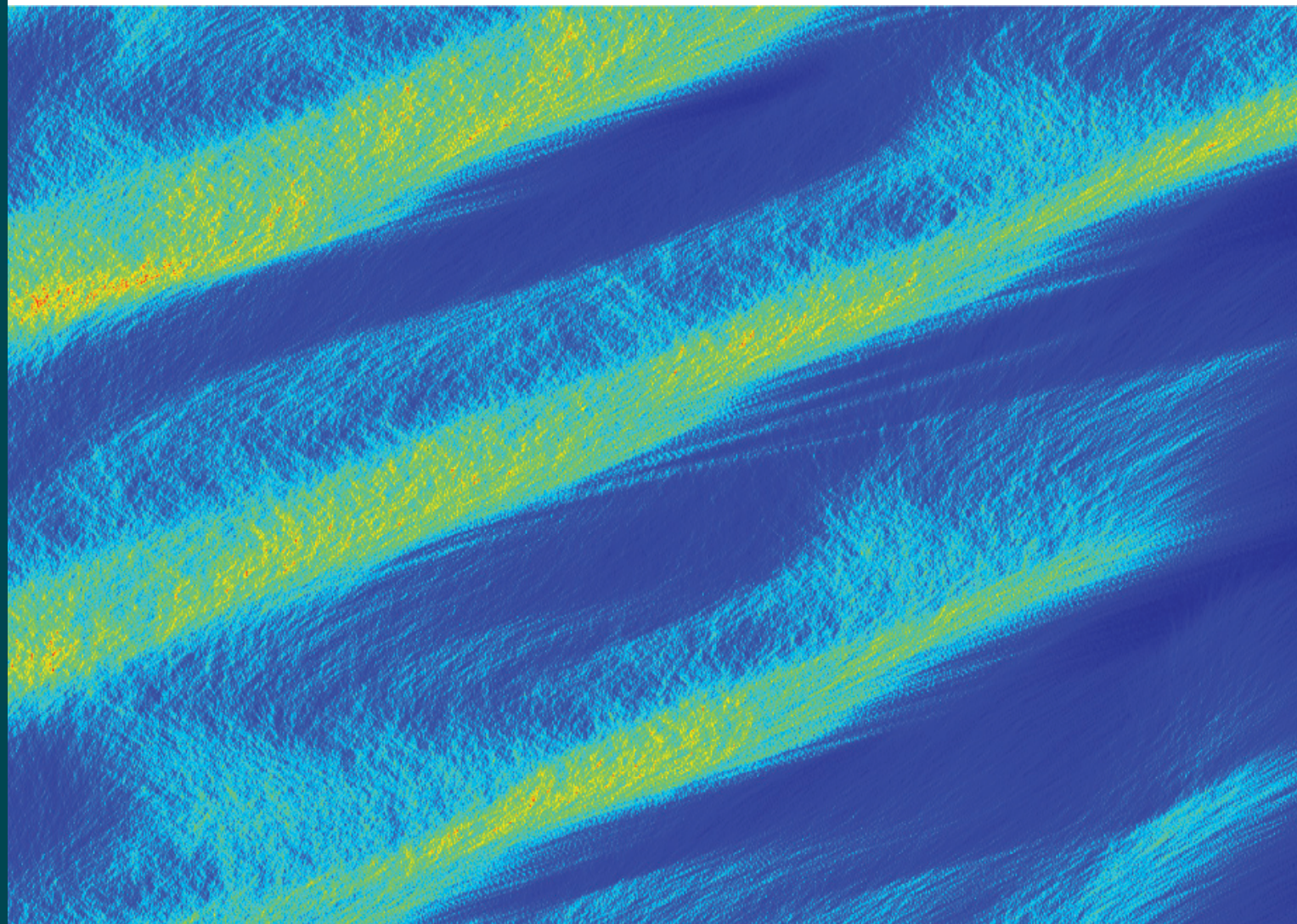
2015 Annual Report

Aston University
Birmingham

AIPT
Aston Institute of Photonic Technologies



2015

Annual Report

Contents

Front cover image represents continuous wave intensity fluctuations are mode-locked via single wall carbon nanotube, ensuring stable ultrashort pulse generation.

Welcome

In the beginning and all the way through 2015 there was light. UNESCO proclaimed 2015 as the International Year of Light and light-based technologies (IYL), in recognition of the importance of the contribution of lightwave technologies to sustainable development and providing pivotal solutions to global challenges in energy, education, agriculture and health. Photonics is now on the political agenda in the USA, Europe and many developed and developing countries. The IYL gave people working in photonics a remarkable opportunity to reflect on what they are doing and why. Photonics makes a difference by opening up new significant academic vistas, by contributing to innovation, new products and economy, and by directly improving people's lives. Photonics is capable of changing places and lives. Photonics can make important contributions to the activities of the Global Challenges Research Fund set by the UK Government to support cutting-edge research that addresses the challenges faced by developing countries.

We learned in 2015 about the various (and sometimes amazing) impacts of photonics on communities around the world, what telecom based on light technologies means to the GDP of some African countries, how it can help many people who still cannot read and learn after sunset, how to generate light from surrounding waste in emergencies, and other fascinating applications.

This was a tremendous chance to look at photonics on a global scale and better recognise that how big we are is defined by the scale of the problems we are interested in and the problems we are able to solve. In 2015, AIPT organised an IYL workshop with an impressive list of speakers and world leading experts in the field. Moreover, we organised Lightfest, which in one day brought more than twelve thousand people to Birmingham central library, including a multitude of enthusiastic kids with shining and wide open eyes, looking at whom we knew with apodictic certainty that this event was a great success (of course, it takes a couple of years to become an overnight success – only entropy comes easy). It is likely that we changed some lives and hopefully for the better. The purpose of science is to generate new knowledge. Sometimes we pay less attention to another important goal - passing already accumulated information on to new generations and transforming their lives. Creating new knowledge and transferring it in a structured form through time, somehow, can locally and within certain limits, withstand an increase of entropy (use the term "entropy" and you can never lose a debate, von Neumann told Shannon - because no one really knows what "entropy" is). This gives science a captivating philosophical angle.

As somebody said: "Years ago I discovered the meaning of life, but forgot to write it down". The Lightfest reminded us about the pleasure and satisfaction of sharing passion for science with others and the rediscovery of the true meaning of educational and outreach activities in the life of the research institute. I am sure that the spirit of the IYL will live well beyond 2015.

In 2016 we celebrate the 25th anniversary of the Photonics Research Group (and the 50th anniversary of Aston University, and (some of us, who like to talk about information) the 100th anniversary of the birth of Claude Shannon, what a year). We have a history we are proud of. Our research students and postdoctoral researchers work in industry around the world, JLR, Bell Labs, CISCO, BAE Systems, BT, Ericsson, Alcatel-Lucent-Nokia, Tyco Communications, MIT Lincoln laboratory, even Nature Photonics to mention a few, and became professors, research and industrial leaders in different universities, companies and countries. Our research is well balanced between blue sky fundamental science and down to earth practically important industrial projects.

25 years ago Ian Bennion and Nick Doran transformed this place in Birmingham. The structure they created – the Photonics Research Group, predecessor of the Aston Institute of Photonic Technologies has endured and is capable of expansion, continuing to change this place. Building structures is also against the course of increasing entropy (not sure by now what is wrong with increasing entropy and why we should be happy when we delay its growth while expanding ourselves). This report summarises information about our activities and progress in 2015. Aston University committed £7.5m to develop a brand new laboratory space for AIPT. This gives us transcendent opportunities for further growth and new global initiatives. It is in our strategic plans to increase in coming years the number of research MSc and PhD students and establish a structured MSc by Research program and postgraduate school. We have been awarded in the past five years 24 Marie Skłodowska-Curie Fellowships and in 2016 AIPT won a multimillion EU COFUND project MULTIPLY to run a worldwide international program of MSC Fellowships in photonics, making our international visibility global. We aspire to establish new and strengthen existing long-term industrial partnerships with global companies linking research collaborations and educational programs. We are 25 this year. Our history and proud heritage earned us a formidable reputation and we have a challenge to live up to our reputation and enhance it through writing a new history of Birmingham and photonics science and technology, transforming places and lives.

Sergei K. Turitsyn, Director of AiPT

AiPT Mission

The mission of the Aston Institute of Photonic Technologies is through research integrated with education to generate and advance knowledge and innovation in photonics and translate the scientific breakthroughs into technology making industrial, economic and societal impact.

AiPT Vision

Through growth and consolidation of the current leading position and expansion of our capability, by 2020 the Aston Institute of Photonic Technologies will be a centre of excellence in photonics, with global international visibility, reputation as a trailblazer in research and innovation, strong industrial links and knowledge transfer, several strategic industrial partnerships, and will be a beacon of photonic learning and public outreach activities, ranked among the top academic photonic centres in the world.

AiPT Aims

Based on our vision and mission, we aim to expand our research, translational and outreach activities through attracting world leading academics, talented young researchers and students, the development of world class laboratory facilities commensurate with AiPT growth, building a financial operational model, establishing the Aston Photonics Education Centre and joining efforts with the other groups at the School of Engineering and Applied Science, Aston Business School and School of Life & Health Sciences in creating the Aston Impact Acceleration Centre.

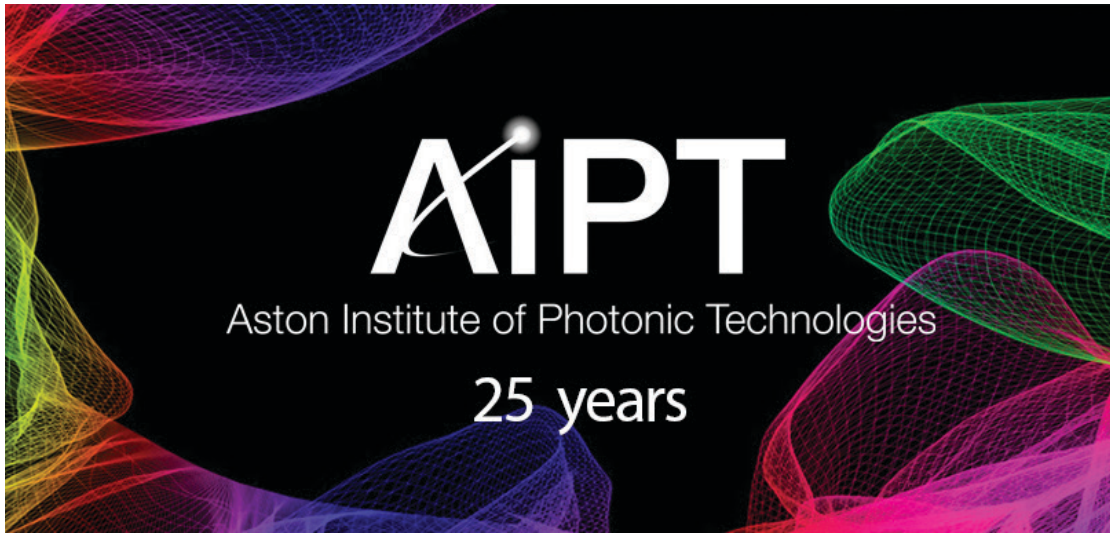
The Aston Institute of Photonic Technologies will be guided by the four interconnected strategic goals: research, post-graduate education, translational activities and public outreach.

25th

Anniversary

Aston Institute of Photonics Technologies was founded as a research group in September 1991 by Ian Bennion and Nick Doran. It was inaugurated as the Institute in March 2012. Now 25 years later much has happened but the group they started then, now led by Sergei Turitsyn, has grown to something way beyond even their most extreme dreams.

We are extremely proud of having such a long history of innovation and research. On 16 of September 2016 we are going to have a celebration to which we invite all our graduates and staff who worked there during all these years.



People

Our passionate and enthusiastic people make us different. The following people made 2015 a successful year for AiPT.

Academic staff

Prof. Sergei Turitsyn,
Director of AiPT

Prof. Lin Zhang,
AiPT Deputy Director, Head of Electrical, Electronic and Power Engineering

Prof. David B. Payne

Dr. Natalia Bazieva
Lecturer

Prof. Andrew Ellis,
AiPT Deputy Director

Prof. Keith Blow,
Head of Adaptive Communications Research Group

Prof. Edik U. Rafailov,
Professor In Optoelectronics

Dr. Sonia Boscolo,
Senior Lecturer

Prof. David Webb,
AiPT Deputy Director

Prof. Nick Doran,
Professor of Photonics

Prof. Misha Sumetsky,
Professor of Photonics

Dr. Wladek Forysiak,
Senior Lecturer in Applied Physics

Dr. Paul Harper,
Director of Undergraduate Electronic Engineering Programmes

Dr. Vladimir Mezentsev,
Senior Lecturer

Dr. Alex Rozhin,
Senior Lecturer in Nanotechnology

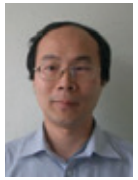
Dr. Kate Sugden Reader,
Placements Tutor

Dr. Elena Turitsyna,
Lecturer in Electronic Engineering,
outreach activities coordinator

Dr. John Williams,
Reader

Dr. Sergey Sergeyev,
Senior Research Fellow

Dr. Stylianos Sygletos,
AiPT Fellow



Dr. Xuewen Shu,
AiPT Fellow

Dr. Kaiming Zhou,
AiPT Fellow

Dr. Haitao Ye,
Associated member of AiPT

Research staff

Dr. Thomas Allsop

Dr. David Benton

Dr. Maria Chernysheva (joined in 2015)

Dr. Dmitry Churkin

Dr. Christian Sanchez Costa

Dr. Artemiy Dmitriev (joined in 2015)

Dr. Mykhaylo Dubov

Dr. Vladislav Dvoyrin (joined in 2015)

Dr. Atalla El-Taher

Mr. Simmon Fabbri

Dr. Farsheed Farjady

Dr. Ksenia Fedorova

Dr. Filipe Ferreira

Dr. Elias Giacoumids

Dr. Neil T. Gordon

Dr. Andrey Gorodetsky

Dr. Biqiang Jiang

Dr. Vladimir Kalashnikov

Dr. Lukasz Krzczanowicz (joined in 2015)

Dr. Sergey Kulinich

Dr. Daniel Lee

Dr. Graham Lee

Dr. Jianfeng Li

Dr. Karina Litvinova (joined in 2015)

Dr. Yury Loika

Dr. Petro Lutsyk (joined in 2015)

Dr. Naoise MacSuibhne

Dr. Amos Martinez (joined in 2015)

Dr. Mary McCarthy

Dr. Chengbo Mou

Dr. Stanislav Kolpakov Nikitin

Dr. Vladimir Osipov

Dr. Junsong Peng

Dr. Andreas Perentos

Dr. Ian Phillips

Dr. Yaroslav Prylepskiy

Dr. Lida Sadeghioon (joined in 2015)

Dr. Sergei Sokolovsky

Dr. Maria Sorokina

Dr. Marc Stephens

Dr. Srikanth Sugavanam

Dr. Qizhen Sun

Dr. Nikita Tarasov

Dr. Ilya Titkov

Dr. Christos P.Tsekrekos (joined in 2015)

Dr. Zhijun Yan

Dr. Wei Zhang

Dr. Junxi Zhang

Dr. Zuxing Zhang

Dr. Mohd Zamani Bin Zulkifli (joined in 2015)

Research Students

Mr. Mohammed AlAraimi

Mr. Mohammad Al-Khateeb

Mrs. Raz Arif

Mr. Abdulyezir Ayomipo Badmos

Mr. Md Asif Iqbal

Mr. Adenowo Gbadebo

Ms. Sandra Donohoe

Mr. Vladimir Gordienko

Mr. Huseyin Karakuzu

Mr. Morteza Kamalian Kopae

Mr. Hani Kbashi (joined in 2015)

Mr. Son Thai Le

Mr. Teerawat Piromjitpong (joined in 2015)

Mr. Auro Michele Perego

Mr. Andreas Pospori

Mr. Zhongyuan Sun

Mr. Mingming Tan

Mr. Nikita Tarasov

Mr. Changle Wang

Mr. Amit Yadav

Ms. Tingting Zhang

Mr. Michal Zubel

Mr. Modestas Zulonas

Mr. Ilya Rafailov (joined in 2015)

Professional staff

Mr. Andrew Abbot,
Technician

Dr. Noreen Akhtar,
ICONE Research Project Manager

Ms. Jolade Azzan,
Business Development Manager

Dr. Christiane Doering-Saad,
TRIPOD Project Manager

Ms. Tatiana Kilina,
Research project manager

Ms. Alisa Nemova,
Business Development Manager

Mrs. Swaroopa Mucheli Sudhakar,
AiPT Technician

Marie Skłodowska-Curie Fellows

Dr. Sergey Kulinich

Dr. Jianfeng Li

Dr. Naoise MacSuibhne

Dr. Carlos Marques

Dr. Junsong Peng

Dr. Qizhen Sun

Dr. Junxi Zhang

Dr. Zuxing Zhang

Dr. Christian Sanchez Costa

Dr. Filipe Ferreira

Dr. Biqiang Jiang

Dr. Petro Lutsyk

Dr. Amos Martinez

Dr. Mohd Zamani Bin Zulkifli

Visiting Researchers in AiPT in 2015

Prof. Valentin Freilikher,
Bar-Ilan University, Israel

Prof. Yuri Kivshar,
The Leverhulme Trust Visiting Professor,
Australian National University, Australia

Prof. Alexander Rubenchik,
Lawrence Livermore National Lab, USA

Prof. Gregory Falkovich,
Weizmann Institute of Science, Israel

Prof. Evgeny M. Dianov,
Fiber Optics Research Centre, RAS, Russia

Dr. Ilya Vatnik,
IAE SB RAS, Russia

Dr. Nikita Toropov,
ITMO University, Russia

Dr. Stanislav Derevyanko,
Weizmann Institute of Science, Israel

Dr. Alexander Turchin,
National Academy of Sciences, Ukraine,

Dr. Anand Srivastava,
Indian Institute of Technology Mandi, India

Dr. Guolu Yin,
Shezhen University, China

Mr. Fangcheng Shun,
Wuhan National Laboratory for
Optoelectronics Huanzhong University
of Science and Technology, China

Mr. Sergei Sukhanov,
Saratov State University, Russia


West 6
TON
RSITY

Researcher Focus

Dr. Wladek Forysiak

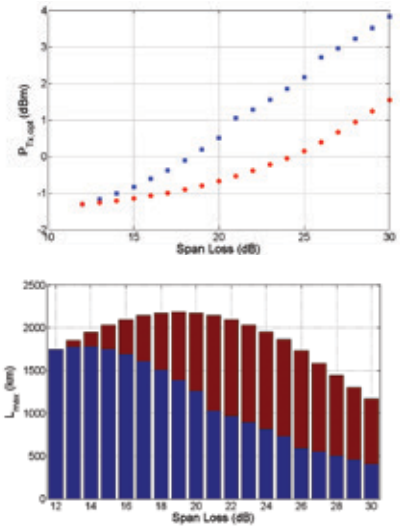
Wladek has been associated with Aston University since 1992 when he became the first post-doctoral research fellow appointed by the then fledgling Photonics Research Group, which has since become AiPT. He has served Aston in multiple roles, as a lecturer/reader in Electronic Engineering in the late nineties, and as a visiting researcher/reader and member of the UG/PG industrial steering committees during the 2000s. In 2012, he returned to Aston as a part-time Royal Society Industry Fellow, and was subsequently appointed a Senior Lecturer in Applied Physics in 2014. In 2015, Wladek began a new 5-year research project as an EPSRC Manufacturing Fellow, entitled "Towards Manufacturing of "Massive WDM" metro" (ToM3).

Wladek's past research interests range from fundamental physics in nonlinear dynamics and chaos of three-level lasers, mode-locking, and ultra-short nonlinear pulse propagation effects, to engineering applications in soliton communications, WDM system design, dispersion management, and link and network planning. From 2000-2010 he worked for Marconi Communications and Ericsson Ltd as a Development Director and Network Modelling Manager, during which time he was responsible for the link design rules for the company's WDM product portfolio. In this period, he also participated in UK DTI project "HiPNET" and EU FP7 project "APACHE". From 2010-14 he was with Oclaro Technology Ltd as their Director of Technology and Systems, working in both UK R&D sites at Paignton and Caswell on various optical amplification and transmission technologies, including digital coherent pluggables using InP-based photonics.

Wladek's EPSRC Manufacturing Fellowship is one of four awarded by EPSRC in 2014/15, as part of the 4th call for such fellowships, specifically aimed at researchers working in, or recently moved to academia from, industry. The objectives of ToM3 are to address future technical requirements for ultra-high capacity optical transport in metropolitan area networks, and to demonstrate the key building blocks of a "massive WDM" metro platform with a transmission bandwidth 3x greater than the current industry standard of 40nm, using compact and scalable "super-channel" transceivers and modular discrete Raman amplifiers. The fellowship grant is held in conjunction with Dr. Paul Harper, Prof. Nick Doran and Prof. Lin Zhang, and in the autumn of 2015 two post-doctoral fellows, Dr. Ian Phillips and Dr. Lukasz Krzczanowicz, joined the project as the associated experimental researchers.

1. W. Forysiak et al. "Analysis of extended range variable gain hybrid Raman-EDFAs in systems using Nyquist-WDM 100/200G PM-QPSK/16QAM", OFC 2014, W2A-8.

2. W. Forysiak et al. "Progress toward 100-G digital coherent pluggables using InP-based photonics", J. Lightwave Technol. 32 (16), 2925, 2014.



PM-16QAM (a) optimum transmission power, and (b) maximum reach versus span loss for regular EDFA-only (blue) and hybrid Raman-EDFA systems (red), calculated using the standard Gaussian Noise model. Note the variable gain EDFA stepwise transitions at 20/25dB.

Dr. Karina Litvinova

My Ph.D. degree in biophysics and physiology, received from the Institute for Biomedical Problems of Russian Academy of Sciences, Laboratory of Myology, provided a strong and diverse foundation in the field. The laboratory's unique background in the area of muscle plasticity during gravitational unloading enabled me to work on projects with the Russian space agency (such as the BION M) and joint with colleagues from NASA and the ESA. Ultimately, my PhD training and my first post-doc position have given me many skills necessary to do gravitational biophysics that are also transferable to other areas of research.

During my postdoctoral work at Laboratory of Electrophysiology University of Bari, I was involved in a multidisciplinary project, granted by Italian Telethon, aimed at evaluating in vivo, ex vivo and in vitro pre-clinical efficacy of prompt-to-use drugs in an animal model of Duchene Muscular Dystrophy. As a recipient of a Telethon Research Fellowship, I was introduced to ex vivo recording of the isometric contractile properties of fast and slow twitch skeletal muscle of wild-type and dystrophic mdx mice and involved full-time in the experimental plans requiring these recordings. Along with notable results, I also became co-supervisor of a PhD-student, who successfully defended her PhD project.

I changed my research field in 2009, when I moved to the Medphys Laboratory of the Moscow Regional Research and Clinical Institute to work with in research and development of new diagnostic devices and equipment for the non-invasive fluorescence diagnostics. My work led to the development of new practical methods and diagnosis techniques, which greatly expanded the diagnostic capabilities of physicians. This resulted in my receiving three patents and producing various guidelines for medical practitioners. Thanks to MEDILASE and ABLADE research fellowships, I spent time at the University of Dundee and Ninewells Hospital, Dundee, UK.

