the developed genetic algorithm framework, and theoretical models for QWI and absorption, I have a reliable method to (i) find structures which have specific bandgaps pre- and post-intermixing, (ii) simultaneously optimising for a QW geometry with high performing electro-absorption qualities at the band-edge based on the quantum confined stark effect (pre- or post-intermixing), while (iii) staying within conventional fabrication limits.

This process has been parallelised on Tyndall's computing cluster and the simulations utilised are based on highly efficient numerical methods. This has allowed for the evaluation of over 1,000,000 unique QW structures so far in the project. We are currently working towards growing a subset of the promising material identified using this algorithm for use in novel photonic devices based on QWI. I am aiming to fabricate devices based on these materials throughout the remainder of my project.

My work has won awards for "Best Poster Presentation" at the Photonics Ireland 2025 conference and I was runner-up for the "Best Student Poster" at the Tyndall Internal Conference 2025 - netting me winnings of 455eu, which I have put towards a new computer!



My visit to the University of British Columbia - Owen Moynihan

In February and March of 2025, I had the opportunity to visit the University of British Columbia in Vancouver, Canada. This was done in conjunction with a collaboration with Professor Lukas Chrostowski's group. This was facilitated by a Wrixon travel bursary, which is a grant provided through the Tyndall National Institute and Professor Gerry Wrixon. During my time there, I was able to work on novel methods of laser integration to photonic integrated circuits. During this work, we achieved coupling between transfer printed lasers and silicon photonic circuits using a 3D printed laser defined polymer waveguides. This waveguide was able to attach the transfer printed lasers with the silicon waveguide, allowing light to enter the silicon waveguide platform.

This work aims to address a major limitation of silicon photonics, which is the inability of monolithic silicon to efficiently produce light! Aside from this, I was also given the opportunity enter their fabrication facilities, test labs and lectures to develop my skills and understanding. It also paves the way for future possibilities and collaborations between research teams in the future. This visit significantly raised the impact of my research by gaining access and expertise from leaders in 3D photonic waveguide fabrication, which saw immediate effects as it solved previous issues seen in my research. This PhD and experience was made possible through the PIADs program, which has given me an unforgettable experience as I aim to finish my PhD.

European Conference on Optical Communications (ECOC) 2025 – Copenhagen, Denmark

- Conor Russell

This September I had the opportunity to attend and present at the European Conference on Optical Communications (ECOC), held in the vibrant city of Copenhagen, Denmark. ECOC is one of the largest and longest-running events in the field of optical communications, with ECOC 2025 marking the conference's 51st year. This edition was among the biggest to date, bringing together approximately 2,000 technical conference delegates from more than 70 countries, alongside over 340 companies showcasing their technologies in the exhibition. Returning to Copenhagen was particularly meaningful for me, as I previously completed my MSc in Photonics at the Technical University of Denmark (DTU), where the course laid strong foundations for my current PhD research.

ECOC 2025 offered a remarkably wide array of talks covering everything from coherent transmission and integrated photonics to quantum communication, machine-learning-enabled networks, and advancements in optical fibre sensing. The diversity of topics highlighted the current trends shaping the photonics community, and attending talks outside my immediate research area helped broaden my perspective on the field. Along with the many informative sessions, networking was one of the most valuable aspects of the conference. Throughout the week, I had the chance to speak with researchers working on a range of photonics technologies and to engage with industry professionals and product engineers in the exhibition hall, which provided helpful insight into current industrial priorities.

A highlight of the week was presenting my paper, "Dual Comb Distributed Acoustic Sensing for PON Multi-Branch Monitoring at the Remote Node." The paper explores how fibre-optic sensing can be integrated with existing broadband access networks to monitor vibrations and disturbances across multiple network branches using a single system. It proposes a novel photonic system architecture that enables simultaneous sensing across the network while leaving normal communication services unaffected, pointing toward more scalable and practical fibre-sensing solutions. Speaking to a room of specialists created a great atmosphere for discussion, and the audience responded with a level of interest that exceeded my expectations. I received several thoughtful questions during the session and had productive follow-up conversations afterwards. The constructive feedback sparked new ideas and left me feeling energised to continue developing the project.

Outside the technical programme, the conference dinner at Langelinie Pavillonen offered a welcome opportunity to relax and chat with other attendees in a more informal setting, rounding off the week with a memorable social evening.