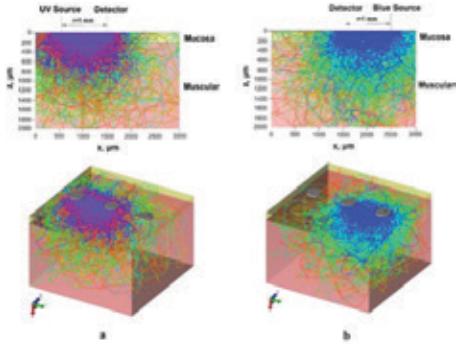
Currently, our team, Dr. Sergei Sokolovski and PhD students Mr Ilya Rafailov and Mr Argyrios Tsatsakoulias, is young, but quite active. We have established strong contacts with the LHS and are using Laser Fluorescence Spectroscopy and Laser Doppler Flowmetry to develop optical sensors for diabetic foot. Following the development of methodologies, in collaboration with Prof. Asif Ahmed's group, we present a technique that allows us to non-invasively assess the condition of animals during laboratory experiments and treatment. Our laser-based multifunctional diagnostics system was chosen to carry out non-invasive analysis of multiple parameters in the aim of improving preeclampsia diagnosis. In collaboration with Queen Elizabeth Hospital and Aston Medical School (Prof. Francesco Leyva), we are also developing biosensors for the diagnosis of cardiac muscle tissue. We are also conducting interesting pilot research with ophthalmologists at Aston University (Prof. James Wolffsohn) to explore the possibility of determining eye lens wearing individuals' susceptibility to "dry eye" and other potential conditions. In collaboration with Professor Dion Morton from Institute of Cancer and Genomic Sciences and Dr. Roger Kockelbergh, University Hospitals of Leicester NHS Trust, we pursue previous research in the diagnosis and treatment of cancer.

Key publications in 2015-2016:

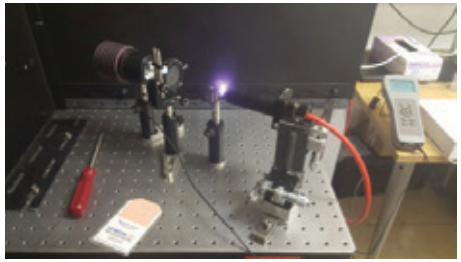
1. Ilya E. Rafailov, Victor V. Dremin, Karina S. Litvinova, Andrey V. D unaev, Sergei G. Sokolovski, Edik U. Rafailov. Computational model of bladder tissue based on its measured optical properties. 2016. JBO 21(2), 025006.

2. Scott Palmer, Karina Litvinova, Andrey Dunaev, Stewart Fleming, David McGloin, Ghulam Nabi. 2016. Changes in autofluorescence based organoid model of muscle invasive urinary bladder cancer. Biomed Opt Express 7(3): 255408.

3. Scott Palmer, Karina Litvinova, Edik U. Rafailov, Ghulam Nabi. 2015. Detection of urinary bladder cancer cells using redox ratio and double excitation wavelengths autofluorescence. Biomed Opt Express, 6(3): 977–986.



(a) Side and 3D view of the model, displaying simulated UV light within tissue. b) Side and 3D view of model displaying simulated Blue light within tissue. The source, detector and the tissue layers are labelled. The passage of individual photons through the tissue is indicated by the lines.



Year Highlights

It was an extremely busy and successful year for us across multiple directions.

Public outreach

- The main highlight of 2015 was Lightfest, which is fully detailed in the Outreach section of this report. Aston University's first ever artist in residence, Chris Plant, worked with the photonics experts to create a stunning light installation for the inaugural Lightfest event, held at the Library of Birmingham. Taking inspiration from the innovative ways in which the AiPT use optical fibres, laser beams and advanced LED technology, he developed his installation to make people experience light in a fundamentally different way. (See image 1.)
- AiPT organised two engagement events for local secondary schools in 2015, aimed at establishing continuous network partnership between the AiPT and science and physics teachers in the Greater Birmingham area. The events were attended by science teachers from the High Arcal School, Christopher Whitehead Language College, Barr Beacon School, Bridgnorth Endowed School, Ercall Wood Technology College and Prince Henrys High School. Joint activities were planned with the West Midlands STEMNET (the Science, Technology, Engineering and Mathematics Network) to create opportunities to inspire young people in science.

Key research grants awards and industrial outreach activities

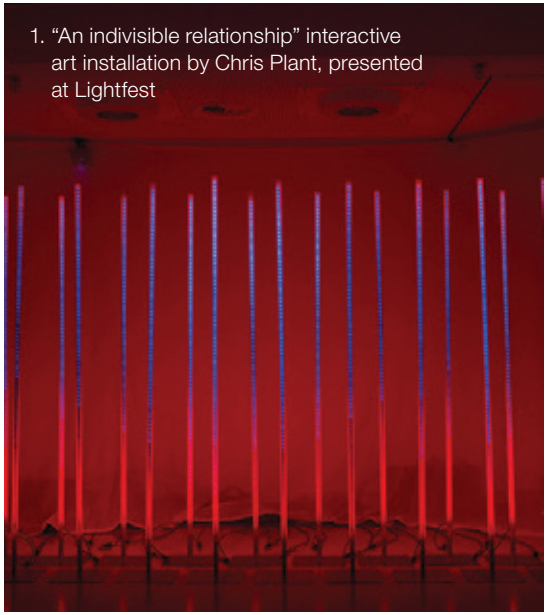
- AiPT was awarded the Newton Fund International Exchanges grants with Mexico (Dima Churkin) and (David Webb and Kaiming Zhou) and the Newton Fund Visiting Professorship with Malaysia (Sergei K. Turitsyn).
- AiPT was awarded the Erasmus+ International Credit Mobility Programme grant supporting exchanges of PhD students and staff members between Aston University and Novosibirsk University (Russia), in the field of photonics. The programme is focused on mutual sharing of best practice and is led by Dr. Sonia Boscolo, Dr. Dmitry Churkin and Professor Sergei Turitsyn.
- Sergey Sergeyev was awarded the Leverhulme Trust grant: Combined Harnessing of Sychronisation in mode locked lasers.
- Nick Doran and Andrew Ellis were awarded EPSRC project grant UPON - Ultimate Passive Optical Network.
- Kaiming Zhou and David Webb were awarded the Techincal Strategy Board grant from the Aerospace Technology Institute - Fuel and Systems Integrated Research.
- Dr. David Benton has been awarded a grant from the Centre for Defence Enterprise to investigate a concept for 'a low cost method for detecting lasers'.
- AiPT was awarded three Marie Skłodowska-Curie actions in the Research and Innovation Staff Exchange (RISE) projects (led by Sergei K. Turitsyn and Dmitry Churkin, Alex Rozhin and Misha Sumetsky).
- Three Marie Skłodowska-Curie Fellowships were awarded to AiPT in 2015. (See image 2.) Edik Rafailov will host a fellow to carry out research in the area of bio-photonics, Sergei Turitsyn and Stelios Sygletos will be hosting a project in optical communications, and Sergey Sergeyev will host a fellow to carry out research on fibre lasers.
- A Knowledge Transfer Showcase event took place in April 2015. In the Knowledge Transfer Project poster competition, AiPT members were involved in both the winning and runner up projects. The winner was a project assisting Gas Data Ltd of Coventry to develop a range of laser based gas monitors for biogas applications, while the runner up involved both AiPT and LHS assisting Optimec Ltd to develop a system for high precision monitoring of contact lens shape.
- With the support of European Research Development Fund, AiPT have organised 7 half day industrial outreach seminars for local companies throughout the year. We've explained the science behind photonics, how it is being used in industry already and how companies might benefit from it.

Organisation of the international conferences and workshops

- AiPT, with the Vinca Institute of Nuclear Sciences, University of Belgrade, and the Optical Society of Serbia, co-organised the 5th International School and Conference on Photonics – 'PHOTONICA2015' in Belgrade, Serbia. The conference is one of the central events in the International year of Light in Serbia. (See image 3.)
- Sergei Turitsyn and Dmitry Churkin were awarded a grant from the Abdus Salam International Centre for Theoretical Physics and will co-organizes a workshop "Disorder, Interactions, Turbulence and Wave Dynamics: Fundamentals and Applications".
- Prof. Andrew Ellis, Prof. David Saad and Prof. Sir David Payne (Optical Research Centre, Southampton) organised the Royal Society workshop, 'Communication networks beyond the capacity crunch' on 11 and 12 May 2015. The workshop has strong impact on discussion of the

future of broadband communication in the United Kingdom.

- Prof. Edik Rafailov co-organised the 3rd "Photonics Meets Biology" summer school in Crete, Greece, from 28 September to 2 October 2015 – an event bringing together experts from world-leading academic centres in order to educate students and young researchers in this cutting edge field.
- Sergei Turitsyn and Dmitry Churkin have received a grant from the Max Planck Institute for the Physics of Complex Systems to organise the international workshop, 'Discrete, Nonlinear and Disordered Optics' in 2017.



1. "An indivisible relationship" interactive art installation by Chris Plant, presented at Lightfest

3. Photonica 2015, Belgrad, Serbia

2. The Marie Skłodowska-Curie actions, named after the double Nobel Prize winning Polish-French scientist famed for her work on radioactivity, support researchers at all stages of their careers, irrespective of nationality.

4. Prof. Andrew Ellis explaining how new technologies will prevent the energy consumption of the internet increasing beyond its current high levels.

AiPT Current Awards

Funder	No. Awards	Total Award Value (£)
European Commission	30	£7,991,967
ESPRC	7	£6,528,140
Leverhulme Trust	3	£486,402
ERDF Fibre Optics Phase 2-Photonics	1	£385,942
Knowledge Transfer Partnerships	2	£312,203
The Royal Society	5	£223,086
EPSRC Dorothy Hodgkin Postgraduate Award	1	£45,000
Innovative UK	2	£385,299
US AIR Force	1	£45,559
Russian Ministry of Education & Science	1	£77,102
DSTL	1	£66,178
II-VI LASER UK LTD	2	£69,000
Other grants	3	£33,724
Total	59	£16,604,650

AiPT Personnel

	2015	2014	2013
Academic staff	23	21	18
Research staff	51	38	23
Marie-Curie Research Fellows	14	9	4
Research Students	24	26	21
Project Managers	5	3	2
Technicians	2	2	1
Total	119	99	69

Male	87
Female	18

Dr. Maria Chernysheva, Marie-Curie Fellow, is characterising the spectrum of her fibre laser

Marie Skłodowska-Curie Individual Fellows

The AiPT has a total of 14 fellows, including 6 new comers that are introduced over the following pages.

Existing fellows:

Dr. Sergey Kulinich
MC IIF NPS4FM

Dr. Jianfeng Li
MC IIF MIDFIL

Dr. Naoise MacSuibhne
MC IEF SOLAS

Dr. Carlos Marques
MC IEF POSSIBLE

Dr. Junsong Peng
MC IIF ULTRAFIL

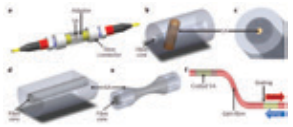
Dr. Qizhen Sun
MC IIF SOFST

Dr. Junxi Zhang
MC IIF Plasm-on-fibre

Dr. Zuxing Zhang
MC IIF DISCANT

Amos Martinez

Structured photonics for advanced fibre lasers
Host: Sergei Turitsyn



I completed my PhD at Aston University in 2006. Before re-joining AiPT in July 2015 I worked in The University of Tokyo and Nature Communications.

I am interested in exploring new ways to exploit two-dimensional materials such as graphene, and transition metal dichalcogenides in photonics through their interaction with micro-cavities, in particular fibre-based cavities with the aim of developing new classes of light sources.

I am also interested in exploring alternative approaches to modify the linear and nonlinear optical properties of two-dimensional materials through their interaction with light. While this project originates from a desire to advance our understanding of the fundamental optical properties of these materials, I believe it can also influence applied research in areas such as laser science, nanotechnology and material science.

Biqiang Jiang

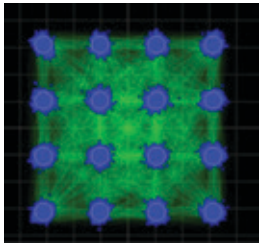
Fibre Optic Multi-parametric Biochemical Sensing Technology (FOMBIST)
Host: Prof. Lin Zhang & Dr. Kaiming Zhou

Proposed structure of the nanofilm integrated tilted fibre grating.

I received my PhD degree in Optical Engineering from Northwestern Polytechnical University (NPU), China, in 2013. Since then, I have worked in the School of Science of NPU as a lecturer. My research interests focus on optical fibre devices and their sensing applications. I have authored/co-authored more than 20 peer reviewed publications and generated nine patents. I joined the AiPT as a Marie Skłodowska-Curie Individual Fellow in 2015. My current project is called as FOMBIST (Fibre Optic Multi-parametric Blochemical Sensing Technology) and aims to develop advanced optical fibre devices and sensing technologies for highly sensitive multi-parametric biochemical measurements. These devices are urgently demanded both from industry and for scientific research and are used for quality control and process study.

Christian Sánchez Costa

INnovatiVE cohereNt detecTIon
Optical access Networks
Host: Prof. Andrew Ellis

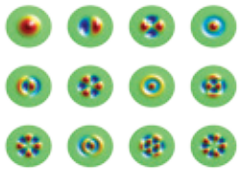


I received my PhD degree in 2014, focused on the study of optical OFDM systems for optical access networks. Afterwards, I started a post-doctorate at Aston University, where I have been working on digital-signal-processing for spatial-division-multiplexing communication systems and on optical phase-conjugation for its employment in optical networks. My main research interests include optical fiber communications, advanced optical modulation formats, and signal processing techniques. INVENTION project proposes new approaches to make feasible the employment of coherent detection in optical access networks targeting the development of cost efficient optical architectures and of low complexity DSP techniques. These are key enabling factors for achieving highly feasible and practically employable optical networks.

More specifically, INVENTION will (1) reduce the DSP complexity of ONU receivers by utilising the transmission of intensity modulated (2) enable the use of low-cost finely tunable VCSELs in the ONU by adopting line-width tolerant envelope detection schemes, (3) reduce the cost of upstream transmitters by reusing the same lasers as directly modulated sources for QAM formatted data.

Dr. Filipe Ferreira

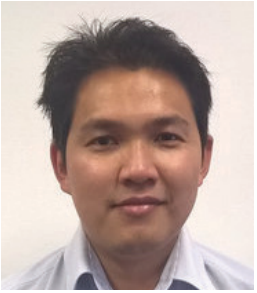
HSPACE - High capacity space division multiplexing systems
Host: Prof. Andrew Ellis



Field distribution of the first twelve non-degenerated linearly polarized modes guided by a multimode optical fibre.

In 2014, I was awarded my Ph.D. degree in Electrical and Computer Engineering with specialization in Telecommunications from the University of Coimbra, Portugal. During my Ph.D., I was the recipient of an industrial fellowship granted by the Portuguese Ministry of Education and Science, and worked simultaneously with Instituto de Telecomunicações, Portugal, and Coriant Portugal. My thesis was focused on high capacity optical transmission systems based on mode division multiplexing.

In September 2014, I joined the AiPT as a Research Fellow. Soon after, I was awarded with a Marie Sklodowska-Curie Individual Fellowship. My fellowship will be dedicated to the development of advanced spatial division multiplexing systems to unlock the capacity of future information systems by enabling the transmission of spatial super-channels over a single fibre. The proposed concept will be implemented using multi-core fibres and few-mode fibres as underlying technology platform along with novel digital signal processing techniques that minimise the mode/core interference and inter mode/core nonlinearities, keeping the required digital processing at realizable levels.

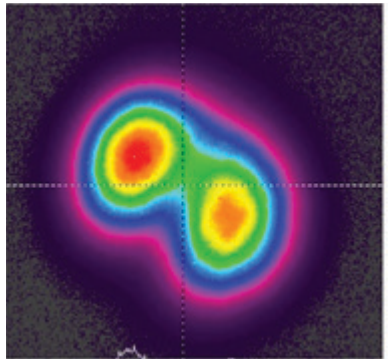


Mohd Zamani Zulkifli

Tunable Mode Random Fibre Laser For Mode Division Multiplexing Laser Source (TUNEMODE)
Host: Prof. Sergei Turitsyn

I am a Marie Curie Research fellow in the Aston Institute of Photonic technologies. My research interests include fiber laser and amplifiers, non-linear fiber and fiber-optic sensors. I received a B.Sc. degree in instrumentation physics from University Putra Malaysia, Selangor, Malaysia, in 2005 and subsequently the M.Sc. and Ph.D. degrees from the University of Malaya, Kuala Lumpur, Malaysia.

Project TUNEMODE targets theoretical and experimental study, design optimization, and development of the spatial mode tuning random fibre laser sources for application in spatial division multiplexing (SDM) telecommunication systems. Conventional fibre lasers, based on rare earth elements such as Erbium and Ytterbium, are not optimized for lasing at modes other than the fundamental mode LP01. The proposed concept will use the flexibility of random fibre lasers (RFL) combined with microfibre technology and fibre Bragg grating (FBG) techniques. Moreover, the tunable laser source generating at various spatial modes will have numerous applications beyond telecommunications. The TUNEMODE is an interdisciplinary project that brings together laser science, fibre optics, theory of disordered systems, and optical engineering.



The LP11 mode to be produced by the random fibre laser.

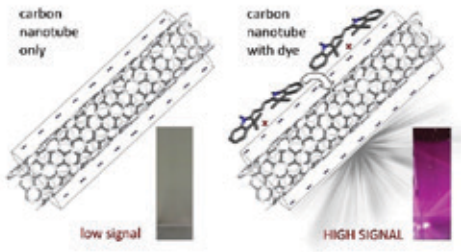
Petro Lutsyk

FOC4SIP — H2020-MSCA-IF-2014 “Functionalised Organic Complexes for rapid Sensing of Industrial Polluters” (FOC4SIP)
Host: Dr. Alex Rozhin

I received a PhD degree in Physics from the Institute of Physics, National Academy of Sciences of Ukraine (Kyiv), in 2008. Since then, I have worked as a Research Scientist in the Institute of Physics (Kyiv, Ukraine) and the Institute of Physical and Theoretical Chemistry (Wroclaw, Poland). My scientific background and interests are related to research areas of physics, chemistry, and engineering of advanced materials; nanoscience and soft matter technology.

FOC4SIP Fellowship is focused on the development of new organic macromolecular complexes including carbon nanomaterials functionalised by organic molecules for rapid detection of hazardous industrial polluters. Recently, we have developed an efficient molecular-engineering method for detecting carbon nanotubes that involves amplifying their photoluminescent signal through the formation of ionic complexes with tailorable polymethine dyes.

The dye absorbs visible light and transfers the energy of this light to the CNT emitting in NIR.



The studied carbon nanotubes (CNT) with anionic surfactant (left) and CNT-surfactant-dye complexes (right).

Cationic dye attaches to anionic CNT through Coulomb attraction, resulting in enhanced photoluminescence in NIR range.

Research Areas

1. Nonlinear Photonics and Signal Processing

We aim to harness the potential of nonlinear system response to create new engineering concepts. Nonlinear photonics is the science and technology of light (photon) generation, manipulation and detection through nonlinear optical processes in structures, devices and systems. The focus of our research is the study of various phenomena encountered by the manipulation of fundamental properties of light, such as the intensity profile, phase and state of polarisation, in optical fibre systems, as well as the new applications already made possible by the nonlinear fibre-optic technology.

Researchers in this group:

Academic Staff

Prof. Keith Blow, Dr. Sonia Boscolo, Dr. Sergey Sergeyev, Prof. Sergei Turitsyn, Dr. Elena Turitsyna.

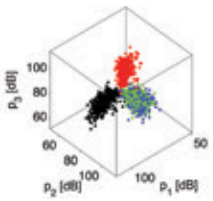
Research Fellows

Dr. Junsong Peng, Dr. Mariia Sorokina, Dr. Chengbo Mou, Dr. Yaroslav Prylepskiy, Dr. Vladimir Kalashnikov, Dr. Stanislav Kolpakov, Dr. Nikita Tarasov, Dr. Dmitry Churkin.

Research Students

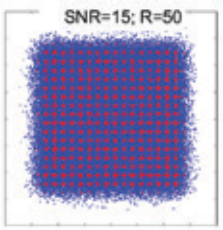
Mr. Auro Michele Perego, Mr. Huseyin Karakuzu, Mr. Hani Kbashi.

Optical encryption based on varying cavity length.



Jointly with our collaborators in France and Spain, we presented a new scheme for secret key exchange involving varying the cavity length of an ultra-long fibre laser. Unlike schemes that rely on random changes to the cavity losses, the proposed scheme employs random variations to the free spectral range of the laser cavity, ensuring above-threshold operation. It is based on the realisation that the free spectral range of laser cavity can be used as an information carrier. We demonstrate the scheme experimentally using a 50-km-long fibre laser to link two users, both of whom can randomly add an extra 1-km-long fibre segment. While the classical scheme does not ensure the same security as quantum key distribution, it provides enhanced security beyond standard software protocols and can be implemented using standard components.

Regenerative Fourier transform.

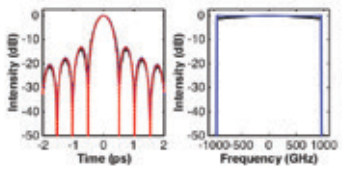


Regenerator for regular rectangular quadrature-amplitude-modulation (QAM) signals based on non-linear optical loop mirror configuration. The scheme achieves suppression of noise distortion on both signal quadratures through the realisation of two orthogonal regenerative Fourier transformations. The RFT transfer function is the first-order Fourier series expansion of the step-wise transfer function; therefore, it represents a smooth and close approximation of an ideal regenerator. Numerical simulations show the performance of the scheme for high constellation complexities (including 256-QAM formats).

Dark and bright vector rogue waves.

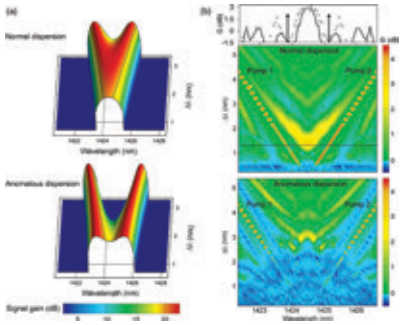
For an erbium-doped mode-locked fibre laser, we demonstrate the first experimental and theoretical evidence of new types of dark and bright vector rogue waves which result from polarisation switching between two orthogonal states of polarisation. The underlying physics comprises an interplay between anisotropy and cavity birefringence tuning, which enables rogue waves control.

Passively mode-locked Nyquist laser.



We propose a novel, simple approach to the design of a Nyquist laser, which relies on nonlinear in-cavity pulse dynamics and pulse shaping by an in-cavity flat-top spectral filter in a passively mode-locked fiber laser. An improved approach, based on the use of a filter's profile with a corrective convex top, is also proposed to compensate for the concavity of the pulse spectrum obtained after nonlinear expansion in the fiber. The need for large nonlinear phase accumulation in the fiber is thereby relaxed. We numerically show the possibility to achieve sinc-shaped Nyquist pulses of high quality and widely tunable bandwidth with the proposed scheme.

Inverse four-wave mixing.



We present a new nonlinear self-action effect—self-parametric amplification—which reveals itself as optical spectrum narrowing in normal dispersion fibre, leading to very stable propagation with a distinctive spectral distribution. The narrowing results from inverse four-wave mixing, resembling an effective parametric amplification of the central part of the spectrum by energy transfer from the spectral tails. Self-parametric amplification and the observed stable nonlinear spectral propagation with a random temporal waveform can find applications in optical communications and high-power fibre lasers with nonlinear intra-cavity dynamics.

Nonlinear comb generation for astronomy.

In collaboration with groups in Germany and Argentina, we have studied the generation of optical combs suitable for application in calibration of astronomical spectrographs. A two stage process is considered. In the first fibre, standard NLS evolution leads to soliton like compression of the beat between two CW lasers. In the second stage the signal is amplified leading to further compression of the pulses and a corresponding expansion of the frequency comb bandwidth.

Key publications of the group in 2015

1. A. Tonello, A. Barthélémy, K. Krupa, V. Kermène, A. Desfarges-Berthelemot, B. M. Shalaby, S. Boscolo, S. K. Turitsyn, and J. D. Ania-Castañón, “Secret key exchange in ultralong lasers by radiofrequency spectrum coding,” Light: Science & Applications, vol. 4, no. 2, article ID e276, 2015; doi:10.1038/lsa.2015.49.
2. M. Sorokina, S. Sygletos, A. Ellis, and S. K. Turitsyn, “Regenerative Fourier transform for dual-quadrature regeneration of multilevel rectangular QAM,” Optics Letters, vol. 40, no. 13, pp. 3117-3120, 2015.
3. S. Boscolo, J. Peng, and C. Finot, “Design and applications of in-cavity pulse shaping by spectral sculpturing in mode-locked fibre lasers” (Feature paper), Applied Sciences, vol. 5, pp. 1379-1398, 2015; doi: 10.3390/app5041379.
4. S. K. Turitsyn, A. E. Bednyakova, M. P. Fedoruk, S. B. Papernyi, and W. R. L. Clements, “Inverse four-wave mixing and self-parametric amplification in optical fibre,” Nature Photonics, vol. 9, pp. 608-614, 2015.
5. M. Zajnulina, M. Böhm, K. J. Blow, A. A. Rieznik, D. Giannone, R. Haynes, and M. M. Roth, “Soliton radiation beat analysis of optical pulses generated from two continuous-wave lasers,” Chaos, vol. 25, p. 103104, 2015.

Grants

The Leverhulme Trust Research Project Grant “Nonlinear waveguide-based all-optical waveform generators”. PI: Dr. Sonia Boscolo. 2011-2015.

FP7-PEOPLE-2012-IAPP 324391 GRIFFON. Coordinator: Dr. Sergey Sergeyev. 2013-2017.

Marie Curie International Incoming Fellowship project ULTRAFIL. Fellow: Dr. Junsong Peng.

Marie Curie International Incoming Fellowship project DISCANT. Fellow: Dr. Zuxing Zhang.

Erasmus Mundus Partnerships Project NANOPHI (552066-EM-1-2014-1-IT-ERA MUNDUS-EMA22). Local Coordinator at Aston: Dr. Sonia Boscolo. 2014-2018.

Awards

The Leverhulme Trust Research Project Grant “Combined harnessing of synchronisation in mode locked fibre lasers”. PI: Dr. Sergey Sergeyev. 2015-2018.

The Leverhulme Trust Visiting Professorship for Yuri Kivshar, 2015-2016.

Erasmus+ KA107, Mobility with partner countries (2015-1-UK01-KA107-012618). PIs: Dr. Sonia Boscolo, Prof. Sergei K. Turitsyn. 2015/16.

2. Optical fibre sensing

Originally developed for communications purposes, optical fibres now form the basis of a sensing technology that offers some key advantages:

– The low fibre loss permits sensing over long distances
– The dielectric nature of optical fibres renders them immune to electromagnetic interference
– The small size of optical fibres allows them to be embedded inside modern composite materials
– Techniques exist to create hundreds of sensors along a single fibre

Researchers in this group:

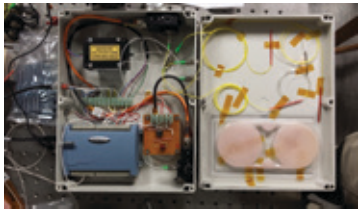
Academic Staff
Prof. Lin Zhang
Dr. Kate Sugden
Prof. David Webb
Dr. Kaiming Zhou

Research Fellows
Dr. Graham Lee
Dr. Amos Martinez
Dr. Carlos Marques
Dr. Thomas Allsop
Dr. Mykhaylo Dubov
Dr. Wei Zhang
Dr. Chengbo Mou
Dr. Neil Gordon
Dr. David Benton
Dr. Zhijun Yan
Dr. Junxi Zhang
Dr. Biqiang Jiang
Dr. Qizhen Sun
Mr. Guolu Yin

Research Students
Ms. Sandra Donohoe
Mr. Lutful Khan
Mr. Andreas Pospori
Mr. Fangcheng Chen
Mr. Michal Zubel
Mr. Changle Wang
Mr. Zhongyuan Sun
Mr. Abdulyesir Badmos
Mr. Adenowo Gbadebo
Ms. Sophie Acheroy

R&D ranges from fundamental new technology development through to prototype construction for specific applications with industry partners.

Photonics for Aerospace



In 2015 AiPT was pleased to be able to commence a project in collaboration with Airbus funded by the Aerospace Technology Institute. The aim is to develop an all-optical method for measuring the quantity of fuel held in aircraft fuel tanks. Motivation for the project comes from the striving of the aerospace industry to continuously improve safety standards on aircraft, so that the number of accidents continues to fall, even while the number of passenger miles per year is increasing. The use of optical fibre technology removes any potential for spark hazards in the fuel tank, which is a risk – albeit a remote one – with conventional electrical sensors. Additional advantages accruing through the use of optical fibres are immunity to electrical interference, which can arise from lightning strikes and a reduction in the weight of cabling, which can be substantial in a modern aircraft; the Airbus A380, for example, contains more than 500km of wiring.

Food safety

As a Key Enabling Technology, photonics can find its way into many different areas of life. One example from 2015 is a project AiPT carried out with three UK companies, Branscan Ltd, Arden Photonics Ltd and Warburtons Bakery. The project successfully delivered a prototype sensing system capable of monitoring the moisture level, protein content and particle size of flour in a grain mill. The system has at its heart Aston's tilted fibre grating technology, used here to couple light out of the side of an optical fibre to permit spectroscopic measurements of the fibre environment.

Gas sensing with nanoparticles

Some of our more fundamental sensing research, funded by the EPSRC, has brought together researchers from AiPT and the Nanoscience Research Group at Aston along with colleagues from Plymouth University. By combining an ultra-high resolution plasmonic sensing platform with a coating of carbon nanotubes, we have provided the first demonstration of the use of the optical properties of carbon nanotubes to provide a gas-specific response, in this case to CO_2.

The approach is much more generic than this though, since techniques are available to functionalise carbon nanotubes to provide sensitivity to other industrially important gases.

Professor David Webb,
Deputy Director of AiPT

"Through the latter part of 2015, increasing amounts of my time have been devoted to detailed planning of a new suite of laboratories for AiPT. The move, likely to occur in mid 2017, will consolidate our activities, providing additional space to accommodate our current expansion and allow redevelopment of the North Wing of the Main Building where most of our laboratories are currently situated."

Key publications of the group in 2015

1. Marques C A F, Peng G-D and Webb D J 2015 Highly sensitive liquid level monitoring system utilizing polymer fiber Bragg gratings Optics Express 23 6058-72
2. Allsop T, Arif R, Neal R, Kalli K, Kundrát V, Rozhin A, Culverhouse P and Webb D J, Photonic gas sensors exploiting directly the optical properties of hybrid carbon nanotube localized surface plasmon structures Light: Science & Applications (2016) 5, e16036
3. Luo, B., Yan, Z., Sun, Z., Liu, Y., Zhao, M., Zhang, L. , Biosensor based on excessively tilted fiber grating in thin-cladding optical fiber for sensitive and selective detection of low glucose concentration, Optics Express, 23, 32429-40.
4. Wang, X., Yan, Z., Wang, F., Hua, J., Mou, C., Sun, Z., Zhang, X. & Zhang, An OTDR and gratings assisted multifunctional fiber sensing system, IEEE Sensors Journal. 15, 8, p. 4660-6.
5. Benjamin J. Coldrick, Colin Richards, Kate Sugden, James S. Wolffsohn, Thomas E. Drew, Developments in contact lens measurement: A comparative study of industry standard geometric inspection and optical coherence tomography, Contact Lens and Anterior Eye, pii: S1367-0484(16)30002-9.

Grants

TRIPOD (Training and Research in Polymer Optical Devices), EC - Marie Curie ITN, 2013-2017

SAFUEL (The SAFer FUEL system), EC – STREP, 2012-2016

Grating and Waveguide Plasmonic Sensors, EPSRC, 2012-2016

FSIR, Innovate-UK (ATI), 2015-2016

POSSIBLE (Polymer Optical Sensing System Innovation Brings Leadership Education), EC – Marie Curie IEF, 2014-2016

Gas Sensing, KTP, 2013-2015

Near Infra-Red Multi-Point Sensing System for Process Control in the Food Processing Industry, Innovate-UK, 2014-2016

SOFST, EC – Marie Curie IEF, 2014-2016

Plasm-on-fibre, EC – Marie Curie IEF, 2014-2016

FOMBIST, EC – Marie Curie IEF, 2015-2017

To develop a new generation of innovative soft contact lens measuring instruments, KTP, 2013-2016

Pathogen detection, CDE, 2015-2016

3. Femtosecond lasers

Ultrafast femtosecond lasers have become an indispensable tool in science, technology and engineering with applications ranging from ultrafast spectroscopy, laser controlled chemical reactions, non-invasive surgery, high precision metrology, and material processing.

At AiPT, we have a selection of femtosecond lasers that are available to fabricate devices with high degree of precision. These lasers allow us to work with a diverse range of media, including ones that are normally not accessible with more conventional material processing techniques.

Researchers in this group:

Academic Staff

Dr. Kate Sugden

Dr. Mykhaylo Dubov

Dr. Kaiming Zhou

Dr. Neil Gordon

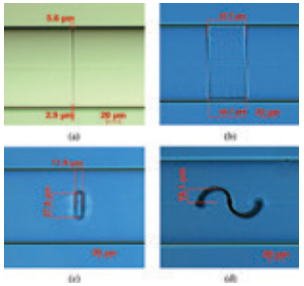
Dr. Graham Lee

Dr. Vladimir Mezentsev

Prof. David Webb

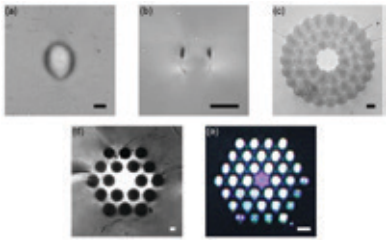
Ultra short pulse lasers permit the modification of materials on a sub-wavelength scale and are becoming an important tool for micro-fabrication.

In-fibre micro-channels.



In 2015 we have extended our work on micro-channels in optical fibres for liquid and gas sensing with femtosecond laser assisted chemical etching expanding the design parameters for novel sensing devices. This includes the fabrication of microholes, microslots, helical channel around the core and Fabry-Pérot-based refractometers. The Fabry-Pérot refractometer was formed by positioning a microchannel between two femtosecond laser inscribed point-by-point fibre Bragg gratings. R.I. sensitivities up to 2.75 nm/RIU was also demonstrated [1].

Metrology

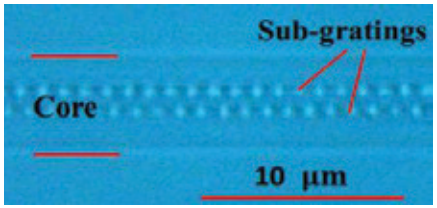


The ultrafast laser was used for the detection of fuel level in an Innovate UK funded research programme in collaboration with Airbus. Due to the ultrashort nature of a femtosecond laser, its pulses can be used to resolve distances with high precision. In combination with a time resolved detection method, time correlated single photon counting (TCSPC) technique, the very weak reflected light, another challenge facing surface detection for liquid, can be detected and give space detection with high resolution.

Waveguide inscription

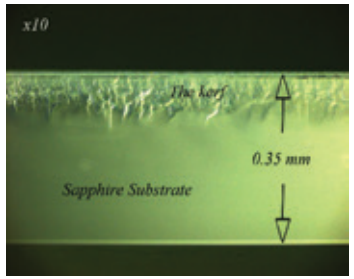
In a collaboration with scientists of Australia, we proposed a return to the original intent of the Type I and II grating classifications, one intrinsically linked to material modification associated with working below or above the optical damage threshold of the irradiated substrate (glass or crystal), optical damage in this case referring to the regime where the target substrate undergoes a rapid change in refractive index in response to a monotonically varying incident laser pulse energy [2].

Dual gratings



One of the advantages of femtosecond laser fabrication is highly localised modification, making it possible to inscribe fibre gratings of different parameters at different location of the core of an optical fibre . In addition, by not requiring photosensitive optical fibre as UV laser technology, fs lasers can inscribe fibre gratings in a more diverse range of optical fibre, including Er- or Yb- doped active fibre. With two channel fibre gratings fabricated at the same section of optical fibre, we implemented a ring cavity fibre laser with the capability with switchable wavelength [3].

Sapphire wafer dicing



Sapphire substrates are widely used for the manufacturing of blue and green LEDs and diode lasers. Dicing of sapphire wafers with deposited GaN device structures is therefore an important technological challenge. We have studied the possibility of using infrared sub-picosecond pulses for dicing of sapphire wafers with widths of both 350 and 75 micrometres. We have observed that pulses with a length of 100-400 femtosecond at a wavelength of 800 nm allows successful cutting of the sapphire substrate as well as having the advantages of a "stealth dicing" method [4].

Key publications of the group in 2015

1. GCB Lee, C Mou, K Zhou, K Sugden, Optimization and characterization of femtosecond laser inscribed in-fibre microchannels for liquid sensing, Journal of Lightwave Technology 33 (12), 2561-2565
2. Simon Gross, Mykhaylo Dubov, and Michael J. Withford, "On the use of the Type I and II scheme for classifying ultrafast laser direct-write photonics," Opt. Express 23, 7767-7770 (2015)
3. F Shen, K Zhou, L Zhang, X Shu , Two-channel Fibre Bragg Grating Fabricated By Femtosecond Laser and Its Application In Switchable Dual-wavelength Erbium-doped Fibre Laser, - Asia Communications and Photonics Conference, 2015
4. SA Kolpakov, NT Gordon, A Yadav, H Kbashi, I Titkov, E Rafailov, K Zhou, Dicing of a sapphire wafer using sub-picosecond pulses at a wavelength of 800 nm, The European Conference on Lasers and Electro-Optics, CM_P_15

Grants

Fuel system integrated research, Innovate UK in collaboration with Airbus, £220,000

Fibre-Optic Multi-parametric Blochemical Sensing Technology , EU Horizon 2020 Marie Skłodowska-Curie actions, £180,000.

4. Fibre Lasers

Understanding the fundamental physics behind laser generation in nonlinear fibre resonators is critically important for development of novel high-performance laser sources offering turn-key solutions for practical applications. By combining advanced theoretical and experimental concepts, we are able to achieve breakthrough understanding of the operational principles and develop new laser sources of the likes of random fibre lasers, turbulent quasi-CW fibre lasers, and passively mode-locked fibre lasers.

Researchers in this group:

Academic Staff

Prof. Sergei Turitsyn, Dr. Sergey Sergeyev

Research Fellows

Dr. Junsong Peng, Dr. Chengbo Mou, Dr. Stanislav Kolpakov, Dr. Vladislav Dvoyrin, Dr. Amos Martinez, Dr. Srikanth Sugavanam, Dr. Nikita Tarasov, Dr. Zamani Zulkifli, Dr. Dmitry Churkin

Research Students

Mr Auro Perego

Visitors

Prof. Valentin Freilikher, Dr. Ilya Vatnik, Dr. Ivan Terekhov

Spatio-temporal generation regimes in lasers

Conventionally, lasers are the epitome of stable optical output. While there is an ever increasing demand for shorter pulses and higher energies, these conditions lead to nonlinear interaction between light and the fibre medium, resulting in seemingly chaotic dynamics in long fibre cavities. This in its turn limits the optimum performance achievable in such laser systems. Although experimentalists tend to avoid unstable regimes because of challenges posed by their irregularity, these highly non-linear generation regimes must be understood to discover new modalities and develop better lasers. To meet this challenge, we change a paradigm of thought - usually lasers are thought to operate in a distinct temporal regime. Instead, we present experimental evidence that the laser operates in a distinct, albeit complex and dynamic spatio-temporal regime. Different spatio-temporal regimes could have different periodicity properties over different scales. This shift in paradigm is set to bring new insights into rich underlying nonlinear physics of not only practical active and passive-cavity photonic systems, but also other physical systems from fields ranging from studies of brain activities to astrophysics, which exhibit a similar co-existence and interplay of processes featuring distinct spatio-temporal scales.

Cyclic wave kinetics

Kinetic theory is a mathematical framework that is used to describe nonlinear systems with a large number of degrees of freedom. Traditional kinetics describes slow evolution to equilibrium via numerous weakly nonlinear interactions and fails for very important class of dissipative (active) optical systems with cyclic gain and losses, such as e.g. lasers. To meet the challenge of kinetic description of a laser, we introduce a new class of wave kinetic systems – active cyclic systems – and a new kinetic formalism for its description. To make a kinetic description of active cyclic systems, we use field theory apparatus. This results in a breakthrough in a very different field – we make first ever description of recently emerged random fibre lasers. More generally, we propose first ever nonlinear kinetic theory of laser radiation (not limited to class of random lasers). We carry out experiments whose results support the theory. The formalism is general and could be applied for a wide class of kinetic problems, for example meteorological and biological cycles.

Isolator-free passively Q-switched fibre laser at 2μm

Ultrafast mid-infrared fibre lasers have found applications in metrology, gas identification, and ranging. However, fibre components at this wavelength region are still quite expensive and complicated to manufacture. We have proposed a novel modified ring fibre laser configuration of Thulium-doped fibre laser, so-called theta or Yin-Yang cavity, which features S-shaped feedback. Such approach helps to ease the configuration and decrease the cost of the laser resonator by removing in-line fibre optical isolator. The fibre laser cavity is formed by two coupler-based nonlinear optical loop mirrors. Varying the coupling ratios directly alters the total power distribution within the cavity and modifies its gain and pulse dynamics behaviour. Hence, the design opens the opportunities to predefine the operation direction.

Q-switched and mode-locked fibre lasers with large angle tilted fibre brag grating

Tilted fibre gratings possess unique polarization spectrum characteristics. They are capable to tap out the s-light and propagate the p-light based on the Brewster's law and, hence, has been used as a new type of in-fibre polarizer. The polarization dependence of the large angle-tilted fibre gratings can induce nonlinear polarisation evolution effect in the laser cavity and induce pulsed laser generation, i.e. passive Q-switching or mode-locking. We have proposed and demonstrated both Q-switched and mode-locked all-fibre laser operating

at switchable single wavelength and dual wavelength. We proved that the use of large angle-tilted fibre gratings as an in-line polariser in a ultrafast fibre lasers provides several advantages compared to bulk polarisers, including low insertion loss, high integrability and less temperature sensitivity.

Ginzburg-Landau turbulence in quasi-CW fiber lasers

Fiber lasers operating via Raman gain or rare-earth-doped active fibers are widely used as sources of continuous wave (CW) radiation. However, these lasers are only quasi-CW: their intensity fluctuates strongly on short time scales. We have shown how the framework of the complex Ginzburg–Landau equations (GLEs), which are well known as an efficient model of mode-locked fiber lasers, can be applied for the description of quasi-CW fiber lasers. The vector Ginzburg–Landau model of a Raman fiber laser describes the experimentally observed turbulent-like intensity dynamics, as well as polarization rogue waves. Our results imply that the very essence of both quasi-CW fiber lasers like the Raman lasers above and partially mode-locked fiber lasers should be revisited, and opens the debate about the common underlying physics of operation of lasers of dramatically different types.

Dr. Chengbo Mou:
"This year was very fruitful for AiPT, we have a couple of high impact papers published in laser dynamics study. AiPT is getting more and more renowned in the community. Feel proud of it!"

Dr. Vladislav Dvoyrin:
"The year was successful in research and development of fibre lasers' technology; the novel mode-locked fibre lasers operating in the broad spectral range of 1-2.4 μm were realized. The obtained results are of great importance for both fundamental laser science and practical applications."

Key publications of the group in 2015

1. Churkin, D. V., Srikanth Sugavanam, Nikita Tarasov, Serge Khorev, Sergey V. Smirnov, Sergey M. Kobtsev, and Sergei K. Turitsyn. "Stochasticity, periodicity and localized light structures in partially mode-locked fibre lasers." Nature communications 6 (2015).
2. Maria Chernysheva, Chengbo Mou, Raz Arif, Mohammed AlAraimi, Mark Rummeli, Sergei Turitsyn, Alex Rozhin "High power Q-switched Thulium doped fibre laser using carbon nanotube polymer composite saturable absorber" Scientific reports (accepted 2015)
3. Zuxing Zhang, Chengbo Mou, Zhijun Yan, Yongjin Wang, Kaiming Zhou, and Lin Zhang, "Switchable dual-wavelength Q-switched and mode-locked fiber lasers using a large-angle tilted fiber grating," Opt. Express 23, 1353-1360 (2015)
4. Sugavanam, Srikanth, Nikita Tarasov, Stefan Wabnitz, and Dmitry V. Churkin. "Ginzburg–Landau turbulence in quasi CW Raman fiber lasers."Laser & Photonics Reviews 9, no. 6 (2015): L35-L39.
5. Churkin, D.V., Kolokolov, I.V., Podivilov, E.V., Vatnik, I.D., Nikulin, M.A., Vergeles, S.S., Terekhov, I.S., Lebedev, V.V., Falkovich, G., Babin, S.A. and Turitsyn, S.K., 2015. Wave kinetics of random fibre lasers. Nature communications, 2.
6. Churkin, D.V., Sugavanam, S., Vatnik, I.D., Wang, Z., Podivilov, E.V., Babin, S.A., Rao, Y. and Turitsyn, S.K., 2015. Recent advances in fundamentals and applications of random fiber lasers. Advances in Optics and Photonics, 7(3), pp.516-569.

Grants

ERC Advanced Grant "UltraLaser", 2011-2016.

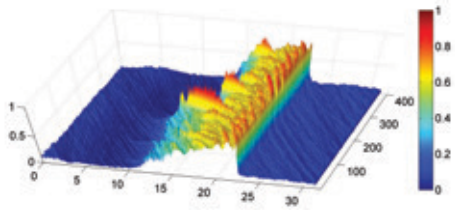
Horizon 2020 RISE, "CARDIALLY - Capturing and quantitative analysis of multi-scale multi-channel diagnostic data» (Aston Uni – coordinator), 2015-2019

Erasmus+ Programme, Staff and student mobility for teaching and training with Russia, (Aston Uni - coordinator), 2015-2016

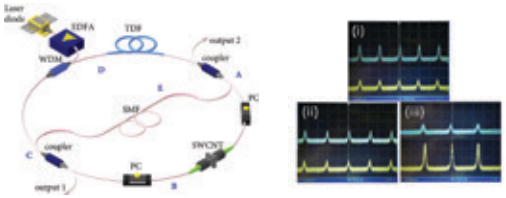
Newton Fund, International Exchanges Programme, Visiting Researcher – Dr. E. Chaikina (Mexico), 2015-2016

FP7 IRSES, "Random fibre lasers for telecommunications and distributed sensing", (Aston Uni - coordinator,), 2011-2015

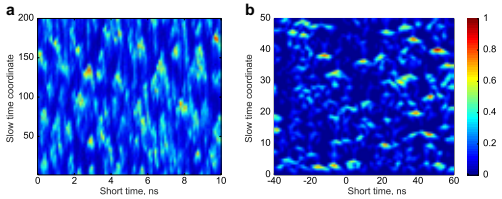
Real-time intensity domain measurements using spatio-temporal dynamics



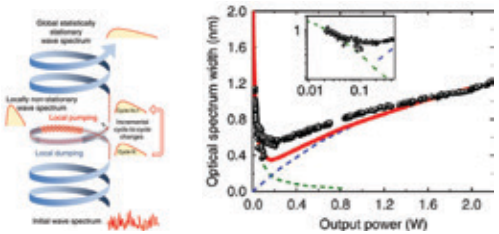
Isolator-free passively Q-switched fibre laser at 2 um.