Attending ECOC 2025 has been one of the most valuable experiences of my PhD. I came away with a broader technical understanding, constructive feedback on my work, and renewed motivation for the final stages of my project. Presenting to a wider audience helped reinforce the relevance of my research and gave me greater confidence moving forward. I am grateful to PIADS for supporting this opportunity.

Pierre Maidment

My name is Pierre and I am a photonics design and testing engineer at Duality Quantum Photonics in Bristol. I finished my PhD thesis with PIADS in early 2023 and immediately joined DQP when there were only 6 employees in the company. We are building photonic integrated devices for quantum computing applications and fast optical processors.

My current role focuses on designing photonic integrated circuits in the increasingly popular thin-film lithium niobate platform and, once they have been fabricated in the cleanroom, undertaking the optical testing of the devices in our lab. My day-to-day activities can be very varied, from optical simulations of the components in the photonics circuit, such as high efficiency fibre-chip couplers, inverse design structures and electro-optic modulators, to laying out the full circuit into a mask or reticle before it is sent to our fabrication team to be used for the lithography exposures.

On the experimental side of things, I am also in charge of validating the automated optical testing of the fabricated devices using optical fibre arrays and both DC and RF electrical probes. I built and programmed a setup consisting of multiple motorised stages that, together with lasers, optical spectrum analysers and photodetectors can automatically measure all of the devices over the photonic chip and even a full wafer! After testing has been completed, we occasionally package the photonic chip by attaching optical fibres and wire-bonded electrical connections to a printed circuit board, before putting the device into a cryostat to a temperature below 1K!

As we achieve higher quality photonic chips with excellent coupling efficiency and low propagation loss, we are looking to use the circuits for quantum applications. Lithium niobate has a high nonlinear susceptibility which allows us to integrate single photon sources directly into the photonic circuit by periodic poling of the lithium niobate crystal domains. After careful engineering of the crystal domain structure, the process spontaneously converts photons from one wavelength to produce photon pairs of a longer wavelength, so we also must design photonic circuit components for different wavelength ranges. This involves a lot of design and simulation work to accommodate varied optical circuit designs with many operating wavelengths, fortunately lithium niobate also has a wide transparency window from the UV to beyond the mid-infrared. Eventually, we will also integrate superconducting detectors into these circuits to detect the single-photons on-chip, to alleviate the excess loss caused by off-chip coupling structures.

I have enjoyed the transition into industry after completing my PhD in Glasgow, especially because I am using the full skillset that I built in my PhD in photonic component design, fabrication and characterisation while maintaining an independent approach to much of my work. I also enjoy working in our small team across 2 sites and contributing to written technical reports, grant applications and specification documents to customers.

Daniel Kelly

Under Prof Marc Sorel's supervision, I researched the electro-optic properties of thin-film lithium niobate waveguides and structures at the University of Glasgow. It was a fantastic opportunity to gain so many hard skills in nanofabrication and optics, which few people ever get the chance to even try: SEM microscopy, AFM, electron beam lithography, high-power laser measurements, and so on. I enjoyed being part of the JWNC community at the University of Glasgow, as well as PIADS.

After my PhD I decided to transition into patent law, getting a job at a London-based firm, Gill Jennings and Every. Even though I don't fabricate samples anymore, I still use a lot of the knowledge and skills gained during the PhD. I would say, without hesitation, that the analysis skills I had to develop as a researcher are highly transferable even to the corporate world. Almost no amount of information I've come by at work, so far, has been as complex as starting a literature review in an unfamiliar area!

I feel very lucky to have been part of PIADS over the years of my PhD. The biggest highlight and, possibly, the biggest discussion point in all my job interviews was the strength of industry ties, most prominently Seagate, as well as Vector Photonics and other companies that I had the privilege to visit, interact with, and get to see what goes on behind closed doors.

The community at PIADS is another massive highlight. It was amazing to make so many friends across three countries and more than three institutions, and being able to follow how their research progressed.

And as much as the careers-oriented training seemed unnecessary at the time, I'm glad to have done it, and to have had the opportunity to do it with PIADS, because it does make it much easier when it comes to doing all the same things at work (obviously with much higher stakes at hand!). I was quite surprised to meet people at work who said they haven't done a presentation since school, or early undergraduate!