Unifying the physics of partially mode locked and quasi-CW fibre lasers



Wave kinetics of random fibre lasers



5. Nanomaterials Photonics

The nanomaterials photonics group has an active interdisciplinary research programme funded by, BBSRC, FP7 and Horizon 2020 on development and utilization of functional nanomaterials such as carbon nanotubes, graphene, CdS, ZnO for:

– photonic sensors for food and environmental monitoring,

– ultra-fast fibre laser systems,

– functional thin film coatings,

– drug delivery systems.

The group has state-of-the-art facilities for wet chemistry processing of nanomaterials, and fabrication of polymer nano-composites and nano-ink.

We operate absorption/transmission spectroscopy, photoluminescence excitation –emission spectroscopy and micro Raman spectroscopy for optical characterisation of photonic materials.

We integrate functional nanomaterials in planar photonic structures, fibre Bragg gratings, plasmonic structures, fibre laser cavities with the aim to achieve unprecedented sensitivity for gas molecules, micro bacteria, hazardous agents and to realise novel laser generation regimes.

Researchers in this group:

Academic Staff

Dr. Alex Rozhin

Research Fellows

Dr. Sergey Kulinich

Dr. Petro Lutsyk

Dr. Chengbo Mou

Dr. Maria Chernysheva

Research Students

Mrs Raz Arif

Mr Mohammed AlAraimi

Mr Peter Stone

Visitors

Dr. Igor Yanchuk

Dr. Volodymyr Yukhymchuk

Mr Semeon Ponomarov

Mr Oleksandr Hreshchuk

Mr Serhii Krasnovyd

The special structure of nanomaterials gives rise to their amazing properties. The ability to manipulate the structure and composition on the nanoscale provides very large opportunities to create new materials with superior performance for new products and devices. Since optical properties of nanomaterials can be controlled by changing their size, shape and aspect ratio, as well as via their surface modification, nanomaterials are prime candidates as building blocks for photonic systems.

A range of semiconductor and oxide nanomaterials (ZnO, SnO2, CdO and CdS) were synthesized via laser ablation and chemical routes. The nanomaterials were prepared with pure or passivated surfaces, which was realized either in situ or ex situ, i.e. during the material preparation or afterwards, if necessary. Materials then used to produce either polymer nanocomposites or nano-ink for development of photonic and sensor devices.

Graphene is promising material for a number of applications in photonics such as optical modulators, saturable e absorbers and photo diodes. We demonstrated poor fluorinated graphene sheets produced by thermal exfoliation embedding in carboxymethylcellulose polymer composite (GCMC) as an efficient mode locker for erbium doped fibre laser for generation of sub-ps soliton type pulses.

We developed functional coating with the anti-icing (or icephobic) performance. The results were highlighted in Advances in Engineering!

Key publications of the group in 2015

1. C. Mou, R. Arif, A.S. Lobach, D.V. Khudyakov, N.G. Spitsina, V.A. Kazakov, S. Turitsyn, A. Rozhin “Poor fluorinated graphene sheets carboxymethylcellulose polymer composite mode locker for erbium doped fiber laser”, Appl. Phys. Lett., 106, 061106 (2015).

2. S. A. Kulinich, M. Honda, A. L. Zhu, A.G. Rozhin, X. W. Du “The icephobic performance of alkyl-grafted aluminum surfaces” Soft Matter, 11, 856-861 (2015).

3. Mou, C, Sergeyev, S, Kolpakov, S, Arif, R, Rozhin, A, Chernysheva, M & Turitsyn, S 2015, ‘Polarization dynamics of dissipative solitons in a erbium doped fiber laser passively mode locked by carbon nanotube polymer composite’. in CLEO: QELS fundamental science 2015., paper FW4D.4, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_QELS.2015.FW4D.4

4. Song, J, Kulinich, SA, Li, J, Liu, Y & Zeng, H 2015, 'A general one-pot strategy for the synthesis of high-performance transparent-conducting-oxide nanocrystal inks for all-solution-processed devices' Angewandte Chemie, vol 54, no. 2, pp. 462-466., 10.1002/anie.201408621.

5. Goto, T, Honda, M, Kulinich, SA, Shimizu, Y & Ito, T 2015, 'Defects in ZnO nanoparticles laser-ablated in water-ethanol mixtures at different pressures' Japanese Journal of Applied Physics, vol 54, no. 7, 070305., 10.7567/JJAP.54.070305.

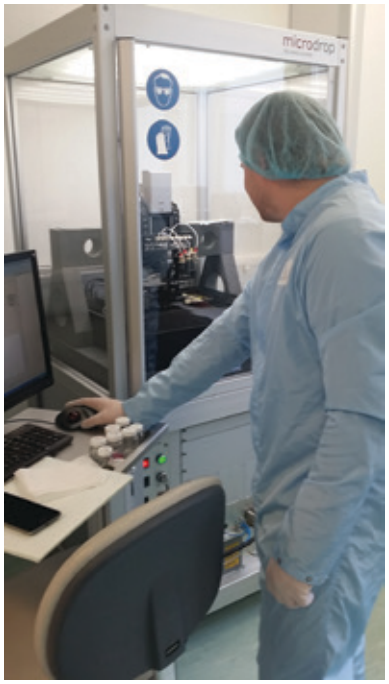
Grants

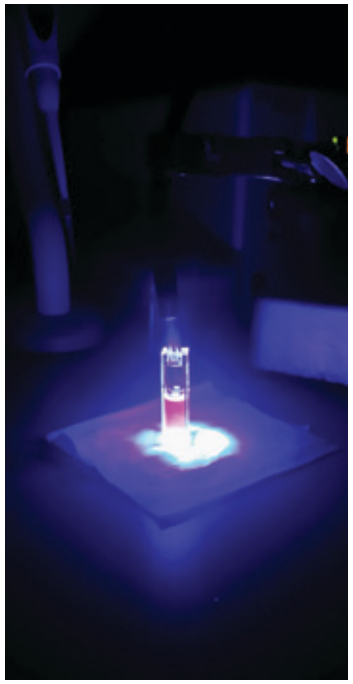
"Carbon Nanotubes Technologies in Pulsed Fibre Lasers for Telecom and Sensing Applications", Proposal No 269271- Acronym: TeLaSens FP7 Marie Currie International Research Staff exchange Scheme Project

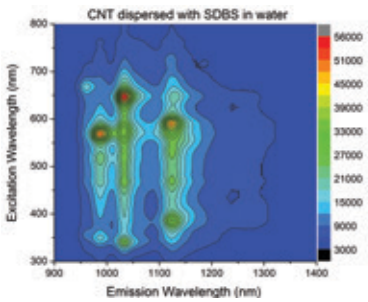
"Nanomaterial Photonic Sensors for Food Manufacturing", Marie Curie International Incoming Fellowship (FP7-PEOPLE-2012-IIF, Proposal number: 330516),

BBSRC Industrial Case PhD studentship "Developing new tools for understanding the in vivo distribution of vaccine adjuvants"

Functionalised Organic Complexes for rapid Sensing of Industrial Polluters" Marie Sklodowska-Curie Individual European Fellowship (H2020-MSCA-IF-2014_ST, Proposal #: 654733)







Our nanomaterials can greatly enhance performance of many photonic systems!

6. Optoelectronics and Biomedical Photonics

Our research focuses on development and application of photonic devices for biology and medicine. In particular, we focus on non- and minimally invasive cancers diagnostics and treatment, laser-based Doppler flowmetry, fluorescent tissue analysis, multi-photon imaging and spectroscopic techniques in biomedicine. Photonic devices we develop include compact, tunable, high-power ultrafast and CW lasers in visible, near and mid IR spectral regions, THz sources and detectors and high-brightness white LEDs.

Researchers in this group:

Academic Staff

Prof. Edik Rafailov

Dr. Natalia Bazieva

Research Fellows

Dr. Ksenia Fedorova

Dr. Andrei Gorodetsky

Dr. Karina Litvinova

Dr. Sergei Sokolovsky

Dr. Ilya Titkov

Research Students

Mr. Argyrios Tsatsakoulias

Mr. Amit Yadav

Mr. Modestas Zulonas

Visitors

Prof. Grigorii Sokolovskii

Ms. Alessandra Cecchini

Mr. Ivo Leite

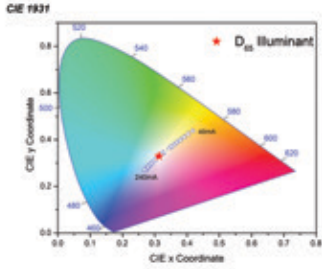
Mr. Shamil Mirkhanov

Mr. Thomas Rabl

Mr. Salvatore Smirni

Mr. Sergey Turtaev

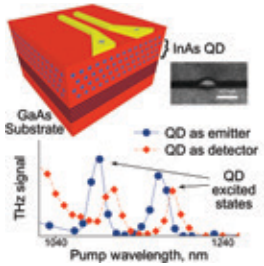
High CRI White light LEDs



Light emitting diode (LED)-based lighting solutions with their superior efficiency are rapidly replacing the traditional sources for indoor and outdoor applications alike. The ability of these sources to render true colours of an object is of critical importance for an adequate and appropriate visual appearance at place like art galleries, museums, hospitals, and exhibitions. For achieving a high colour rendering index (CRI), broad emission linewidth is suitable. In an effort to achieve this, various approaches to realize white emission are being applied.

In the frame of the €11.8M FP7 IP Project "NEWLED" we work on the development of high brightness white LEDs with high CRI and efficacies. Furthermore, solutions to improve quantum efficiencies and reduce losses are targeted from epitaxial growth to application. In 2015, we demonstrated a monolithic white LED with CCT tuneable from warm (3500 K) to cool (13000 K) white. We have also demonstrated a very high value of CRI, Ra = 67, from dual wavelength monolithic, phosphor free devices, for the first time to the best of our knowledge.

Terahertz Laser Sources and their applications



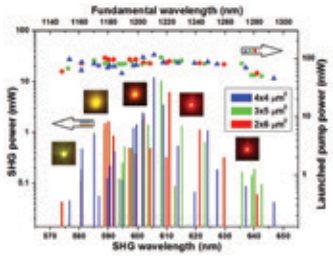
Compact and tunable semiconductor terahertz sources providing direct electrical control, efficient operation at room temperatures and device integration opportunities are of great interest for the past two decades. One of the most well-established techniques for terahertz generation utilises photoconductive antennas driven by ultrafast pulsed or dual-wavelength continuous wave laser systems, though some limitations, such as confined optical wavelength pumping range and thermal breakdown, still exist.

Our group proposed the use of quantum dot-based semiconductor materials, which have unique carrier dynamics and material properties. These materials can help to overcome limitations and enable efficient optical-to-terahertz signal conversion at room temperatures.

We proposed the construction of novel and versatile terahertz transceiver systems based on quantum dot semiconductor devices. We demonstrated their configurability, energy-dependent optical and electronic characteristics and the resonant response to optical pump wavelength. Terahertz signal generation and detection at energies that resonantly excite only the implanted quantum dots, shown recently, opens the potential for using compact quantum dot-based semiconductor lasers (the main area of group's expertise) as pump sources. We ran proof-of-concept experiments that showed quantum dot-based samples to have higher optical pump damage thresholds and reduced carrier lifetime with increasing pump power.

The results were presented by two talks at CLEO Europe 2015 and one presentation at Photonica 2015 in Belgrade.

Broadly tunable second harmonic generation



The development of compact, widely tunable laser sources in the visible spectral region is an attractive subject, motivated by demand

from the biomedical community, where practical laser sources are required for use in photodynamic therapy, laser-Doppler velocimetry, flow cytometry, spectroscopy, and advanced imaging techniques. However, these applications normally require a number of lasers to cover the whole visible spectrum, making the system bulky, expensive, and complex to operate. Therefore, a laser system that will be cost effective, easy to use, shoebox sized, and tunable across the visible spectrum is of great interest.

Currently, there is no single compact laser system capable of tuning over the whole visible spectral range with the output powers required for most biomedical applications. In this respect, semiconductor lasers with their small size, high efficiency, reliability, and low cost in combination with second-harmonic generation phenomenon are promising for the realization of such sources, enabling a spectrally flexible tool for biomedical applications.

Our group has demonstrated a number of compact laser sources operating in the visible spectral region in the CW and pulsed regimes. Among them the recently demonstrated compact yellow-to-red (574 nm – 647 nm) tunable all-room-temperature CW laser source, which is based on frequency doubling of a broadly tunable InAs/GaAs quantum dot external cavity diode laser in PPKTP crystal waveguides. The presented widely tunable laser source with the unique spectral coverage represents an important step toward a compact, efficient, and versatile laser source that can replace available, inefficient, and bulky visible lasers.

Biomedical photonics

For years, photonics based techniques have been employed all over the world to screen, diagnose and treat many medical conditions. Autofluorescence diagnosis has come to the fore, particularly for cancer diagnosis. Of special interest is urinary bladder cancer, which is one of the top ten most prevalent cancers worldwide.

The multi-functional diagnostic system "LAKK-M" was used to assess autofluorescence profiles of healthy and cancerous bladder tissue to identify novel biomarkers of the disease. Statistically significant differences were observed in the optical redox ratio (a measure of tissue metabolic activity), the amplitude of endogenous porphyrins and the NADH/porphyrin ratio between tissue types. We designed a computer simulator optical 3D bladder cross-sectional model to allow for the study of light propagation by a wide range of wavelengths through bladder tissue.

These findings could advance understanding of bladder cancer and aid in the development of new techniques for detection and surveillance.

Key publications of the group in 2015

1. G.S. Sokolovskii, E.A. Viktorov, M. Abusaa, J. Danckaert, V.V. Dudelev, E.D. Kolykhalova, K.K. Soboleva, A.G. Deryagin, I. I. Novikov, M.V. Maximov, A.E. Zhukov, V.M. Ustinov, V.I. Kuchinskii, W. Sibbett, E. U. Rafailov, T. Erneux, "Dropout dynamics in pulsed quantum dot lasers due to mode jumping," Applied Physics Letters, 106, 261103 (2015).
2. A.V. Dunaev, V.V. Dremin, E.A. Zherebtsov, I.E. Rafailov, K.S. Litvinova, S.G. Palmer, N.A. Stewart, S.G. Sokolovski, E.U. Rafailov, "Individual variability analysis of fluorescence parameters measured in skin with different levels of nutritive blood flow," Medical Engineering & Physics, Vol. 37, No. 6, p. 574-583 (2015).
3. D. Al Nakdali, M. Gaafar, M.K. Shakfa, F. Zhang, M. Vaupel, K.A. Fedorova, A. Rahimi-Iman, E.U. Rafailov, M. Koch, "High-Power Operation of Quantum-Dot Semiconductor Disk Laser at 1180 nm," IEEE Photonics Technology Letters, 27(10), pp. 1128-1131 (2015).
4. K.A. Fedorova, G.S. Sokolovskii, P.R. Battle, D.A. Livshits, E.U. Rafailov, "574-647 nm wavelength tuning by second-harmonic generation from diode-pumped PPKTP waveguides," Optics Letters, 40(5), pp. 835-838 (2015).
5. S. Palmer, K. Litvinova, E. Rafailov, G. Nabi, "Detection of urinary bladder cancer cells using redox ratio and double excitation wavelengths autofluorescence," Biomed. Opt. Express, 6, pp. 977-986 (2015).

Grants

FP7-IP NEWLED €11.8m

Ongoing Fletcher Fund grant £250,000

Incoming Leverhulme fellowship (K. Staliunas)

Andrei Gorodetsky

"The year was hard, but we've got very promising results: QD antennae can be pumped with powers exceeding 1W! This is something to stand on when drafting new projects. Also I was very happy to see so many Aston participants on CLEO Europe."

7. Optical Communications

Communication services are critical to the people of the UK and the British economy, with over 99% of our data being carried around the country and beyond by optical fibre communication networks which rely on photonics technology. These optical systems are being deployed ever-closer to the end-user, at home, at work, and on the move, and are critical to our modern information society. AIPT's optical communications research group is working on several key aspects of optical fibre communications to enable society's every increasing demands for information.

Researchers in this group:

Academic Staff

Prof. Sergei Turitsyn, Prof. Andrew Ellis, Prof. Keith Blow, Prof. Nick Doran, Prof. David Payne, Dr. Paul Harper, Dr. Wladek Forysiak, Dr. Stylianos Sygletos, Dr. Sergey Sergeyev.

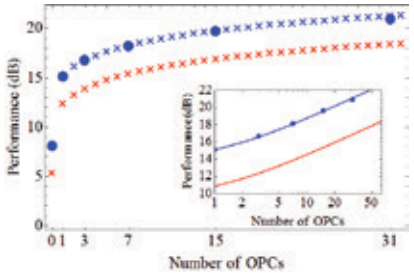
Research Fellows

Dr. Atala El-Taher, Dr. Filipe Ferreira, Dr. Naoise MacSuibhne, Dr. Marc Stephens, Dr. Mary McCarthy, Dr. Ian Phillips, Dr. Christian Sanchez Costa, Dr. Mariia Sorokina, Dr. Son Thai Le, Dr. Mingming Tan, Dr. Lukasz Krzczanowic, Dr. Christos Tsekrekos, Dr. Lida Sadeghion.

Research Students

Mr Vladimir Gordienko, Ms Tingting Zhang, Mr Morteza Kamalian Kopae, Mr Asif Iqbal, Mr Mohammad Al-Khateeb.

Core and Access Networks



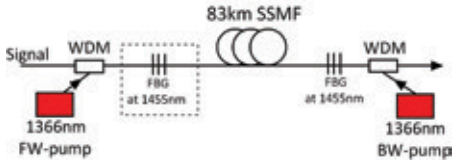
Having broken the nonlinear Shannon limit through nonlinearity compensation and establishing a thorough understanding of the nonlinear interaction between communication signals and noise associated with signal amplification, we have investigated techniques to break this limit as well. By distributing optical phase conjugators along the transmission line, rather than allowing the interaction to accumulate along the entire transmission line, each successive fibre section (separated by OPCs) compensates the previous section significantly reducing the net interaction length. For a long haul transmission link, this approach enables the system performance to be more than doubled.

At the same time, traffic studies revealed the impact of optical phase conjugation deployment at network level. The OPCs placement and the launched optical power into the fibre links proved critical parameters in getting the efficiency benefits of this technique.

Nonlinear amplification

The Aston Communications group is actively pursuing research into optical amplifier technology in order to help supersede Erbium Doped Fibre Amplifiers (EDFAs). EDFAs can provide ~35nm of gain bandwidth which may not be adequate in a future capacity limited, data driven world. One promising technique to extend this bandwidth is to leverage nonlinear effects in optical fibre to provide gain: typically a high power pump light beam can create additional signal photons either via the well-known Raman effect or via parametric mixing processes. The latter is normally termed a Fibre Optical Parametric Amplifier (FOPA). The FOPA offers potential gain bandwidths as high as 200nm using novel dispersion-stable highly nonlinear fibres (HNLFs). One limitation of the FOPA is the generation of undesired mixing products when using multiple input signals for amplification , which can interfere with the amplified signals and thus act as crosstalk, decreasing the effective optical signal to noise ratio (OSNR) and hence received performance. The Aston team have recently experimentally demonstrated for the first time that by additionally incorporating a counter-propagating Raman pump within a FOPA, the crosstalk can be reduced in magnitude by up to 6dB compared with a standard FOPA.

Raman fibre laser based amplification

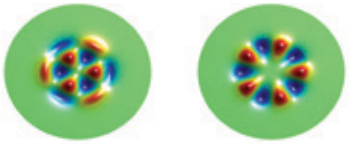


A distributed amplifier provides amplification along the length of the actual transmission fibre improving the signal-to-noise ratio of the system. Distributed Raman amplifiers have been increasingly deployed in both long-haul and unrepeatered transmission systems. Ideally, the signal power profile would be perfectly uniform to minimize the impact of noise. This can be achieved by using a novel amplifier configuration - Raman fibre laser (RFL) based amplification – which uses second order pumping and the passive Fabry Bragg grating (FBG) to create a first order ultra-long fibre laser to amplify the signal.

Our recent work provides a detailed investigation of the impact of second order forward propagated Raman pumping on long-haul 100Gbit/s repeatered transmission using Raman fibre laser based amplifications. Our results show that whilst using FW-pumping minimises the signal power variation, the performance penalty due to relative intensity noise (RIN) associated with forward Raman pumping was too great for any overall advantage to be seen. However, by using a random DFB fiber laser based configuration

the RIN can be reduced making forward pumping feasible. This scheme offers the best transmission performance whilst maintaining a low signal power variation, and as such it can be highly suitable for different nonlinearity compensation schemes.

Space Division Multiplexing



Space division multiplexing (SDM) has recently received great attention a promising technology to increase system capacity. Parallel transmission of N information signals can be accomplished by exploiting the guiding modes of a few-mode fibre (FMF). However, the optical link and the transceiver must be designed in order to cope with the arising impairments such as modal coupling and differential mode delay.

Our recent work includes the detailed investigation of the group delay statistics in a few mode fibre system operating in the weak and strong linear coupling regimes as well as in the intermediate coupling regime. We have derived a single expression linking the standard deviation of the group delay spread to the fibre linear mode coupling and we have validated this for any coupling regime, considering up to six linearly polarized guided modes. Also, a DSP code has been developed for the realization of multiple-input multiple-output (MIMO) optical transmission experiments and and we have investigated the required memory length to ensure a minimum acceptable performance in a variety of coupling strength and differential mode group delay conditions of an SDM transmission system.

Grants

UNLOC - Unlocking the capacity of optical communications, Engineering and Physical Sciences Research Council, co-PI's : S. Turitsyn, A. Ellis, P. Harper, L Zhang

PEACE – Petabit energy aware capacity enhancement, Engineering and Physical Sciences Research Council, PI : A. Ellis

FOX-C - Flexible optical cross-connect Nodes enabling next generation optical networking, European Commission, co-PI's : A. Ellis, S. Sygletos

INSPACE - Spatial-Spectral flexible optical networking enabling solutions for a simplified and efficient SDM, European Commission, co-PI's : A. Ellis, S. Sygletos

FOPA – Wideband optical communication systems using phase-sensitive/insensitive fibre optical parametric amplifiers, Engineering and Physical Sciences Research Council, PI : N. Doran

DISCUS – The distributed core for unlimited bandwidth supply for all users and services, European Commission, PI's : N. Doran, D. Payne

Awards

UPON – Ultimate passive optical network, Engineering and Physical Sciences Research Council, co-PIs : N. Doran, A. Ellis

TOM3 – Towards manufacturing of Massive WDM metro, Engineering and Physical Sciences Research Council, PI: Wladek Forysiak

Radio, Optical and Digital design for UHD transceivers, co-PI : A. Ellis, Wladek Forysiak, S. Sygletos

INNOVATION – Multi-wavelength regeneration technologies for advanced modulation optical signals, European Commission, co-PIs : S. Turitsyn, S. Sygletos

Key publications of the group in 2015

1. A.D.Ellis, M.E.McCarthy, M.A.Z. Al-Khateeb, and S. Sygletos, "Capacity limits of systems employing multiple optical phase conjugators", Optics Express, vol. 23, no. 16, pp 20381-20393 (2015).
2. Mingming Tan, Paweł Rosa, Son Thai Le, Ian. D. Phillips, and Paul Harper, "Evaluation of 100G DP-QPSK long-haul transmission performance using second order co-pumped Raman laser based amplification," Opt. Express 23, 22181-22189 (2015)
3. M. Tan, P. Rosa, I. Phillips, and P. Harper, "Extended Reach of 116 Gb/s DP-QPSK Transmission using Random DFB Fiber Laser Based Raman Amplification and Bidirectional Second-order Pumping," in Optical Fiber Communication Conference, OSA Technical Digest (online) (Optical Society of America, 2015), paper W4E.1.
4. A. Redyuk, M.F.C. Stephens, and N.J. Doran, "Suppression of WDM four-wave mixing crosstalk in fibre optic parametric amplifier using Raman-assisted pumping," Opt. Express 23, 27240-27249 (2015)
5. F. M. Ferreira, C. S. Costa, N. Mac Suibhne, S. Sygletos, A. D. Ellis, "Nonlinear distortion in mode delay compensated few-mode fibre spans with intermediate coupling" accepted for publication in ECOC 2016

Education

AiPT offers extensive educational opportunities to its students.

We run PhD and Masters level courses, as well as recently launched MSc by research. Aston School of Engineering and Applied Sciences also provides a few BSc courses which may lead to career in photonics too.

Being an active member of a range of European funding schemes, AiPT is currently running two Innovative Training Networks, which bring together universities and companies from different countries to train a new generation of doctoral-level researchers.

Innovative Training Networks

TRIPOD

TRIPOD is a Marie Curie Initial Training Network located in the field of optical fibre sensors - an area where Europe has developed internationally competitive research and commercial activity. The project has received funding from the People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme FP7/2007-2013. We have brought together an interdisciplinary scientific team with expertise covering all aspects of the sensor fabrication path to enable us to obtain a full understanding of the process, with the aim of enabling us to produce optimised grating sensors, efficiently, repeatably and reliably.

www.tripod-itn.eu

ICONE

The ICONE Initial Training Network provides training and education of engineers and researchers within the most advanced optical transmission systems, i.e. high capacity high constellation coherent systems using digital signal processing (DSP). European industry is experiencing an explosive growth in demand for qualified engineers, researchers and staff well trained in all of these fields, both for direct application in the development of products and services for core communication networks. Students graduating from this program will be well placed to fill this gap.

www.iconeproject.com

PhD students graduated in 2015

Janarthanan Rasakanthan

Advances in Characterisation, Calibration and Data Processing Speed of Optical Coherence Tomography Systems

Supervisor: Dr. Kate Sugden

Raz Arif

Functional carbon nanotubes for Photonic Applications

Supervisor: Dr. Alex Rozhin

Ada Abang Akpan

Development of Polymer Grating Technology

Supervisor: Prof. David Webb

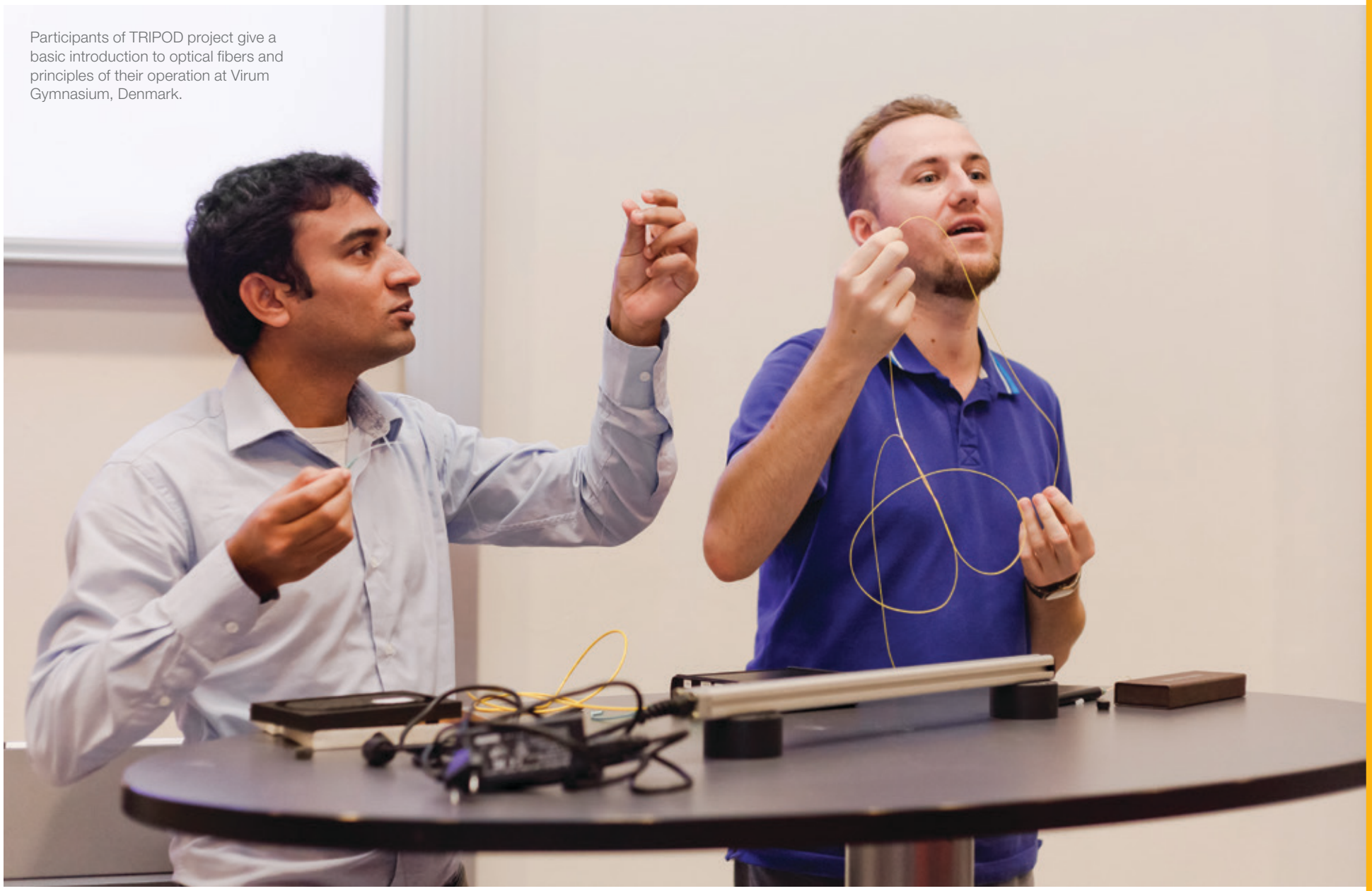
Srikanth Sugavanam

Real-time Intensity and Spectral Characterization of Fibre Lasers

Supervisor: Prof. Sergei Turitsyn

TRIPOD project participants are giving a lecture on photonics basics at Virum Gymnasium, Denmark.

Workshop put on for ICONE students



Participants of TRIPOD project give a basic introduction to optical fibers and principles of their operation at Virum Gymnasium, Denmark.

PhD graduate 2015

Srikanth Sugavanam

"To do a PhD at AiPT has been one of the best decisions I have taken so far. It has been an enriching and fulfilling experience. The hands-on training approach, together with the available state-of-the-art infrastructure and the innumerable training programmes have helped me to accelerate my learning, and actively contribute to relevant scientific advance in the process. The constant flux of distinguished scientific visitors from all over the world, and the unparalleled opportunity to interact with them one-on-one has been particularly enlightening. Seeing science in action is a thrilling experience, and as an AiPT PhD student, I got the best seat in the house."

Graduation ceremony at Aston University.

PhD Student Research Areas and Projects

Mr. Mohammad Al-Khateeb
Dispersion and functionalization of carbon nanotubes for photonic applications
Prof. Andrew Ellis

Mr. Mohammed Al Araimi
Experimental demonstration of the extension of non-linear capacity limits in optical fibre networks
Dr. Alex Rozhin

Mr. Abdulyezir Ayomipo Badmos
Advanced optical grating and sensing applications
Prof. Lin Zhang

Mr. Md Asif Iqbal
Advanced Raman amplification and ultra-long Raman fibre laser for long haul coherent optical communication
Dr. Paul Harper

Mr. Adenowo Gbadebo
Advanced method of fabricating Fibre Bragg Gratings
Prof. Sergei Turitsyn

Mr. Vladimir Gordienko
Broadband fibre parametric amplifiers
Prof. Nick Doran

Mr. Huseyin Karakuzu
Microstructured waveguides in z-cut Lithium Niobate
Dr. Sonia Boscolo

Mr. Morteza Kamalian Kopae
Communication systems based on nonlinear Fourier transformation
Prof. Sergei Turitsyn

Mr. Hani Kbashi
Vector optical rogue waves in a fibre laser
Dr. Sergey Sergeyev

Mr. Son Thai Le
Advanced digital signal processing techniques for optical coherent OFDM transmissions
Prof. Sergei Turitsyn

Mr. Teerawat Piromjitpong
'Micro-structured optical waveguides for nonlinear-optics and mid-infrared applications
Dr. Sonia Boscolo

Mr. Auro Michele Perego
Nonlinear dynamics of Raman lasers and amplifiers
Prof. Sergei Turitsyn

Mr. Andreas Pospori
Polymer fibre grating UV fabrication and testing
Prof. David J. Webb

Mr. Zhongyuan Sun
Near- and mid-IR fibre grating devices and applications
Prof. Lin Zhang

Mr. Mingming Tan
Raman fibre laser based amplification in coherent transmission systems
Dr. Paul Harper

Mr. Nikita Tarasov
Temporal and spatio-temporal regimes of generation of Raman fibre lasers
Prof. Sergei Turitsyn

Mr. Changle Wang
Fibre gratings in sophisticated fibres (multicore and multimode fibre)
Prof. Lin Zhang

Mr. Amit Yadav
Novel semiconductor based light emitting sources
Prof. Edik Rafailov

Ms. Tingting Zhang
Design and experimental demonstration of energy-efficient super-channel transponders
Prof. Andrew Ellis

Mr. Michal Zubel
Development of polymer optical fibre Bragg grating technology for deployment and interrogation
Prof. David Webb/ Dr. Kate Sugden

Mr. Modestas Zulonas
Highly efficient light emitting devices
Prof. Edik Rafailov

Mr Ilya Rafailov
The development of novel photonics based techniques for biomedicine
Prof. Lin Zhang

Ms. Sandra Donohoe
Polymer fibre gratings for applications in life and health sciences
Prof. David Webb/ Prof. Chris Hewitt

Community

Industrial Collaboration

Using its specialist equipment and know-how built up over 25 years, AiPT attracts science and technology projects and brings academics and industry professionals together in mutually beneficial collaborations.

The advanced facilities available are typically far beyond the economic reach of SMEs, allowing small-scale businesses to test products and prove concepts to internationally recognised standards.

Photonics R&D has opened up new opportunities in core industry areas such as lighting, automotive and aerospace, advanced manufacturing, energy, construction, health care, environment and food safety.

AiPT helps local companies to grow with ERDF

The development of new photonic technologies in the UK is currently considered by the Department for Business, Innovation and Skills and the Technology Strategy Board among the top priorities in development of innovative high-technology businesses.

The Aston Institute of Photonic Technologies (AiPT) run a programme funded by the European Regional Development Fund (ERDF) to promote and support photonic technology by offering free consultancy and business support to small and medium-sized businesses in Birmingham and West Midlands region.

Through this project we were able to help businesses work together and test out new technologies to identify cost savings and help establish brand new products that will boost profits, support longevity of our regional businesses and help strengthen the local economy

During the last stage of the project AiPT has helped 51 local companies through the range of consultations, events, lab experiments and reports.

A few examples

MagiLED

MagiLED (UK) Ltd is one of the growing SME in the LED industry in the UK. They have their own design team and assembly facilities. Based on the high competition in the global LED market, especially when low cost Asian manufacturing business involved in, MagiLED is looking at the market with new perspectives with an emphasis on precisely machined metal material for efficient energy saving purposes. In collaboration with the AiPT team, MagiLED managed to achieve initial result using the cutting edge ultra-precision femtosecond laser micromachined metal materials which serves as the proof of concept for the next generation LED design and implementation.

KIMAL

Kimal is a medium sized company which develops catheters and associated kits for a range of medical requirements. These catheters are used for both the introduction of medications and removal of fluids from patients during surgical procedures. At present these devices are purely passive however company believes that there is scope to add additional functionality to produce a more useful product and increase their added value. Initially, Kimal was not familiar with the latest achievements in the field of photonic sensors but were attracted to the possibility of remote measurement with light.

The company was aware that glass based optical fibres would not be acceptable for many medical applications due to safety concerns should the fibre break. AiPT described the range of properties that can be measured with photonic sensors. There was also some discussion about progress in plastic fibres.

The company was interested in both photonic sensors and photonic laser micro-machining. Following the meeting, the company made a list of 3 possible programmes where they had an interest and it was agreed that the ERDF team should evaluate these and write a report. The ERDF team was able to successfully micro-machine the surface of a catheter making both holes and writing shapes.

The second project could not be completed due to the non-availability of a solid catheter tube. Finally, an investigation was undertaken into the state of the art with plastic fibres. It was found that these would have suitable performance for temperature sensors and oxygen sensors however it was thought that currently achieved performance with pressure sensors was not sufficient for the company's requirements.

A possible problem was the lack of commercial availability of suitable plastic fibres.

This problem is currently being addressed by an EU programme known as TRIPOD. Contact was made with the leader of the TRIPOD team (Prof. David Webb) and Kimal were offered the opportunity to assess the fibres produced on this programme and to collaborate with it.

KIMAL
Making a Difference

Optimec ltd develops new generation of innovative soft contact lens measuring equipment

Optimec Ltd (Optimec) has 34 years of experience in the design and manufacture of soft contact lens measuring instruments, and has an understanding of customer and operator requirements and a strong presence in the market.

The manufacturing process for contact lenses has become increasingly precise and accurate through the use of higher performance lathes and moulds. It was essential that Optimec could develop measuring instruments capable of the same degree of precision.

The company has entered into a two and a half year Knowledge Transfer Partnership (KTP) with Dr. Kate Sugden and Dr. Tom Drew of Life and Health Sciences from Aston Institute of Photnic Technologies, to develop a new generation of innovative soft contact lens measuring instruments, utilising novel techniques to match improved accuracy of lens manufacturing processes.

This project was strategically essential for Optimec to maintain and improve its market position through the introduction of a unique product, which will form the platform for a full range of lens measuring instruments that will measure soft contact lenses and also enable expansion into new markets such as intraocular lenses.

The development of interference methods will not only minimise operator dependent variation, but offer improved resolution and accuracy. This enables the de-skilling of these measurements and opens opportunities to address the difficulties of measuring modern non symmetrical lenses such as toric and varifocal. It is also possible to introduce the capability of full 3D mapping, lens ray tracing, simulation, performance assessment capabilities and very advanced metrology compared to current metrology systems.

Dr. Kate Sugden: Working with Optimec has been beneficial to all concerned. The KTP partnership provided an ideal vehicle to work on an exciting new product development. It also instigated a number of student projects and various other areas of common interest.

Fuel & systems integrated research with Airbus

Aston University and Airbus are to collaborate in a part of a significant aerospace technology institute project called "fuel & systems integrated research" (fsir).

The project will evaluate four novel photonic techniques for measuring liquid levels and will develop the most promising of these techniques for potential application to fuel gauging on aircraft.

This project will focus on the development of the next generation of fuel systems and enabling technologies and capabilities. The project will address some of the key challenges facing the development of the next generation of fuel and inerting systems technologies.

Steve Lawson, Project Leader from Airbus
"We are happy to be working with Aston University on this project which will enable us to assess these different photonic methods. It's a new and exciting area and we look forward to the results."

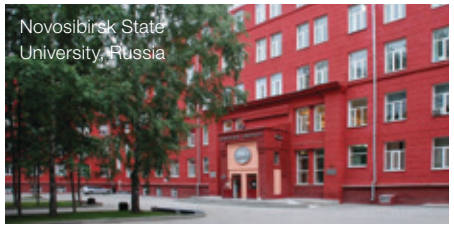
International Collaborations

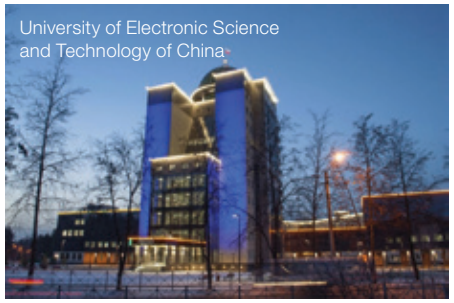
It goes without saying nowadays that international research collaborations and networking is critically important in the modern science. International scientific cooperation is a fast growing component of core research activities around the globe. One of the key goals of the Aston Institute of Photonic Technologies is to build through top level research, growth and expansion of our capability a global international visibility.

The AiPT research can only thrive if we engage with the best people, academic groups and industry around the world. The AiPT International collaboration map shows locations of our international collaborators either in joint papers or projects and how impact of their research is stretching beyond the UK. Over past five years AiPT researchers published papers with more than 70 international groups. For the same period we hosted more than 160 research visitors in AiPT.

We are happy to collaborate with the leading academic and research centres from MIT and Princeton to Lawrence Livermore National Laboratory and Bell Labs. With establishing new UK programmes such as the Newton Fund and Global Challenges Research Fund internationalisation of our activities is even more important. In simple terms, AiPT international collaborations provide us access to a wider range of ideas, facilities and resources. Our international links enable our researchers to participate in networks of cutting-edge and innovative activity providing opportunities to do research deeper and faster by working with other leading people in their field. In terms of regular Research Excellence Framework (REF) assessments it is also impact of internationally co-authored work is significantly higher than the overall average. Two our joint research centres: one with the Novosibirsk State University and second with the University of Electronic Science and Technology of China are contributing substantially to high level of our publications.

Laser laboratory in the Aston-NSU intertantional centre for photonics, Novosibirsk, Russia





The development of a joint research centres increase our research capacity and provide us with access to new knowledge, technologies, facilities and infrastructure. The centres operate as distributed laboratories with locations in UK, Russia and China. These collaboration already led to more than 30 joint publications including a number of 4* papers in journals such as Nature Photonics, Physics Reports, Nature Communications, Advances in Optics and Photonics, Physical Review Letters, Light: Science & Applications.

Events

We organise and participate in numerous events throughout the year.

Prof. Sir David Payne gives a talk

Aston Year of Light Conference

As part of the International Year of Light celebrations, the AiPT hosted a two-day Aston Year of Light workshop on the 6th and 7th of October. The workshop was an initiative of the PhD students co-ordinated by Mr. Srikanth Sugavanam, Ms. Tania Kilina and Ms. Alisa Nemova.

The workshop brought together researchers from diverse walks of optics and photonics, paving the way for collaborative thought and the conceptualisation of disruptive applications.

It was attended by leading researchers in the field of photonics from EU, Australia and the USA. The speakers were prominent figures from the field of photonics - Prof. Manijeh Razeghi (North Western University, USA), Prof. Boris N. Chichkov (Laser Zentrum, Germany), Prof. Yuri Kivshar (Australian National University), Prof. Alexander Szameit (Institute of Applied Physics, Jena, Germany), Prof. Richard Penty (University of Cambridge, UK), Prof. Paul French (Imperial College, UK), Prof. Ian Walmsley (University of Oxford, UK), Mr. Andrew Lowe (Hexagon Metrology, UK) and Prof. Sir David Payne (University of Southampton, UK).

The talks were equally diverse, ranging from quantum optics, biophotonics, and nanophotonics, to optical communications and metrology. Apart from the talks, the sixty attendees interacted one-to-one with the invited speakers and visiting academics during the poster sessions. The best poster award went to Mr. Nikita Tarasov from AiPT, with the second and third prizes going to Mr. Marco Lamperti of Insubria University, Italy, and Mr. Guoqing Wang of the University of Kent. The workshop was well received by all delegates.

Making light work of the internet: how photonics has powered the information revolution

Inaugural Lecture by Professor Andrew Ellis was held on 30th April 2015. Part of Aston University's inaugural lecture series it was free and open to public. Andrew is Professor of Optical Communications. Before pursuing a career in academia, he previously worked for British Telecom Research Laboratories as a Senior Research Engineer. He has published over 150 journal papers and over 24 patents in the field of Photonics.

During the lecture Andrew Ellis examined the history and future of optical communications, tracing its evolution from Greek mythology to the immense web of fibres used today to transport information ranging from social media to financial transactions, from entertainment to government systems.

He explained, that being a victim of its own success, significant problems lie just around the corner and we shall investigate their causes, and discuss potential solutions, and likely outcomes if solutions are not found.

Seminars

To stay on top of things the AiPT runs a series of seminars. The seminars cover a range of topics, from experimental and theoretical problems of photonics to industrial applications. People from outside the University are welcome to attend the seminar series. Check our website for the upcoming seminars programme.

AiPT Seminar programme 2015

Dr. Josef Vojtech, Head of Reseach Department of Optical Networks, CESNET
Non telecom transmission in fibre networks

Dr. Konstantin Zloschastiev, Durban University of Technology, South Africa
Logarithmic Schrödinger equation in theory of quantum liquids

Dr. Konstantin Zloschastiev,
Durban University of Technology, South Africa
Quantum-statistical approach for non-Hermitian dielectric media and waveguides with dissipation and noise

Prof. Evgeny M.Dianov, Fiber Optics Research Centre of the Russian Academy of Sciences (FORC RAS)
Bismuth-doped optical fibers:a new promising active medium for near IR lasers and amplifiers

Dr. Luc Bergé, French Atomic Energy Commission [CEA]
Filamentation of ultrashort laser pulses and their conversion to the terahertz range in gases

Dr. Pablo Loza-Alvarez, ISFO - The Institute of Photonics Sciences, Barcelona,Spain
Fast volumetric light-sheet microscopy

Dr. Guillaume Huyet, Applied Physics and Instrumentation, Cork Institute of Technology
Properties of frequency swept sources

Prof. Alexander Rubenchik,
Lawrence Livermore National Lab (USA)
Physics of additive manufacturing. Promises and problems

Dr. Ekaterina Golovchenko, Fellow at TE Connectivity Ltd
Wearable technology - next frontier in connectivity solutions

Prof. Akihiro Maruta, Osaka University, Japan
Analysis of Rough Wave Phenomenon in Optical Fibers Based on Soliton's Eigenvalue

Prof. Akihiro Maruta, Osaka University, Japan
Eigenvalue Modulated Optical Transmission

Professor Yuri Kivshar,
Australian National University
Recent advances in optical metamaterials
All-dielectric metamaterials: magnetic light, Fano resonances, and metasurfaces

Dr. Marc Eberhard, Aston University
Massively Parallel Optical Communication System Simulator

Dr. Murilo Baptista,
University of Aberdeen, ICSMB
The physics of information transmission in complex networks and applications

Prof. Yuri Kivshar, Nonlinear Physics Center, Australian National University, Canberra
Recent progress in metamaterial and nanophotonics from Down Under

Dr. Alexander Szameit,
Institute of Applied Physics,
Friedrich Schiller University Jena,Germany
Integrated optical circuits for classical and quantum light

Prof. Martin Cryan
Optical and microwave beamshaping using surface plasmons, plasmas and phase change materials

Prof. Sven Hoefling from,
University of Wuerzburg
Mid-infrared Heterostructure Semiconductor Lasers

Dr. Jordi Soriano Fradera,
Neurophysics Lab, Barcelona, Spain
Neuronal cultures as model systems: exploring open questions in physics and medicine

Prof. Boris N.Chichkov, Laser Zentrum Hannover e.V.,Nanotechnology Department,Germany
3D Nanoengineering and laser printing

Dr. Jinlong Wei, ADVA Optical Networking
Cost and Energy Efficient Optical Links for Data Centre Interconnects

Dr. Alexander Legand, Nanoscribe GmnH,Germany
3D µ-Printing by Direct Laser Writing

Prof. Valentin Freilikher, Department of Physics Bar-Ilan University, Israel
Total disorder as an alternative to perfect periodicity

Prof. Richard Hogg,Electronic and Electrical Department, University of Sheffield
Coherently coupled photonic crystal surface emitting lasers

Dr. Jeroen Nijhof, Photonics Modelling for Ericsson Telecommunications,Italy
DWDM Network Design and Software Defined Networking

Prof. Paulo Andre,
Instituto de Telecomunicações, Portugal
Optical/Photonic components for sensing, energy and communications

Professor Misha Sumetsky presents at the seminar

Prof. Govind P. Agrawal, The Institute of Optics, University of Rochester, Rochester, USA
Space-Time Duality in Optics

Lightfest Science Festival

On the 25th September, the Aston Institute of Photonic Technologies together with the Library of Birmingham and Flatpack Film Festival hosted the Lightfest science festival - an interactive science exhibition exploring the science of light - in Birmingham (UK) to celebrate Aston University's forthcoming 50th anniversary and the International Year of Light. The event was hosted at the Library of Birmingham, Europe's largest public library. Over 12,000 attendees visited the Lightfest. Lightfest was funded by the European Researchers' Night, a Marie Sklodowska Curie initiative, part of the European Commission Horizon 2020 programme.