Serene Pauly

Over the past few months, I've really settled into my role as a Sensor Technology Engineer in the R&D team at Synaptec in Glasgow. Moving from my PhD into an industry-focused research environment has been energising, and it's been rewarding to see how naturally my academic work feeds into real engineering challenges.

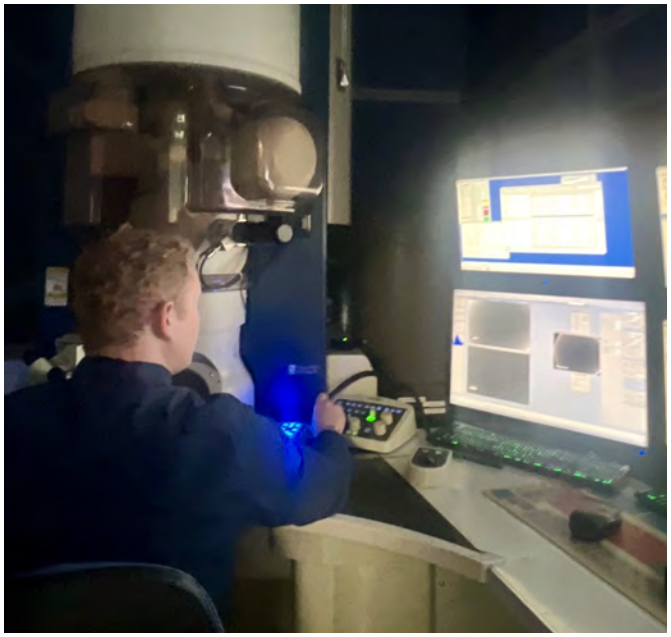
My work centres around developing and testing fibre-optic and photonic sensing technologies for power grid monitoring. Day to day, I'm split between hardware development, signal behaviour analysis, and validation testing. Shifting from nanoscale plasmonic measurements to large-scale system sensing has given me a fresh perspective on precision, noise, and data interpretation, and I've been able to use that mindset across several ongoing projects.

A typical week involves designing prototypes, running characterisation experiments, and working closely with the electronics and software teams to integrate results into Synaptec's wider systems. I enjoy the collaborative nature of the work and the ownership I have over my projects, whether that's evaluating signal-processing methods, exploring new sensing approaches, or planning test cycles.

I'm also genuinely grateful to PIADS for the support and training that helped shape this transition. The courses I completed through the programme, especially the CMI leadership certification have been incredibly useful. The project-management, communication, and strategic-thinking skills I developed there are things I rely on every single day, from organising experiments to presenting findings and coordinating with different teams.

Overall, this role has been a really natural continuation of my research journey, and I'm thankful for the strong foundation PIADS provided. I'm excited to keep growing in a role that blends technical depth with meaningful impact.

Colin Kirkbride



When deciding where to direct my career after PIADS, I knew I wanted to stay in research. Throughout my PhD research, I focussed on understanding magnetic spin textures in multilayer magnetic thin films with applications in novel data storage devices supported by Prof. Stephen McVitie. I utilised a range of techniques such as Lorentz transmission electron microscopy to image and analyse these magnetic structures, leading to direct measurements of wall widths and domain density. Importantly these were both key optimisation parameters for domain-based magnetic storage in commercial hard-disk drives. From this research, it was clear, I enjoyed the demands of finding out new things and the challenge of investigating problems which would lead to new insights in technologies with real-world impact.

With this in mind, I began a postdoctoral research position at the University of Glasgow with Prof. Donald MacLaren, working on a high-impact Innovate UK funded project called UK-GRAFT. The project involved direct collaboration with Paragraf, the first company in the world to manufacture large-scale graphene-based devices who were scaling up their device production from 2" to 6" wafers. The main objective was to characterise fabricated devices using electron microscopy, assessing the device architecture for insights into the lithography processing stages and characterising their graphene structure. In collaboration with engineering colleagues, we also investigated the impact of accelerated ageing tests on device performance. I found the project particularly enjoyable since I gained valuable insight into the workings of an industry directed research programme. The notable pace difference between academia and industry was a refreshing challenge which helped build my communication skills and it was rewarding to see the results of my research directly impacting commercial direction.