"In addition to a series of public lectures, there were lots of demonstrations put on by electronic-engineering students from, including a "laser harp", an LED light cube and a clever gadget that lights up when you receive an e-mail or social-media post. (I'm sure that could make a great geeky product some day.) Local astronomers were doing a spot of solar-watching from the balcony, while film-makers screened a selection of short light-related films." Blog post by Matin Durrani, science journalist

Lightfest was the first event of its type hosted by AIPT and it was an enormous success. We think that taking researchers out from their labs and engaging with public is extremely important for development of both parties.

"My children really enjoyed the sessions, especially the electrical paint which we used in the Make a Flashing Greeting Card." — Lightfest attendee

The Maxwell Torch was specially created for the events throughout Scotland in 2015, the International Year of Light. The International Year of Light celebrates the 150th anniversary of James Clerk Maxwell's papers that linked together for the first time the electric and magnetic forces. Lightfest was the first event outside Scotland to host the Maxwell Torch.

Lightfest

Lightfest Public Lectures

Lightfest was designed to engage adults and young people and to enable them to identify the importance of light in their lives. Lightfest public lectures are available online at **www.lightfest.astonphotonics.uk**

Making light work of the Internet

Professor Andrew Ellis, Aston Institute of Photonic Technologies

How does the Internet work? We think about tablets, smart phones and computers, but they are all connected together by optical fibre. This lecture examines the history and future of optical communications, tracing its evolution from Greek mythology to the immense web of fibres used today to transport information ranging from social media to financial transactions, from entertainment to government systems.

Five most amazing photos taken by Hubble space telescope!

Dr. Maggie Aderin-Pocock, BBC The Sky at Night

The BBC presenter shared her fascination for the stars, space and light with a guided tour of the electromagnetic spectrum and described her favourites images from the Hubble telescope.

Light and art: an indivisible relationship

Professor Alessandro Farini, CNR-National Institute of Optics and University of Florence

It is impossible to separate our vision from light, but the relationship between light, vision and perception is not completely clear nowadays.

The Pen is mightier than the Laser? The Power of Light in Literature, Art and Culture

Dr. Greg Lynall, University of Liverpool

How the imaginative power of light inspires us to think about the relationships between science and nature, humanity and the cosmos?

Working at the Speed of Light

Lecture by Professor William O'Neill

The talk showcased the state-of-the-art in modern high power laser technology and their applications. From Nano machining to shipbuilding, and destroying missiles to making spaceships, the applications seem endless.

Lightfest Workshops

How can a Lego robot recognise colours?

Lego Mindstorms robots used colour sensors to recognise colours and played a melody after looking at coloured bricks.

How thick is your hair?

How laser light can be used to measure the size of tiny objects!

Sola light painting

Sola is an artist and photographer who creates amazing images using just a camera, a tripod and a light source (no Photoshop involved!). Hands-on 20-minute sessions went extremely well across all ages.

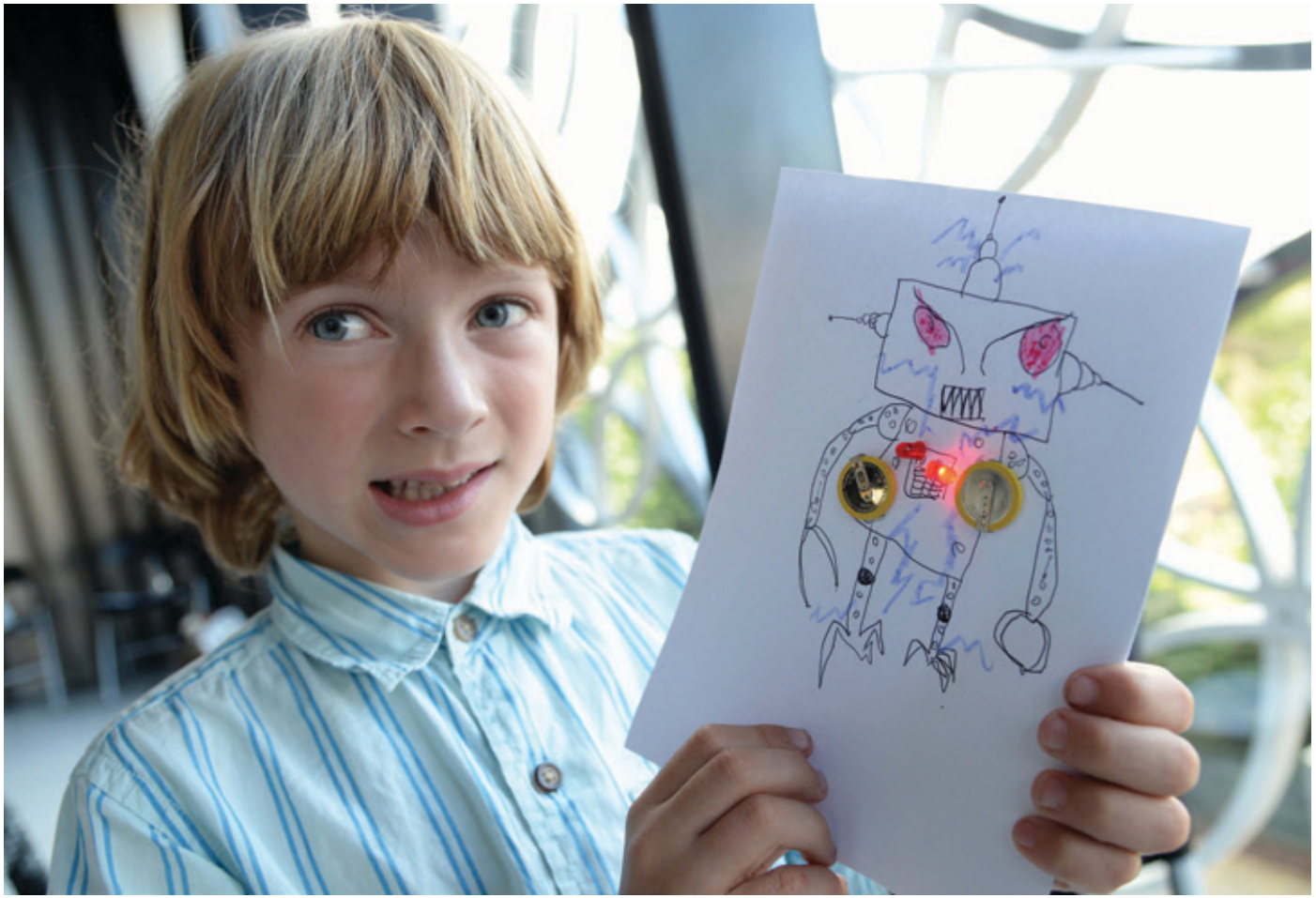
Make a flashing greeting card

With LED, battery and a special electrically conductive paint pen

"Three year old Adam is really proud of his card and has been showing it off to anyone who comes to our house! We also managed to see some of the installations elsewhere on the day." Adam's mum

Denisiuk holography

This workshop helped attendees to get acquainted with holography. Guests were able to make their own holograms and take them home afterwards!



Lightfest Demonstrations

All demonstrations were accompanied by clear, easy to understand, posters. All demonstrations were manned by at least two scientists, experts in the field, who were able to explain to the public the phenomena being demonstrated. It was remarkable atmosphere with kids and general public asking numerous questions and receiving answers from experts in photonics.

How does a message travel through a fibre?

Light and gummy bears

Laser microscope

Fun with optics

Fibre fuse effect or “Tiny Comet”

Phosphor light converters

Laser harp

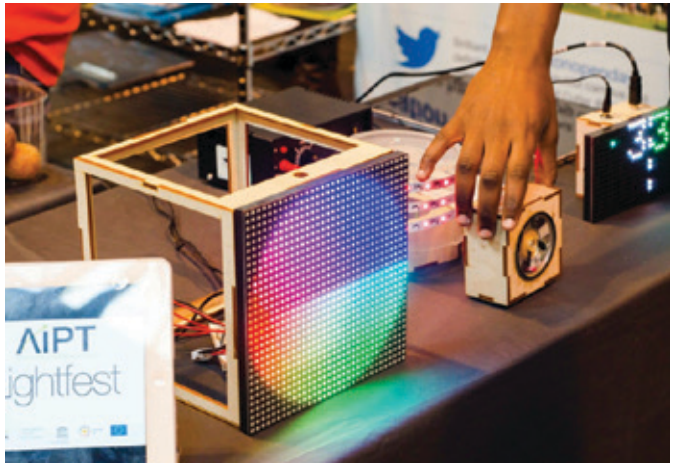
Interactive LED wall

Magic mirror

LED Chameleon

Biophotonics for wellbeing and healthy life

M-squared multicolour panel



Public Outreach Activities

The Big Bang, UK Young Scientists & Engineers Fair

Aston University attended the annual Big Bang Fair, the largest celebration of science, technology, engineering and maths for young people in the UK from 11 to 14 March at The NEC in Birmingham. The four day event witnessed over 50,000 students pass through the doors saw young people aged from 7-19, engage with the University's stand in celebrating the subjects. The event aims to inspire and motivate future scientists and engineers through exciting hands on activities and interactive exhibits.

An Aston volunteer at the event, biomedical science student, Isra Ahmed Qureshi

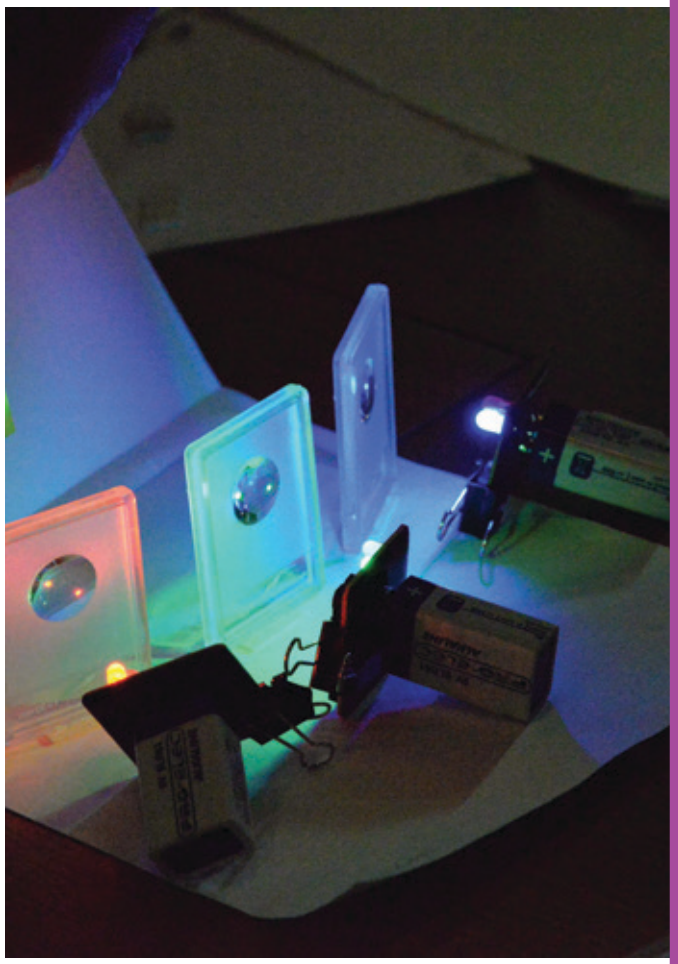
"As an exhibitor representing Aston University I felt that our exhibition at the Big Bang Fair was a huge success and the children engaged enthusiastically in the activities we were presenting. The children had fun making DNA structures out of jelly babies & liquorice as well as extracting DNA from fruits; they found these activities very enjoyable!"

Schools and colleges

With each year AiPT devotes more effort and resources on outreach activities. We are trying to spark an interest and curiosity in engineering among the next generations. Over a year we had organised around twenty workshops, which were attended by 540 secondary school students and 196 primary school students.

"The children were really absorbed by everything they learnt and for the first time ever I had children from all three classes thanking me for the great trip I had organised. I was really taken aback by how much the trip had inspired their thirst for knowledge." Shabana Minhas, primary school teacher

Legacy was a primary deliverable of Lightfest, therefore we now propose follow on activities for schools and colleges based on demonstrations and workshops of Lightfest. This currently includes 7 physics and electronics based workshops for various age groups, light and optics demonstrations to play with, and educational photonics & optics kits to lend for free.



Publications

2015

AiPT team at CLEO Munich 2015

- Turpin, A, Polo, J, Loiko, YV, Küber, J, Schmaltz, F, Kalkandjiev, TK, Ahufinger, V, Birkl, G & Mompart, J 2015, 'Blue-detuned optical ring trap for Bose-Einstein condensates based on conical refraction' Optics express, vol 23, no. 2, pp. 1638-1650., 10.1364/OE.23.001638
- Redyuk, A, Stephens, MFC & Doran, NJ 2015, 'Suppression of WDM four-wave mixing crosstalk in fibre optic parametric amplifier using Raman-assisted pumping' Optics express, vol 23, no. 21., 10.1364/OE.23.027240
- Dmitriev, A, Toropov, N & Sumetsky, M 2015, 'Transient reconfigurable subangstrom-precise photonic circuits at the optical fiber surface'. in Photonics Conference (IPC), 2015 . IEEE, pp. 1-2, 2015 IEEE Photonics Conference, 28th annual conference of the IEEE Photonics Society, Reston, VA, United States, 4-8 October., 10.1109/IPCon.2015.7323759
- Okhrimchuk, AG, Mezentsev, VK, Lichkova, NV & Zagorodnev, VN 2015, 'Femtosecond laser writing in the monoclinic RbPb2Cl5: Dy3+ crystal' Optical materials, vol 43, pp. 1-5., 10.1016/j.optmat.2015.02.005
- Ellis, AD, Le, ST, McCarthy, ME & Turitsyn, SK 2015, 'The impact of parametric noise amplification on long haul transmission throughput'. in M Jaworski & M Marciniak (eds), 17th International Conference on Transparent Optical Networks (ICTON 2015)., We. D 1.5, IEEE, Warsaw (PL), 17th International Conference on Transparent Optical Networks, Budapest, Hungary, 5-9 July., 10.1109/ICTON.2015.7193619
- Ellis, AD, Mccarthy, ME, Al-khateeb, MAZ & Sygletos, S 2015, 'Capacity limits of systems employing multiple optical phase conjugators' Optics express, vol 23, no. 16, pp. 20381-20393., 10.1364/OE.23.020381
- Ellis, AD, Phillips, ID, Tan, M, Stephens, MFC, McCarthy, ME, Al Kahteeb, MAZ, Iqbal, MA, Perentos, A, Fabbri, S, Gordienko, V, Lavery, D, Liga, G, Saavedra, MG, Maher, R, Sygletos, S, Harper, P, Doran, NJ, Bayvel, P & Turitsyn, SK 2015, 'Enhanced superchannel transmission using phase conjugation'. in European Conference on Optical Communication, ECOC. IEEE, 41st European Conference on Optical Communication, Valencia, Spain, 27-1 October., 10.1109/ECOC.2015.7341993
- Rubenchik, AM, Chekhovskoy, IS, Fedoruk, MP, Shtyrina, OV & Turitsyn, SK 2015, 'Nonlinear pulse combining and pulse compression in multi-core fibers' Optics letters, vol 40, no. 5, pp. 721-724., 10.1364/OL.40.000721
- Zhu, AL, Duch, D, Roberts, GA, Li, SXX, Wang, H, Duch, K, Bae, E, Jung, KS, Wilkinson, D & Kulinich, SA 2015, 'Increasing the electrolyte capacity of alkaline Zn-air fuel cells by scavenging zincate with Ca(OH)2' ChemElectroChem, vol 2, no. 1, pp. 134-142., 10.1002/celc.201402251
- Lobato, A, Rabe, J, Ferreira, F, Kuschnerov, M, Spinnler, B & Lankl, B 2015, 'Near-ML detection for MDL-impaired few-mode fiber transmission' Optics express, vol 23, no. 8, pp. 9589-9601., 10.1364/OE.23.009589
- Aceves, AB, Shtyrina, OV, Rubenchik, AM, Fedoruk, MP & Turitsyn, SK 2015, 'Spatiotemporal optical bullets in two-dimensional fiber arrays and their stability' Physical review A, vol 91, no. 3, 033810., 10.1103/PhysRevA.91.033810
- Martínez, AJ, Molina, MI, Turitsyn, SK & Kivshar, YS 2015, 'Nonlinear multicore waveguiding structures with balanced gain and loss' Physical review A, vol 91, no. 2, 023822., 10.1103/PhysRevA.91.023822
- Tonello, A, Barthélémy, A, Krupa, K, Kermène, V, Desfarges-Berthelemot, A, Shalaby, BM, Boscolo, S, Turitsyn, SK & Ania-Castañón, JD 2015, 'Secret key exchange in ultra-long lasers by radio-frequency spectrum coding' Light, vol 4, no. 2, e276., 10.1038/lsa.2015.49
- Turpin, A, Loiko, YV, Kalkandjiev, TK & Mompart, J 2015, 'Light propagation in biaxial crystals' Journal of optics, vol 17, no. 6, 065603., 10.1088/2040-8978/17/6/065603
- Turpin, A, Loiko, YV, Kalkandjiev, TK, Corbalán, R & Mompart, J 2015, 'Conical refraction healing after partially blocking the input beam' Physical review A, vol 92, no. 1, 013802., 10.1103/PhysRevA.92.013802
- Bednyakova, A & Turitsyn, SK 2015, 'Adiabatic soliton laser' Physical review letters, vol 114, no. 11, 113901., 10.1103/PhysRevLett.114.113901
- Pospori, A & Webb, DJ 2015, 'Optimisation of polymer optical fibre based interferometric sensors'. in K Kalli, J Kanka & A Mendez (eds), Micro-structured and specialty optical fibres IV., 95070M, SPIE proceedings, vol. 9507, SPIE, Bellingham, WA (US), Micro-Sstructured and Specialty Optical Fibres IV, Prague, Czech Republic, 15-16 April., 10.1117/12.2180764
- Ellis, AD & Sygletos, S 2015, 'The potential for networks with capacities exceeding the nonlinear-Shannon limit'. in Photonic networks and devices 2015., paper NeT2F.1, OSA technical digest, Optical Society of America, Photonic networks and devices 2015, Boston, MA, United States, 27-1 July., 10.1364/NETWORKS.2015.NeT2F.1
- Dunaev, AV, Dremin, VV, Zherebtsov, EA, Rafailov, IE, Litvinova, KS, Palmer, SG, Stewart, NA, Sokolovski, SG & Rafailov, EU 2015, 'Individual variability analysis of fluorescence parameters measured in skin with different levels of nutritive blood flow' Medical engineering and physics, vol 37, no. 6, pp. 574-583., 10.1016/j.medengphy.2015.03.011
- Rahimi-Iman, A, Gaafar, M, Al Nakdali, D, Möller, C, Zhang, F, Wichmann, M, Shakfa, MK, Fedorova, KA, Stolz, W, Rafailov, EU & Koch, M 2015, 'Recent advances in the field of vertical-external-cavity surface-emitting lasers'. in M Guina (ed.), Vertical external cavity surface emitting lasers (VECSELs) V., 934906, SPIE proceedings, vol. 9349, SPIE, Bellingham, WA (US), Vertical External Cavity Surface Emitting Lasers (VECSELs) V, San Francisco, CA, United States, 9-10 February., 10.1117/12.2079182
- Dmitriev, A & Sumetsky, M 2015, 'Formation and precise geometry control of SNAP microresonators by external electrostatic fields' 5th international school and conferenceon photonics, Belgrade, Serbia, 24/08/15 - 28/08/15, pp. 121.
- El-Taher, A, Pang, X, Schatz, R, Jacobsen, G, Popov, S & Sergeyev, S 2015, 'Noise characterization and transmission evaluation of unrepeated Raman amplified DP-

16QAM link'. in Optical Fiber Communication conference 2015., paper Th2A.31, OSA technical digest, Optical Society of America, Optical Fiber Communication conference 2015, Los Angeles, CA, United States, 22-26 March., 10.1364/OFC.2015.Th2A.31