Having spent almost a year on the UK-GRAFT project, I knew I wanted to return to my interests in magnetism and storage materials. As such, I applied for (and was successfully awarded!) an EPSRC Doctoral Prize Research Fellowship. The Fellowship project titled 'Uncovering the Influence of Molecular Films on Magnetic Spin Textures using Multimodal Electron Microscopy' aimed to build on work during my PhD which showed how organic fullerenes can directly impact magnetic domain textures in multilayer films. I am now exploring the use of alternative organic molecules and their impact on multilayer domain textures. The primary goal of this research is to identify molecules able to induce complex magnetic structures such as skyrmions which show promising applications in neuromorphic computing and next-generation logic devices. The Fellowship also coincides with an exciting time for the Materials and Condensed Matter Physics group at the University of Glasgow, which will see the commissioning of the MagTEM2 microscope in 2026. I hope to make good use of this once it is installed!

It goes without saying that much of my own research direction and success would not have been possible without the continued support of my supervisors Prof. Stephen McVitie, Prof. Donald MacLaren and the wider Materials and Condensed Matter Physics Group. There are also many other collaborators involved in the sample fabrication at the Henry Royce Institute in Leeds and further afield who I am also grateful to. I strongly believe that my time in the CDT has enabled me to embark on an exciting research career and I know the collaborations, skills and partnerships I have made through PIADS will serve me well now and into the next stages of my career.

Winter School 2025

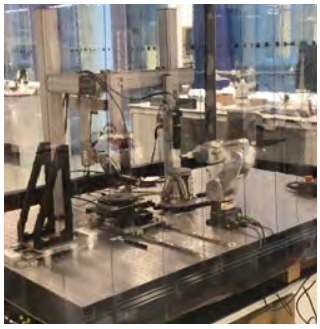
We were delighted to return to Queen's University Belfast, for before our annual Photonic Integration and Advanced Data Storage Centre for Doctoral Training Winter School. This two-day event is dedicated to supporting the personal and professional development of our PhD researchers, providing a focused opportunity for our doctoral community to build the skills, confidence, and networks needed to excel in both academic and professional settings.

The programme featured a range of engaging and informative sessions. Highlights included insights into the cutting-edge research taking place within the Smart Nano NI laboratory, with presentations from Mike Hardy and Yessenia Jauregui-Sánchez. Students also took part in a practical session on "How to Use LinkedIn Effectively for Researchers", with special thanks to Mike Hardy for sharing valuable tips and perspectives on leveraging the platform for professional visibility, collaboration, and personal branding.

A thought-provoking session delivered by Autism NI provided valuable insights into autism awareness and understanding, reinforcing our ongoing commitment to fostering an inclusive, supportive, and equitable research culture. In addition, Dr Michael O'Connor led an insightful Knowledge Management session, while Tom Magee delivered a practical workshop on navigating difficult conversations and developing the communication skills required for challenging professional interactions.