- Yao, BC, Rao, YJ, Wang, ZN, Wu, Y, Zhou, JH, Wu, H, Fan, MQ, Cao, XL, Zhang, WL, Chen, YF, Li, YR, Churkin, D, Turitsyn, S & Wong, CW 2015, 'Graphene based widely-tunable and singly-polarized pulse generation with random fiber lasers' Scientific reports, vol 5, 18526., 10.1038/srep18526
- Yao, BC, Wu, Y, Webb, DJ, Zhou, JH, Rao, YJ, Pospori, A, Yu, CB, Gong, Y, Chen, YF & Wang, ZG 2015, 'Graphene-based D-shaped polymer FBG for highly sensitive erythrocyte detection' IEEE photonics technology letters, vol 27, no. 22, pp. 2399-2402., 10.1109/LPT.2015.2466614
- Luo, B, Yan, Z, Sun, Z, Liu, Y, Zhao, M & Zhang, L 2015, 'Biosensor based on excessively tilted fiber grating in thin-cladding optical fiber for sensitive and selective detection of low glucose concentration' Optics express, vol 23, no. 25, pp. 32429-32440., 10.1364/OE.23.032429
- Sánchez, C, McCarthy, M, Ellis, AD, Wright, P & Lord, A 2015, 'Optical-phase conjugation nonlinearity compensation in Flexi-Grid optical networks'. in V Mladenov, E Giacoumidis & J Wei (eds), Recent advances on systems, signals, control, communications and computers: Proceedings of the 13th international conference on Data Networks, Communications, Computers (DNCOCO '15), Proceedings of the 10th international conference on dynamical systems and Control (CONTROL '15), Proceedings of the 8th European Computing Conference (ECC '15), Proceedings of the 7th international conference on Sensors and Signals (SENSIG '15). Recent advances in electrical engineering, vol. 57, WSEAS, pp. 39-43, 13th international conference on Data Networks, Communications, Computers (DNCOCO '15) / 10th international conference on dynamical systems and Control (CONTROL '15) / 8th European Computing Conference (ECC '15) / 7th international conference on Sensors and Signals (SENSIG '15), Budapest, Hungary, 12-14 December.
- Marques, CAF, Pospori, A, Sáez-Rodríguez, D, Nielsen, K, Bang, O & Webb, DJ 2015, 'Fiber-optic liquid level monitoring system using microstructured polymer fiber Bragg grating array sensors: performance analysis'. in 24th international conference on Optical Fibre Sensors., 96345V, SPIE proceedings, vol. 9634, SPIE, Bellingham, WA (US), 24th international conference on Optical Fibre Sensors, Curitiba, Brazil, 28-2 October., 10.1117/12.2193898
- Marques, CAF, Pospori, A, Sáez-Rodríguez, D, Nielsen, K, Bang, O & Webb, DJ 2015, 'High performance liquid-level sensor based on mPOFBG for aircraft applications'. in 2015 IEEE Avionics and Vehicle Fiber-Optics and Photonics Conference (AVFOP) ., WD2, IEEE, pp. 56-57, 2015 IEEE Avionics and Vehicle Fiber-Optics and Photonics Conference, Santa Barbara, CA, United States, 10-12 November., 10.1109/AVFOP.2015.7356619
- Marques, C, Peng, G-D & Webb, DJ 2015, 'Highly sensitive liquid level sensor using a polymer optical Bragg grating for industrial applications'. in CLEO: applications and technology 2015., ATu1M.6, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_AT.2015.ATu1M.6
- Marques, CAF, Peng, G-D & Webb, DJ 2015, 'High performance liquid level monitoring system based on polymer fiber Bragg gratings embedded in silicone rubber diaphragm'. in K Kalli, J Kanka & A Mendez (eds), Micro-structured and specialty optical fibres IV., 95070N, SPIE proceedings, vol. 9507, SPIE, Bellingham, WA (US), Micro-Sstructured and Specialty Optical Fibres IV, Prague, Czech Republic, 15-16 April., 10.1117/12.2180563
- Marques, CAF, Peng, G-D & Webb, DJ 2015, 'Highly sensitive liquid level monitoring system utilizing polymer fiber Bragg gratings' Optics express, vol 23, no. 5, pp. 6058–6072., 10.1364/OE.23.006058
- Marques, CAF & Webb, DJ 2015, 'Perspective work on optical fibre sensors' 21st annual international conference on Advanced Laser Technologies, Faro, Portugal, 7/09/15 - 11/09/15, pp. 198.
- Mou, C, Arif, R, Lobach, AS, Khudyakov, DV, Spitsina, NG, Kazakov, VA, Turitsyn, S & Rozhin, A 2015, 'Poor fluorinated graphene sheets carboxymethylcellulose polymer composite mode locker for erbium doped fiber laser' Applied physics letters, vol 106, no. 6, 061106., 10.1063/1.4908057
- Mou, C, Sergeyev, S, Kolpakov, S, Arif, R, Rozhin, A, Chernysheva, M & Turitsyn, S 2015, 'Polarization dynamics of dissipative solitons in a erbium doped fiber laser passively mode locked by carbon nanotube polymer composite'. in CLEO: QELS fundamental science 2015., paper FW4D.4, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_QELS.2015.FW4D.4
- Gamlath, CD, Benton, DM & Cryan, MJ 2015, 'Microwave properties of an inhomogeneous optically illuminated plasma in a microstrip gap' IEEE transactions on microwave theory and techniques, vol 63, no. 2, pp. 374-383., 10.1109/TMTT.2014.2387276
- Broadway, C, Gallego, D, Woyessa, G, Pospori, A, Carpintero, G, Bang, O, Sugden, K & Lamela, H 2015, 'Fabry-Perot micro-structured polymer optical fibre sensors for opto-acoustic endoscopy'. in C Kurachi, K Svanberg, BJ Tromberg & VS Bagnato (eds), Biophotonics South America., 953116, SPIE proceedings, vol. 9531, Progress in biomedical optics and imaging, no. 52, vol. 16, SPIE, Bellingham, WA (US), Biophotonics South America, Rio de Janeiro, Brazil, 23-25 May., 10.1117/12.2181095
- Broadway, C, Gallego, D, Woyessa, G, Pospori, A, Bang, O, Webb, DJ, Carpintero, G & Lamela, H 2015, 'Polymer optical fibre sensors for endoscopic optoacoustic imaging'. in V Ntziachristos & R Zemp (eds), Opto-acoustic methods and applications in biophotonics II., 953907, SPIE proceedings, vol. 9539, Progress in biomedical optics and imaging, no. 57, vol. 16, SPIE, Opto-acoustic methods and applications in biophotonics II, Munich, Germany, 22-23 June., 10.1117/12.2183452

- Weber, C, Drzewietzki, L, Rossetti, M, Xu, T, Bardella, P, Simos, H, Mesaritakis, C, Ruiz, M, Krestnikov, I, Livshits, D, Krakowski, M, Syvridis, D, Montrosset, I, Rafailov, EU, Elsäßer, W & Breuer, S 2015, 'Picosecond pulse amplification up to a peak power of 42 W by a quantum-dot tapered optical amplifier and a mode-locked laser emitting at 1.26 μm' Optics letters, vol 40, no. 3, pp. 395-398., 10.1364/OL.40.000395
- Finot, C & Boscolo, S 2015, 'Parabolic similaritons in optical fibres'. in K Porsezian & R Ganapathy (eds), Odyssey of light in nonlinear optical fibers: theory and applications. CRC press, pp. 323-350, Physics and Mathematics of Nonlinear Phenomena 2015, Gallipoli (Lecce), Italy, 20-27 June.
- Finot, C & Boscolo, SA 2015, 'Compression spectrale dans les fibres optiques en présence de dispersion normale'. in Proceedings of the 35èmes Journées Nationales d'Optique Guidée (JNOG'35), Optique Bretagne 2015., 241, Société Française d'Optique, Rennes (FR), 35èmes Journées Nationales d'Optique Guidée, Rennes , France, 6-9 July.
- Finot, C & Boscolo, S 2015, 'Parabolic similaritons in optical fibres' Physics and Mathematics of Nonlinear Phenomena 2015, Gallipoli (Lecce), Italy, 20/06/15 - 27/06/15, pp. 10.
- Sáez Rodríguez, D, Nielsen, K, Bang, O & Webb, DJ 2015, 'Time-dependent variation of fiber Bragg grating reflectivity in PMMA-based polymer optical fibers' Optics express, vol 40, no. 7, pp. 1476-1479., 10.1364/OL.40.001476
- Churkin, DV, Kolokolov, IV, Podivilov, EV, Vatnik, ID, Nikulin, M, Vergeles, SS, Terekhov, IS, Lebedev, VV, Falkovich, GE, Babin, SA & Turitsyn, SK 2015, 'Wave kinetics of random fibre lasers' Nature communications, vol 6, 6214., 10.1038/ncomms7214
- Churkin, DV, Sugavanam, S, Tarasov, N, Khorev, S, Smirnov, SV, Kobtsev, SM & Turitsyn, SK 2015, 'Stochasticity, periodicity and localized light structures in partially mode-locked fibre lasers' Nature communications, vol 6, 7004., 10.1038/ncomms8004
- Al Nakdali, D, Gaafar, M, Shakfa, MK, Zhang, F, Vaupel, M, Fedorova, K, Rahimi-Iman, A, Rafailov, E & Koch, M 2015, 'High-power operation of quantum-dot semiconductor disk laser at 1180 nm' IEEE photonics technology letters, vol 27, no. 10, pp. 1128-1131., 10.1109/LPT.2015.2408619
- Sáez-Rodriguez, D, Nielsen, K, Bang, O & Webb, DJ 2015, 'Simple room temperature method for polymer optical fibre cleaving' Journal of lightwave technology, vol 33, no. 23, pp. 4712-4716., 10.1109/JLT.2015.2479365
- Payne, DB 2015, 'Operational issues in access networks: past, present, and future'. in Optical Fiber Communication conference 2015., paper Th3B.3, OSA technical digest, Optical Society of America, Optical Fiber Communication conference 2015, Los Angeles, CA, United States, 22-26 March., 10.1364/OFC.2015.Th3B.3
- Webb, DJ 2015, 'Fibre Bragg grating sensors in polymer optical fibres' Measurement science and technology, vol 26, no. 9, 092004., 10.1088/0957-0233/26/9/092004
- Churkin, DV, Kolokolov, I, Podivilov, EV, Vatnik, I, Nikulin, M, Vergeles, S, Terekhov, I, Lebedev, V, Falkovich, G, Babin, SA & Turitsyn, S 2015, 'How optical spectrum of random fiber laser is formed'. in CLEO: QELS fundamental science 2015., paper FW4D.5, OSA technical digest , Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_QELS.2015.FW4D.5
- Rafailov, EU, Litvinova, KS & Sokolovski, SG 2015, 'Towards novel compact laser sources for non-invasive diagnostics and treatment'. in H Mohseni, MH Agahi & M Razeghi (eds), Biosensing and Nanomedicine VIII., 95500G, SPIE proceedings, vol. 9550, SPIE, Biosensing and nanomedicine VIII, San Diego, United States, 9-12 August., 10.1117/12.2193777
- Sooudi, E, O'Gorman, J, Gunning, P, Ellis, AD, Garcia Gunning, FC & Manning, RJ 2015, 'Practical and cost-effective high-fidelity optical carrier dissemination using coherent communication techniques' Optics express, vol 23, no. 17, pp. 21678-21689., 10.1364/OE.23.021678
- Turitsyna, EG, Gbadebo, A & Williams, JAR 2015, 'A technique for mitigating the effect of the writing-beam profile on fibre Bragg grating fabrication' Optics express, vol 23, no. 10, 12628., 10.1364/OE.23.012628
- Giacoumidis, E, Wei, J, Jarajreh, MA, Le, ST, Haigh, PA, Bohata, J, Perentos, A, Mhatli, S, Ghanbarisabagh, M, Aldaya, I & Doran, NJ 2015, 'Numerical analysis of artificial neural network and volterra-based nonlinear equalizers for coherent optical OFDM'. in PIERS 2015 Prague: Progress in Electromagnetics Research Symposium, proceedings. PIERS proceedings, Electromagnetics Academy, Cambridge, MA (US), pp. 2473-2477, Progress in Electromagnetics Research Symposium, Prague, Czech Republic, 6-6 July.
- Giacoumidis, E, Talli, G, Suibhne, NM, Le, ST, Doran, NJ & Payne, DB 2015, '100-Gb/s point-to-point solutions for long-reach passive optical networks in sparse rural and urban areas'. in PIERS 2015 Prague: Progress in Electromagnetics Research Symposium, proceedings. PIERS proceedings, Electromagnetics Academy, Cambridge, MA (US), pp. 2468-2472, Progress in Electromagnetics Research Symposium, Prague, Czech Republic, 6-6 July.
- Giacoumidis, E, Le, ST, Ghanbarisabagh, M, McCarthy, M, Aldaya, I, Mhatli, S, Jarajreh, MA, Haigh, PA, Doran, NJ, Ellis, AD & Eggleton, BJ 2015, 'Fiber nonlinearity-induced penalty reduction in CO-OFDM by ANN-based nonlinear equalization' Optics letters, vol 40, no. 21, pp. 5113-5116., 10.1364/OL.40.005113
- Coscelli, E, Poli, F, Li, J, Cucinotta, A & Selleri, S 2015, 'Chalcogenide suspended-core fibers for supercontinuum generation in the mid-infrared'. in Nonlinear frequency generation and conversion: materials, devices, and applications XIV., 93471P, SPIE proceedings, vol. 9347, SPIE, Nonlinear Frequency Generation and Conversion: Materials, Devices, and Applications XIV, San Francisco, United States, 9-12 February., 10.1117/12.2077431
- Coscelli, E, Poli, F, Li, J, Cucinotta, A & Selleri, S 2015, 'Highly nonlinear chalcogenide suspended-core fibers for applications in the mid-infrared'. in K Kalli,

J Kanka & A Mendez (eds), Micro-structured and specialty optical fibres IV., 950707, SPIE proceedings, vol. 9507, SPIE, Bellingham, WA (US), Micro-structured and specialty optical fibres IV, Prague, Czech Republic, 15-16 April., 10.1117/12.2178751

- Gutierrez, FA, Martin, PE, Perry, P, Ellis, AD, Anandarajah, P, Smyth, F & Barry, LP 2015, '100 Gbit/s real-time all-analogue filter bank OFDM based on a gain-switched optical comb'. in European Conference on Optical Communication, ECOC. IEEE, 41st European Conference on Optical Communication, Valencia, Spain, 27-1 October., 10.1109/ECOC.2015.7341858
- Suhailin, FH, Healy, N, Franz, Y, Sumetsky, M, Ballato, J, Dibbs, AN, Gibson, UJ & Peacock, AC 2015, 'Kerr nonlinear switching in a hybrid silicasilicon microspherical resonator' Optics express, vol 23, no. 13, pp. 17263-17268., 10.1364/OE.23.017263
- Ai, F, Sun, Q, Cheng, J & Liu, D 2015, 'High resolution demodulation platform for large capacity hybrid WDM/FDM microstructures sensing system assisted by tunable FP filter'. in PIERS 2015 Prague: Progress in Electromagnetics Research Symposium, proceedings. PIERS proceedings, Electromagnetics Academy, Cambridge, MA (US), pp. 1200-1203, Progress in Electromagnetics Research Symposium, Prague, Czech Republic, 6-6 July.
- Suhailin, FH, Healy, N, Sumetsky, M, Ballato, J, Dibbs, A, Gibson, U & Peacock, AC 2015, 'Kerr nonlinear switching in a core-shell microspherical resonator fabricated from the silicon fiber platform'. in CLEO: science and innovations 2015., paper STh1O.2, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_SI.2015.STh1O.2
- Gutiérrez, FA, Perry, P, Smyth, F, Ellis, AD & Barry, LP 2015, 'Optimum bias point in broadband subcarrier multiplexing with optical IQ modulators' Journal of lightwave technology, vol 33, no. 1, pp. 258-266., 10.1109/JLT.2014.2384838
- Gutiérrez, FA, Perry, P, Smyth, F, Ellis, AD & Barry, LP 2015, 'Impact of band rejection in multichannel broadband subcarrier multiplexing' Journal of optical communications and networking, vol 7, no. 4, pp. 248-252., 10.1364/JOCN.7.000248
- Ferreira, F, Sygletos, S & Ellis, AD 2015, 'Impact of linear mode coupling on the group delay spread in few-mode fibers'. in Proceedings of Optical Fiber Communication Conference, 22–26 March 2015, Los Angeles, California, United States., Tu2D.1, OSA technical digest, Optical Society of America, Optical Fiber Communication conference 2015, Los Angeles, CA, United States, 22-26 March., 10.1364/OFC.2015.Tu2D.1
- Ferreira, F, Fonseca, D, Sygletos, S, Ellis, A & Silva, H 2015, 'Impact of inter-modal four-wave mixing on the performance of mode- and wavelength-division-multiplexing systems'. in M Jaworski & M Marciniak (eds), 17th International Conference on Transparent Optical Networks (ICTON 2015)., We.D1.4, IEEE, Warsaw (PL), 17th International Conference on Transparent Optical Networks, Budapest, Hungary, 5-9 July., 10.1109/ICTON.2015.7193618
- Ferreira, FM, MacSuibhne, N, Sygletos, S & Ellis, AD 2015, 'Few-mode fibre group-delays with intermediate coupling'. in European Conference on Optical Communication, ECOC. IEEE, 41st European Conference on Optical Communication, Valencia, Spain, 27-1 October., 10.1109/ECOC.2015.7341861
- Sokolovskii, GS, Dudelev, VV, Melissinaki, V, Losev, SN, Soboleva, KK, Deryagin, AG, Kuchinskii, VI, Farsari, M, Sibbett, W & Rafailov, EU 2015, 'Optical trapping with superfocused high-M2 laser diode beam'. in AV Kudryashov, AH Paxton, VS Ilchenko, L Aschke & K Washio (eds), Laser resonators, microresonators, and beam control XVII., 93430Q, SPIE proceedings, vol. 9343, SPIE, Laser Resonators, Microresonators, and Beam Control XVII, San Francisco, CA, United States, 9-12 February., 10.1117/12.2078957
- Sokolovskii, GS, Viktorov, EA, Abusaa, M, Danckaert, J, Dudelev, VV, Kolykhalova, ED, Soboleva, KK, Deryagin, AG, Novikov, II, Maximov, MV, Zhukov, AE, Ustinov, VM, Kuchinskii, VI, Sibbett, W, Rafailov, EU & Erneux, T 2015, 'Dropout dynamics in pulsed quantum dot lasers due to mode jumping' Applied physics letters, vol 106, no. 26, 261103., 10.1063/1.4923244
- Sokolovskii, GS, Dudelev, VV, Kolykhalova, ED, Soboleva, KK, Deryagin, AG, Novikov, II, Maximov, MV, Zhukov, AE, Ustinov, VM, Kuchinskii, VI, Sibbett, W, Rafailov, EU, Viktorov, EA & Erneux, T 2015, 'Impact of the carrier relaxation paths on two-state operation in quantum dot lasers'. in B Witzigmann, M Osiński, F Henneberger & Y Arakawa (eds), Physics and simulation of optoelectronic devices XXIII., 93570K, SPIE proceedings, vol. 9357, SPIE, Physics and simulation of optoelectronic devices XXIII, San Francisco, United States, 9-12 February., 10.1117/12.2078746
- Peng, G-D, Bhowmik, K, Rajan, G, Ambikairajah, E & Webb, D 2015, 'Polymer fibre Bragg gratings and sensing'. in Optical sensors 2015., paper SeS3C.2, OSA technical digest, Optical Society of America, Optical Sensors 2015, Boston, United States, 1-1 July., 10.1364/SENSORS.2015.SeS3C.2
- Lee, GCB, Mou, C, Zhou, K & Sugden, K 2015, 'Optimization and characterization of femtosecond laser inscribed in-fiber microchannels for liquid sensing' Journal of lightwave technology, vol 33, no. 12, pp. 2561-2565., 10.1109/JLT.2014.2366833
- Lee, GCB, Allsop, T, Wang, C, Neal, R, Culverhouse, P & Webb, DJ 2015, 'Fiber optic sensing of magnetic fields utilizing femtosecond laser sculpted microslots and long period gratings coated with Terfenol-D'. in HJ Kalinowski, JL Fabris & WJ Bock (eds), 24th international conference on Optical Fibre Sensors., 96340K, SPIE proceedings, vol. 9634, SPIE, Bellingham, WA (US), 24th international conference on Optical Fibre Sensors, Curitiba, Brazil, 28-2 October., 10.1117/12.2194325
- Wu, H, Wang, ZN, Churkin, DV, Vatnik, ID, Fan, MQ & Rao, YJ 2015, 'Random distributed feedback Raman fiber laser with polarized pumping' Laser physics letters, vol 12, no. 1, 015101., 10.1088/1612-2011/12/1/015101
- Luo, H, Sun, Q, Xu, Z, Jia, W, Liu, D & Zhang, L 2015, 'Microfiber-based inline Mach-Zehnder interferometer for dual-parameter measurement' vol 7, no. 2., 10.1109/JPHOT.2015.2395133
- Luo, H, Sun, Q, Li, X, Yan, Z, Li, Y, Liu, D & Zhang, L 2015, 'Refractive index sensitivity characteristics near the dispersion turning

point of the multimode microfiber-based Mach–Zehnder interferometer' Optics letters, vol 40, no. 21, pp. 5042-5045., 10.1364/OL.40.005042

- Yin, H, Gbadebo, A & Turitsyna, E 2015, 'Top-hat random fiber Bragg grating' Optics letters, vol 40, no. 15, pp. 3592-3594., 10.1364/OL.40.003592
- Cao, H, Atai, J, Zuo, J, Yu, Y, Gbadebo, A, Xiong, B, Hou, J, Liang, P, Gao, P & Shu, X 2015, 'Simultaneous multichannel carrier-suppressed return-to-zero to non-return-to-zero format conversion using a fiber Bragg grating' Applied optics, vol 54, no. 20, pp. 6344-6350., 10.1364/AO.54.006344
- Karakuzu, H, Dubov, M, Boscolo, S, Azabi, YO & Agrawal, A 2015, 'Equiangular spiral micro-structured waveguides in lithium niobate'. in Proceedings of the XXIII International Workshop on Optical Wave & waveguide Theory and Numerical Modelling (OWTNM 2015)., P-98, London (UK), 12th international workshop on Optical Wave and waveguide Theory and Numerical Modelling, London, United Kingdom, 17-18 April.
- Vatnik, I, Tikan, AM, Churkin, DV & Sukhorukov, AA 2015, 'Anderson localization in synthetic photonic lattices'. in CLEO: QELS fundamental science 2015., paper FTh3D.1, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_QELS.2015.FTh3D.1
- Prylepskiy, JE, Derevyanko, SA & Turitsyn, SK 2015, 'Channel model and lower capacity bound for the transmission based on nonlinear Fourier transform' Progress in Electromagnetics Research Symposium, Prague, Czech Republic, 6/07/15 - 6/07/15, pp. 492.
- Prylepskiy, JE & Turitsyn, SK 2015, 'Eigenvalue communications in nonlinear fiber channels'. in K Porsezian & R Ganapathy (eds), Odyssey of light in nonlinear optical fibers: theory and applications. CRC press, Boca Raton, FL (US), pp. 459-490.
- Li, J, Luo, H, Wang, L, Liu, Y, Yan, Z, Zhou, K, Zhang, L & Turitsyn, SK 2015, 'Mid-infrared passively switched pulsed dual wavelength Ho3+ -doped fluoride fiber laser at 3 μm and 2 μm' Scientific reports, vol 5, 10770., 10.1038/srep10770
- Song, J, Kulinich, SA, Li, J, Liu, Y & Zeng, H 2015, 'A general one-pot strategy for the synthesis of high-performance transparent-conducting-oxide nanocrystal inks for all-solution-processed devices' Angewandte Chemie, vol 54, no. 2, pp. 462-466., 10.1002/anie.201408621
- Krupa, K, Tonello, A, Boscolo, S, Barthélémy, A, Kermène, V, Desfarges-Berthelemot, A, Shalaby, BM, Turitsyn, SK & Ania-Castañón, JD 2015, 'Radio-frequency spectrum coding in ultra-long fibre laser based cryptography'. in M Jaworski & M Marciniak (eds), 17th International Conference on Transparent Optical Networks (ICTON 2015)., Tu.A1.2, IEEE, Warsaw (PL), 17th International Conference on Transparent Optical Networks, Budapest, Hungary, 5-9 July., 10.1109/ICTON.2015.7193390
- Fedorova, KA, Battle, PR, Livshits, DA & Rafailov, EU 2015, '517 nm - 538 nm tunable second harmonic generation in a diode-pumped PPKTP waveguide crystal'. in KL Vodopyanov (ed.), Nonlinear frequency generation and conversion: materials, devices, and applications XIV., 93470D-1, SPIE proceedings, vol. 9347, SPIE, Nonlinear Frequency Generation and Conversion: Materials, Devices, and Applications XIV, San Francisco, United States, 9-12 February., 10.1117/12.2078334
- Fedorova, KA, Sokolovskii, GS, Battle, PR, Livshits, DA & Rafailov, EU 2015, '574-647 nm wavelength tuning by second-harmonic generation from diode-pumped PPKTP waveguides' Optics letters, vol 40, no. 5, pp. 835-838., 10.1364/OL.40.000835
- Fedorova, K, Turtaev, S, Bakshaev, IO, Livshits, DA & Rafailov, EU 2015, 'Tunable visible dual-wavelength SHG from a diode-pumped PPKTP waveguide'. in 2015 European Conference on Lasers and Electro-Optics - European Quantum Electronics Conference., CD_P_28, Optical Society of America.
- Kochkurov, LA & Sumetsky, M 2015, 'Strong localization of whispering gallery modes in an optical fiber via asymmetric perturbation of the translation symmetry'. in AV Kudryashov, AH Paxton, VS Ilchenko, L Aschke & K Washio (eds), Laser resonators, microresonators, and beam control XVII., 934316, SPIE proceedings, vol. 9343, SPIE, Bellingham, WA (US), Laser Resonators, Microresonators, and Beam Control XVII, San Francisco, CA, United States, 9-12 February., 10.1117/12.2084374
- Kochkurov, LA & Sumetsky, M 2015, 'Nanobump microresonator' Optics letters, vol 40, no. 7, pp. 1430-1433., 10.1364/OL.40.001430
- Kochkurov, LA & Sumetsky, M 2015, 'Nanobump microresonators at the fiber surface'. in CLEO: applications and technology 2015., paper JTu5A.55, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_AT.2015.JTu5A.55
- Galdino, L, Tan, M, Lavery, D, Rosa, P, Maher, R, Phillips, ID, Ania Castañón, JD, Harper, P, Killey, RI, Thomsen, BC, Makovejs, S & Bayvel, P 2015, 'Unrepeatered Nyquist PDM-16QAM transmission over 364 km using Raman amplification and multi-channel digital back-propagation' Optics letters, vol 40, no. 13, pp. 3025-3028., 10.1364/OL.40.003025
- Han, L-L, Xin, HL, Kulinich, SA, Yang, L-J & Du, X-W 2015, 'Hierarchical, ultrathin single-crystal nanowires of CdS conveniently produced in laser-induced thermal field' Langmuir, vol 31, no. 29, pp. 8162-8167., 10.1021/acs.langmuir.5b01923
- Han, L-L, Kulinich, SA, Zhang, Y-Y, Zou, J, Liu, H, Wang, W-H, Liu, H, Li, H-B, Yang, J, Xin, HL, Qiao, S-Z & Du, X-W 2015, 'Synergistic synthesis of quasi-monocrystal CdS nanoboxes with high-energy facets' Journal of materials chemistry A, vol 3, no. 46, pp. 23106-23112., 10.1039/c5ta05472a
- Sorokina, M, Sygletos, S, Ferreira, F, Perentos, A, Ellis, A & Turitsyn, S 2015, 'Advanced 3R regenerator scheme for high spectral efficient '. in M Jaworski & M Marciniak (eds), 17th International Conference on Transparent Optical Networks (ICTON