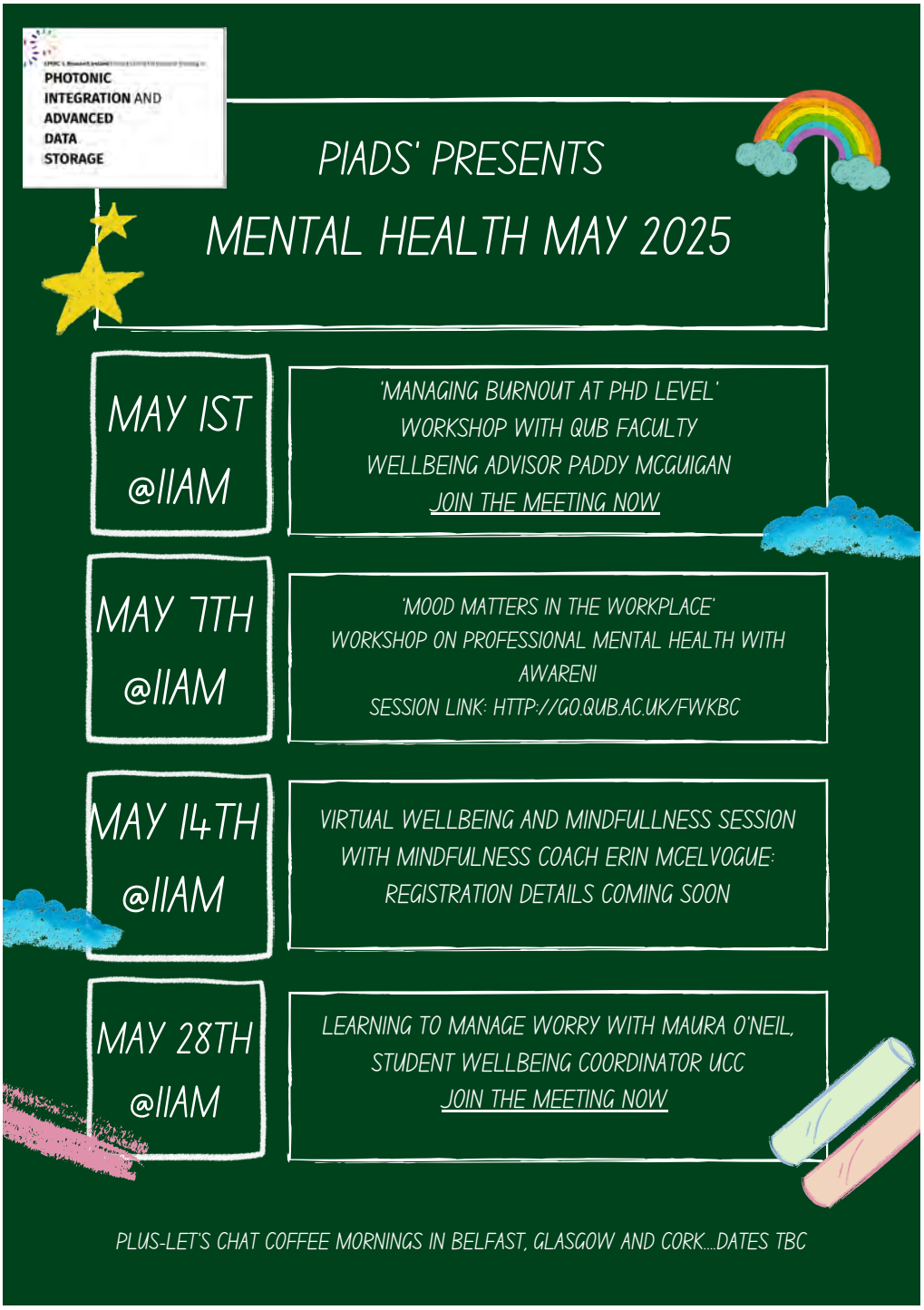
Complementing the academic and professional development activities our students also enjoyed a visit to the W5 Science Museum on Wednesday evening, providing a relaxed and enjoyable social element to the programme.

Huge thanks to the PIADS team — Lynda Mahon, Adam Barr, Elisabeth Wintersteller and Lisa Campbell — as well as our guest speakers and students, for contributing to such a valuable, engaging, and enjoyable Winter School experience.



Mental Health May

Mental Health May was a meaningful initiative for PIADS CDT PhD students, creating valuable space to focus on mental wellbeing during the doctoral journey. Delivered across May, the programme brought together a series of online workshops and sessions that addressed relevant challenges, including managing burnout, maintaining good mental health in the workplace, and developing practical tools for mindfulness and managing worry. Led by experienced wellbeing advisors and mental health professionals, the sessions were approachable, supportive, and directly applicable to students' day-to-day experiences. The mix of structured workshops and more informal opportunities for connection helped conversations around mental health and encouraged students to engage openly with available supports. Overall, Mental Health May was a successful and positive event that reinforced PIADS' commitment to supporting the wellbeing of its PhD community



Conclave 2025

Conclave 2025 marked another successful delivery of our flagship student-led Research Showcase hosted this year at the University of Glasgow. The programme demonstrated the strength of cross-institutional partnership between Queen's University Belfast, the University of Glasgow, and the Irish Photonic Integration Centre, highlighting a shared commitment to student-led research excellence in photonics and related fields.

A key feature of this year's event was a careers roundtable that brought together leading photonics companies from the UK and Ireland. This session provided students with valuable insight into industry expectations, emerging career pathways, and the practical application of academic research, underscoring the strong links between PIADS and the wider photonics sector.

The keynote address by Dr Cleitus Antony, Senior Staff Researcher at the Tyndall National Institute, was a particular highlight. Drawing on more than two decades of experience, Dr Antony delivered an engaging and forward-looking perspective on the convergence of artificial intelligence and photonics, illustrating how these technologies are reshaping research, industry, and society.

Central to Conclave 2025 was the opportunity for PIADS students to present their research through posters and oral presentations. The breadth, originality, and technical depth of the work on display reflected both the high calibre of research and the supportive research environment fostered by the programme. The event was further strengthened by the generous support of Seagate Technology, whose sponsorship and student prizes recognised outstanding research contributions.

Overall, Conclave 2025 successfully upheld its tradition as a vibrant forum for knowledge exchange, professional development, and interdisciplinary collaboration. The event demonstrated the continued vitality of PIADS as a platform for nurturing emerging researchers and advancing student-led innovation in photonics and beyond.

Northern Ireland and Glasgow Science Festival

The NI Science Festival offers more than 250 events across 90+ venues, celebrating the wonders of science, technology, engineering, and maths (STEM). We were delighted to take part once again this year.

Educational outreach is a core pillar of work for PIADS, as we aim to inspire and empower the next generation of scientists and engineers.

On Tuesday, we welcomed school students to Yelo for a STEM Careers Event, featuring talks from Smart Nano NI consortium partners including Seagate Technology, Cirdan Ltd, and Queen's University Belfast | School of Mathematics and Physics.

The session highlighted the wide range of STEM career pathways available, with PIADS PhD student Catalina McLaughlin sharing insights into her PhD journey so far.

We also had the opportunity to take part in another exciting event alongside the fantastic Smart Nano NI team, showcasing the incredible potential of 3D printing.

The team demonstrated their advanced 3D printing capabilities, including a recent collaboration with the QUB Maths Department focused on printing complex mathematical shapes. Visitors were also introduced to Smart Nano's high-resolution 3D scanning technology, which creates detailed digital models of physical objects—allowing parts to be replicated with ease. Students and visitors alike enjoyed scanning their own objects and seeing this technology in action.

A huge thank you to all the volunteers who made these events possible: Mike Hardy, Yessenia Jauregui-Sánchez, Lynda Mahon, Ethan Crawford, Samson Yap, and Adam Barr.

We're looking forward to continuing our participation this year with our partners at Seagate.

We were pleased to report that PIADS PhD students once again participated in the Glasgow Science Festival, a vibrant celebration of science, discovery, and community engagement. As Glasgow marked its 850th anniversary, this event provided a timely opportunity to engage with the public and share the excitement and relevance of cutting-edge research.

Public and educational outreach was a core component of the PIADS research culture rather than a one-off activity. By taking science beyond the laboratory, our PhD researchers developed vital communication skills, inspired future generations of scientists, and strengthened connections with the wider community. From explaining advanced concepts in photonics to exploring the science behind everyday phenomena, the students demonstrated a strong commitment to making research accessible, engaging, and inclusive for audiences of all ages.

We would like to extend our sincere thanks to Ruairidh Heron Cunningham and Che Watson for their valuable contributions to this outreach activity.

Rolls-Royce Doctoral Symposia

We are pleased to share that three PIADS CDT students, together with members of our executive team attended the Rolls-Royce Doctoral Symposia, that took place from 30 June to 3 July 2025 at the Rolls-Royce Learning & Development Centre in Derby, UK. This annual event convenes doctoral researchers and industry leaders to showcase and discuss cutting-edge research across a broad range of disciplines. It provides an excellent platform for our students to engage with peers, present their work, and gain valuable insights from across the wider Rolls-Royce research community. Technical presentations and posters at the event covered a broad range of research themes, including Manufacturing, Materials, Mechanical Integrity, Design, Electrical, Controls, Services, Repair, and Nuclear Engineering, with further themes planned for future events. The session built on the recent University Technology Conference, where Lynda Mahon, PIADS CDT Executive Manager, delivered an engaging and informative presentation on the VIVA process, reinforcing our commitment to deepening technical engagement with our key University partners.

Guided by the light Student Conference

PIADS was delighted to be part of the team to deliver Guided by Light – Student Conference 2025, held on 1–2 September at the Tyndall National Institute. The two-day international conference was hosted by the Irish Optica Student Chapters and SPIE Student Chapters, and brought together Master's and PhD students in photonics alongside members of the wider scientific community with an interest in the science of light.

Supported by PIADS CDT, SPIE, Optica, Edmund Optics, Technological University Dublin, and the Centre for Advanced Photonics & Process Analysis, the conference delivered a vibrant programme of keynote talks, student presentations, poster sessions, and networking opportunities. The event provided an inclusive platform for knowledge exchange and skills development among early-stage researchers.

Research Ireland, Cork

Following the Guided by Light Student Conference the 11th Photonics Ireland Conference (3–5 September) was hosted by the Irish Photonic Integration Centre. This biennial conference brought together PhD students, early career researchers, academic leaders, and industry partners from across photonics and semiconductor research.

Conference highlights included keynote presentations from Kei May Lau, Brian Pogue, and Aaron M Lowe. PIADS-linked research was showcased through contributions such as Thomas McCormack (PIADS, Queen's University Belfast School of Mathematics and Physics) on plasmonic nanoantennas, and Dr Mike Hardy (Smart Nano NI) on white light transmission spectroscopy. The programme also featured engaging poster sessions, short talks, an industry exhibition, and a panel discussion chaired by Patrick Morrissey, addressing the role of public engagement in modern research.

The conference themes spanned photonic materials and devices, optical sensing, nanophotonics and plasmonics, optical communications, integration and packaging, quantum photonics, applications in health, energy and the environment, and high-power and ultrafast lasers.

PIADS acknowledges and thanks all participants, speakers, organisers, and sponsors — including Research Ireland, Trinity College Dublin, University of Limerick, Dublin City University, and University College Cork — for their contributions in making both events highly successful and impactful.

Our Industry – The Foundation of PIADS

The jointly funded EPSRC and Research Ireland CDT Photonic Integration and Advanced Data Storage (PIADS) centre addresses a unique technological opportunity - the intersection of photonic integration and data storage. The success of CDT PIADS 2.0 is contingent on the continuation and evolution of our unique anchor - tenant partnership model which brings together a range of strategic partners of different shapes and sizes, each making valued contributions to enrich the PIADS 2.0 training environment. The make-up of partner companies mirrors the photonics industry in the UK & Ireland. The founding vision of CDT PIADS is to train cohorts of high calibre doctoral research students in the skillsets needed by the data storage and photonics partner base & the wider UK supply chain. Students are trained in an interdisciplinary environment encompassing the five themes of robust semiconductor lasers, planar lightwave circuits, plasmonic devices, advanced characterisation and materials for high density storage. The programme embeds a strong ethos of intellectual enquiry that empowers students to move between fundamental and applied research through the appropriate combination of high level technical, scientific and research training; courses in innovation, management, leadership and personal effectiveness; industrial seminars and placements; student-led activities such as conclaves, educational outreach and winter schools.

Steering Board Members

The CDT Steering Board provides important oversight & guidance on the strategic direction of our CDT, ensuring that it remains closely aligned to industry roadmaps.

It has executive & oversight authority over all aspects of strategy, policies & performance, meeting biannually to monitor progress against the CDT Key Performance Indicators. These include: the recruitment of a diverse, well-qualified student cohort; the delivery of a high quality & dynamic doctoral training programme; the provision of rich & embedded industrial engagement; the delivery of doctoral research projects that are cutting-edge, innovative & collaborative; & strong & robust governance & management.

Prof Robert Bowman - Director
Prof Paul Townsend - Co Director
Prof Marc Sorel - Co Director
Dr John Lincoln - Chair of the Steering Board
Prof William Scanlon - CEO of Tyndall National Institute
Prof Stephen Skinner - Director of the EPSRC&RI CDT-ACM
Mr Benet Hanley - External Recruitment Professional
Prof Kevin Williams - External Senior Academic
Dr Nora Dempsey - NEEL Institute
Mr Aidan Goggin - R&D Director Seagate Technology
Ms Lynda Mahon - CDT Executive Manager
Ms Lisa Campbell - External Engagement Manager
Dr Rair Macedo - Equality, Diversity and Inclusivity Champion
Mr Zeki Shaw - Chair of the Doctoral Forum

EPSRC Centre for Doctoral Training in

PHOTONIC INTEGRATION AND ADVANCED DATA STORAGE

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This brochure was created by PIADS External Engagement Manager, Lisa Campbell. If you have any questions or would like to discuss any of the content within, please do get in touch on: **lisa.campbell@glasgow.ac.uk**