2015)., Mo.D1.5, IEEE, Warsaw (PL), 17th International Conference on Transparent Optical Networks, Budapest, Hungary, 5-9 July., 10.1109/ICTON.2015.7193362

- Zajnulina, M, Böhm, M, Blow, K, Rieznik, AA, Giannone, D, Haynes, R & Roth, MM 2015, 'Soliton radiation beat analysis of optical pulses generated from two continuous-wave lasers' Chaos, vol 25, no. 10, 103104., 10.1063/1.4930316
- Sumetsky, M 2015, 'Microscopic optical buffering in a harmonic potential' Scientific reports, vol 5, 18569., 10.1038/srep18569
- Stephens, MF, Phillips, ID, Harper, P & Doran, NJ 2015, 'Fibre optical parametric amplifier incorporating a Raman-pump for reduced four-wave mixing crosstalk'. in 2015 European Conference on Lasers and Electro-Optics - European Quantum Electronics Conference., CI_P_5, Optical Society of America, Conference on Lasers and Electro-Optics Europe – European Quantum Electronics Conference 2015 (CLEO/Europe-EQEC 2015), Munich, Germany, 21-25 June.
- Stephens, MFC, Phillips, ID, Rosa, P, Harper, P & Doran, NJ 2015, 'Improved WDM performance of a fibre optical parametric amplifier using Raman-assisted pumping' Optics express, vol 23, no. 2, pp. 902-911., 10.1364/OE.23.000902
- Fan, MQ, Wang, ZN, Wu, H, Churkin, DV, Li, Y, Zhang, L, Qian, XY & Rao, YJ 2015, 'Long-range and high-resolution correlation optical time-domain reflectometry utilizing an all optical chaotic source'. in B Lee, S-B Lee & Y Rao (eds), Fifth Asia-Pacific optical sensors conference., 965548, SPIE proceedings, vol. 9655, SPIE, Bellingham, WA (US), 5th Asia-Pacific Optical Sensors conference, Jeju, Korea, Republic of, 20-22 May., 10.1117/12.2203105
- Fan, MQ, Wang, ZN, Wu, H, Churkin, DV, Li, Y, Zhang, L, Qian, XY & Rao, YJ 2015, 'High resolution optical time-domain reflectometry based on correlation utilizing an all-fiber chaotic source'. in B Lee, S-B Lee & Y Rao (eds), Fifth Asia-Pacific optical sensors conference., 96553J, SPIE proceedings, vol. 9655, SPIE, Bellingham, WA (US), 5th Asia-Pacific Optical Sensors conference, Jeju, Korea, Republic of, 20-22 May., 10.1117/12.2184238
- Stephens, MFC, Redyuk, A, Sygletos, S, Phillips, I, Harper, P, Blow, K & Doran, N 2015, 'The impact of pump phase-modulation and filtering on WDM signals in a fibre optical parametric amplifier'. in Proceedings of Optical Fiber Communication Conference, 22–26 March 2015, Los Angeles, California, United States., paper W2A.43, OSA technical digest, Optical Society of America, Optical Fiber Communication conference 2015, Los Angeles, CA, United States, 22-26 March., 10.1364/OFC.2015.W2A.43
- Sorokina, M, Ellis, A & Turitsyn, SK 2015, 'Optical information capacity processing'. in S Wabnitz & BJ Eggleton (eds), All-optical signal processing: data communication and storage applications. Springer series in optical sciences, vol. 194, Springer, Cham (CH), pp. 325-354., 10.1007/978-3-319-14992-9_11
- Sorokina, M, Sygletos, S, Ellis, A & Turitsyn, S 2015, 'Regenerative Fourier transformation for dual-quadrature regeneration of multilevel rectangular QAM' Optics letters, vol 40, no. 13, pp. 3117-3120., 10.1364/OL.40.003117
- McCarthy, M, Fabbri, S & Ellis, A 2015, 'Signal processing using opto-electronic devices'. in S Wabnitz & BJ Eggleton (eds), All-optical signal processing: data communication and storage applications. Springer series in optical sciences, vol. 194, Springer, Cham (CH), pp. 291-323., 10.1007/978-3-319-14992-9_10
- Tan, M, Rosa, P, Phillips, I & Harper, P 2015, 'Extended reach of 116 Gb/s DP-QPSK transmission using random DFB fiber laser based Raman amplification and bidirectional second-order pumping'. in Optical Fiber Communication Conference 2015., paper W4E.1, OSA technical digest, Optical Society of America, Optical Fiber Communication conference 2015, Los Angeles, CA, United States, 22-26 March., 10.1364/OFC.2015.W4E.1
- Tan, M, Rosa, P, Le, TS, Phillips, ID & Harper, P 2015, 'Evaluation of 100G DP-QPSK long-haul transmission performance using second order co-pumped Raman laser based amplification' Optics express, vol 23, no. 17, pp. 22181-22189., 10.1364/OE.23.022181
- Sumetsky, M 2015, 'Surface nanoscale axial photonics sensors'. in Optical sensors 2015., SeT3C.1, OSA technical digest, Optical Society of America, Optical Sensors 2015, Boston, United States, 1-1 July., 10.1364/SENSORS.2015.SeT3C.1
- Leong, MY, Larsen, KJ, Jacobsen, G, Popov, S, Zibar, D & Sergeyev, S 2015, 'Interleavers and BCH codes for coherent DQPSK systems with laser phase noise' IEEE photonics technology letters, vol 27, no. 7, pp. 685-688., 10.1109/LPT.2014.2385731
- Zulonas, M, Slight, TJ, Titkov, I, Sakharov, AV, Fedorova, K, Lundin, WV, Nikolaev, A, Meredith, W, Tsatsulnikov, AF & Rafailov, EU 2015, 'Improvement of external quantum efficiency of blue and green InGaN LEDs using corrugated interface substrates'. in 2015 European Conference on Lasers and Electro-Optics - European Quantum Electronics Conference., CE_11_3, Optical Society of America.
- Ye, N, Gleeson, MR, Sadiq, MU, Roycroft, B, Robert, C, Yang, H, Zhang, H, Morrissey, PE, Mac Suibhne, N, Thomas, K, Gocalinska, A, Pelucchi, E, Phelan, R, Kelly, B, O'Carroll, J, Peters, FH, Garcia Gunning, FC & Corbett, B 2015, 'InP-based active and passive components for communication systems at 2 μm' Journal of lightwave technology, vol 33, no. 5, pp. 971-975., 10.1109/JLT.2014.2383492
- MacSuibhne, N, McCarthy, ME, Le, ST, Sygletos, S, Ferreira, FM & Ellis, AD 2015, 'Optical fibre limits: an approach using ASE channel estimation' Progress in Electromagnetics Research Symposium, Prague, Czech Republic, 6/07/15 - 6/07/15, pp. 489.
- MacSuibhne, N & Ellis, AD 2015, 'Optical communications : past, present and future trends' IONS KOALA, Auckland, New Zealand, 23/11/15 - 27/02/16, .
- Mallouki, N, Nsiri, B, Mhatli, S, Ghanbarisabagh, M, Hakimi, W, Ammar, M, Giacoumidis, E & Attia, R 2015, 'Analysis of Wiener-Hammerstein equalizer for downlink LTE system'. in Proceedings of 2015 Science and Information conference (SAI). IEEE, pp. 1077-1082, Science and Information conference, London, United Kingdom, 28-30 July., 10.1109/SAI.2015.7237276
- Tarasov, N, Sugavanam, S & Churkin, D 2015, 'Spatio-temporal generation regimes in quasi-CW Raman fiber lasers' Optics express, vol 23, no. 19, pp. 24189-24196., 10.1364/OE.23.024189

- Shevchenko, NA, Prylepskiy, JE, Derevyanko, SA, Alvarado, A, Bayvel, P & Turitsyn, SK 2015, 'A lower bound on the per soliton capacity of the nonlinear optical fibre channel'. in ITW2015 : 2015 IEEE Information Theory Workshop. IEEE, pp. 104-108, Information Theory Workshop, Jeju, Korea, Democratic People's Republic of, 11-15 October., 10.1109/ITWF.2015.7360743
- Shtyrina, OV, Yarutkina, IA, Skidin, A, Fedoruk, MP & Turitsyn, SK 2015, 'Impact of the order of cavity elements in all-normal dispersion ring fiber lasers' IEEE photonics journal, vol 7, no. 2., 10.1109/JPHOT.2015.2413591
- Haigh, PA, Chvojka, P, Zvanovec, S, Ghassemlooy, Z, Le, ST, Kanesan, T, Giacoumidis, E, Doran, N, Papakonstantinou, I & Darwazeh, I 2015, 'Experimental verification of visible light communications based on multi-band CAP modulation'. in Optical Fiber Communication conference 2015., paper Tu2G.2, OSA technical digest, Optical Society of America, Optical Fiber Communication conference 2015, Los Angeles, CA, United States, 22-26 March., 10.1364/OFC.2015.Tu2G.2
- Haigh, PA, Le, ST, Zvanovec, S, Ghassemlooy, Z, Luo, P, Xu, T, Chvojka, P, Kanesan, T, Giacoumidis, E, Canyelles-Pericas, P, Minh, HL, Popoola, W, Rajbhandari, S, Papakonstantinou, I & Darwazeh, I 2015, 'Multi-band carrier-less amplitude and phase modulation for bandlimited visible light communications systems' IEEE wireless communications letters, vol 22, no. 2, pp. 46-53., 10.1109/MWC.2015.7096284
- Rosa, P, Tan, M, Le, ST, Philips, ID, Ania-Castañón, JD, Sygletos, S & Harper, P 2015, 'Unrepeatered DP-QPSK transmission over 352.8 km SMF using random DFB fiber laser amplification' IEEE photonics technology letters, vol 27, no. 11, pp. 1189-1192., 10.1109/LPT.2015.2414712
- Rosa, P, Rizzelli, G, Tan, M, Harper, P & Ania-Castañón, JD 2015, 'Characterisation of random DFB Raman laser amplifier for WDM transmission' Optics express, vol 23, no. 22, pp. 28634-28639., 10.1364/OE.23.028634
- Sun, Q, Luo, H, Xu, Z, Liu, D, Zhang, L & Sun, X 2015, 'Dual-parameters sensing based on multimode microfiber with Fresnel reflection'. in CLEO: applications and technology 2015., paper JTh2A.84, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_AT.2015.JTh2A.84
- Sun, Q, Cheng, J & Ai, F 2015, 'High speed and high resolution demodulation system for hybrid WDM/FDM based fiber microstructure sensor network by using Fabry-Perot filter'. in CLEO: science and innovations 2015., paper SW3M.6, OSA technical digest , Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_SI.2015.SW3M.6
- Akbari, R, Zhao, H, Fedorova, K, Rafailov, EU & Major, A 2015, 'Quantum-Dot Saturable Absorber and Kerr Lens Mode-Locked Yb:KGW Laser with >300 kW of Peak Power'. in 2015 European Conference on Lasers and Electro-Optics - European Quantum Electronics Conference., CF_P_2, Optical Society of America.
- Palmer, S, Litvinova, K, Rafailov, EU, Nabi, G & Nabi, G 2015, 'Discrimination of healthy and cancer cells of the bladder by metabolic state, based on autofluorescence'. in B Choi, N Kollias, H Zeng & et al (eds), Photonic therapeutics and diagnostics XI., 93030T, SPIE proceedings, vol. 9303, Progress in biomedical optics and imaging, no. 1, vol. 16, SPIE, Photonic Therapeutics and Diagnostics XI, San Francisco, United States, 7-8 February., 10.1117/12.2077218
- Sugavanam, S, Zulkifli, MZ & Churkin, DV 2015, 'Multi-wavelength erbium/Raman gain based random distributed feedback fiber laser' Laser Physics, vol 26, no. 1, 015101., 10.1088/1054-660X/26/1/015101
- Sygletos, S, Fabbri, S, Giakoumidis, E, Sorokina, M, Marom, DM, Stephens, MFC, Klonidis, D, Tomkos, I & Ellis, AD 2015, 'Numerical investigation of all-optical add-drop multiplexing for spectrally overlapping OFDM signals' Optics express, vol 23, no. 5, pp. 5888-5897., 10.1364/OE.23.005888
- Kulinich, SA, Honda, M, Zhu, AL, Rozhin, AG & Du, XW 2015, 'The icephobic performance of alkyl-grafted aluminum surfaces' Soft matter, vol 11, no. 5, pp. 856-861., 10.1039/c4sm02204a
- Kolpakov, SA, Gordon, NT, Yadav, A, Kbashi, H, Titkov, I, Rafailov, E & Zhou, K 2015, 'Dicing of a sapphire wafer using sub-picosecond pulses at a wavelength of 800 nm'. in 2015 European Conference on Lasers and Electro-Optics - European Quantum Electronics Conference., paper CM_P_15, Optical Society of America, Conference on Lasers and Electro-Optics Europe – European Quantum Electronics Conference 2015 (CLEO/Europe-EQEC 2015), Munich, Germany, 21-25 June.
- Le, ST, Wahls, S, Lavery, D, Prylepskiy, JE & Turitsyn, SK 2015, 'Reduced complexity nonlinear inverse synthesis for nonlinearity compensation in optical fiber links'. in 2015 European Conference on Lasers and Electro-Optics - European Quantum Electronics Conference., CI_3_2, Optical Society of America, Conference on Lasers and Electro-Optics Europe – European Quantum Electronics Conference 2015 (CLEO/Europe-EQEC 2015), Munich, Germany, 21-25 June.
- Le, ST, Prilepsky, JE, Kamalian, M, Rosa, P, Tan, M, Ania-Castañón, JD, Harper, P & Turitsyn, SK 2015, 'Modified nonlinear inverse synthesis for optical links with distributed Raman amplification'. in European Conference on Optical Communication, ECOC., 0257, IEEE, 41st European Conference on Optical Communication, Valencia, Spain, 27-1 October., 10.1109/ECOC.2015.7341904
- Sergeyev, SV, Kalashnikov, V, Mou, C, Popov, S & Jacobsen, G 2015, 'Polarisation phenomena in mode locked fibre lasers and fibre Raman amplifiers griffon tutorial' 17th International Conference on Transparent Optical Networks, Budapest,

Hungary, 5/07/15 - 9/07/15, ., 10.1109/ICTON.2015.7193294

- Palmer, S, Litvinova, K, Rafailov, EU & Nabi, G 2015, 'Detection of urinary bladder cancer cells using redox ratio and double excitation wavelengths autofluorescence' Biomedical optics express, vol 6, no. 3, pp. 977-986., 10.1364/BOE.6.000977
- Bigo, S, Nouchi, P, Ludvigsen, H, Lerminiaux, C, Ellis, A, Raz, O, Frignac, Y, Hamaide, JP & Chanclou, P 2015, 'Foreword to the special issue on European conference on optical communications (ECOC 2014)' Journal of lightwave technology, vol 33, no. 5, pp. 959-963., 10.1109/JLT.2015.2402011
- Turitsyn, SK, Bednyakova, AE, Fedoruk, MP, Papernyi, SB & Clements, WRL 2015, 'Inverse four-wave mixing and self-parametric amplification in optical fibre' Nature photonics, vol 9, pp. 608–614., 10.1038/nphoton.2015.150
- Suchkov, SV, Sumetsky, M & Sukhorukov, AA 2015, 'Reflectionless potentials for slow whispering gallery modes in surface nanoscale axial photonic fiber resonators' Optics letters, vol 40, no. 16, pp. 3806-3809., 10.1364/OL.40.003806
- Smirnov, SV, Tarasov, N & Churkin, DV 2015, 'Radiation build-up in laminar and turbulent regimes in quasi-CW Raman fiber laser' Optics express, vol 23, no. 21, pp. 27606-27611., 10.1364/OE.23.027606
- Papernyi, SB, Bednyakova, AE & Turitsyn, S 2015, 'Spectral narrowing of CW light in optical fibers with normal dispersion'. in CLEO: science and innovations 2015., paper SW3L.3, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_SI.2015.SW3L.3
- Gross, S, Dubov, M & Withford, MJ 2015, 'On the use of the type I and II scheme for classifying ultrafast laser direct-write photonics' Optics express, vol 23, no. 6, pp. 7767-7770., 10.1364/OE.23.007767
- Fabbri, SJ, Sygletos, S, Perentos, A, Pincemin, E, Sugden, K & Ellis, AD 2015, 'Experimental implementation of an all-optical interferometric drop, add, and extract multiplexer for superchannels' Journal of lightwave technology, vol 33, no. 7, pp. 1351-1357., 10.1109/JLT.2015.2390292
- Le, ST, McCarthy, M, Suibhne, NM, Haigh, PA, Giacoumidis, E, Doran, N, Ellis, AD & Turitsyn, SK 2015, 'Decision-directed-free blind phase noise estimation for COOFDM'. in Optical Fiber Communication Conference 2015., paper W1E.5, OSA technical digest (online), Optical Society of America, Optical Fiber Communication conference 2015, Los Angeles, CA, United States, 22-26 March., 10.1364/OFC.2015.W1E.5
- Le, ST, MacSuibhne, N, McCarthy, ME, Ellis, AD & Turitsyn, SK 2015, 'Multiplier-free blind phase noise estimation for CO-OFDM transmission'. in European Conference on Optical Communication, ECOC., 0258, IEEE, 41st European Conference on Optical Communication, Valencia, Spain, 27-1 October., 10.1109/ECOC.2015.7341658
- Le, ST, Prilepsky, JE & Turitsyn, SK 2015, 'Nonlinear inverse synthesis technique for optical links with lumped amplification' Optics express, vol 23, no. 7, pp. 8317-8328., 10.1364/OE.23.008317
- Le, ST, McCarthy, ME, Suibhne, NM, Al-Khateeb, MAZ, Giacoumidis, E, Doran, N, Ellis, AD & Turitsyn, SK 2015, 'Demonstration of phase-conjugated subcarrier coding for fiber nonlinearity compensation in CO-OFDM transmission' Journal of lightwave technology, vol 33, no. 11, pp. 2206-2212., 10.1109/JLT.2015.2408995
- Le, ST & Turitsyn, SK 2015, 'Techniques for noise and nonlinear impairments compensation in CO-OFDM transmission'. in M Jaworski & M Marciniak (eds), 17th International Conference on Transparent Optical Networks (ICTON 2015)., Tu.A1.5, IEEE, Warsaw (PL), 17th International Conference on Transparent Optical Networks, Budapest, Hungary, 5-9 July., 10.1109/ICTON.2015.7193393
- Boscolo, S, Fatome, J, Turitsyn, SK, Millot, G & Finot, C 2015, 'Temporal and spectral nonlinear pulse shaping methods in optical fibers'. in S Wabnitz & BJ Eggleton (eds), All-optical signal processing: data communication and storage applications. Springer series in optical sciences, vol. 194, Springer, Cham (CH), pp. 105-128., 10.1007/978-3-319-14992-9_4
- Boscolo, S, Finot, C & Turitsyn, S 2015, 'Bandwidth programmable optical Nyquist pulse generation in passively mode-locked fiber laser' IEEE photonics journal, vol 7, no. 5., 10.1109/JPHOT.2015.2475177
- Boscolo, S, Finot, C & Turitsyn, S 2015, 'New nonlinear regimes of pulse generation in mode-locked fiber lasers' 9th IMACS international conference on nonlinear evolution equations and wave phenomena: computation and theory, Athens (GA), United States, 1/04/15 - 4/04/15, pp. 97.
- Boscolo, S, Finot, C & Turitsyn, SK 2015, 'Optical Nyquist pulse generation in mode-locked fibre laser'. in 2015 European Conference on Lasers and Electro-Optics - European Quantum Electronics Conference., CI-3.1, Optical Society of America, Conference on Lasers and Electro-Optics Europe – European Quantum Electronics Conference 2015 (CLEO/Europe-EQEC 2015), Munich, Germany, 21-25 June.
- Boscolo, S, Peng, J & Finot, C 2015, 'Design and applications of in-cavity pulse shaping by spectral sculpturing in mode-locked fibre lasers' Applied sciences, vol 5, no. 4, pp. 1379-1398., 10.3390/app5041379
- Sugavanam, S, Fabbri, S, Son, TL, Lobach, I, Kablukov, SI, Khorev, S & Churkin, DV 2015, 'Real-time heterodyne-based measurements of fiber laser spectral dynamics'. in CLEO: applications and technology 2015., JTh2A.50, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_AT.2015.JTh2A.50
- Sugavanam, S, Mou, C, Peng, J & Churkin, DV 2015, 'Pulse-to-pulse spectral evolution of breathing bound solitons in a mode-locked fiber laser'. in CLEO: science and innovations 2015., paper STh3L.2, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_SI.2015.STh3L.2
- Sugavanam, S, Tarasov, N, Wabnitz, S & Churkin, DV 2015, 'Ginzburg-Landau turbulence in quasi-CW Raman fiber lasers' Laser and photonics reviews, vol Early view., 10.1002/lpor.201500012

- Sygletos, S, Fabbri, S, Sorokina, M & Ellis, AD 2015, 'All-optical add-drop multiplexing of OFDM signals'. in Signal Processing in Photonic Communications 2015., SpT2E.1, OSA technical digest, Optical Society of America, Signal Processing in Photonic Communications, Boston, MA, United States, 27-1 July., 10.1364/SPPCOM.2015.SpT2E.1
- Sygletos, S, Fabbri, S, Ferreira, F, Sorokina, M, Perentos, A & Ellis, A 2015, 'All-optical add-drop multiplexer for OFDM signals'. in M Jaworski & M Marciniak (eds), 17th International Conference on Transparent Optical Networks (ICTON 2015)., We.A1.1, IEEE, Warsaw (PL), 17th International Conference on Transparent Optical Networks, Budapest, Hungary, 5-9 July., 10.1109/ICTON.2015.7193525
- Goto, T, Honda, M, Kulinich, SA, Shimizu, Y & Ito, T 2015, 'Defects in ZnO nanoparticles laser-ablated in water-ethanol mixtures at different pressures' Japanese Journal of Applied Physics, vol 54, no. 7, 070305., 10.7567/JJAP.54.070305
- Le, TS, McCarthy, ME, Suibhne, NM, Ellis, AD & Turitsyn, SK 2015, 'Phase-conjugated pilots for fibre nonlinearity compensation in CO-OFDM transmission' Journal of lightwave technology, vol 33, no. 7, pp. 1308-1314., 10.1109/JLT.2015.2388854
- Xu, T, Jacobsen, G, Popov, S, Li, J, Sergeyev, S, Friberg, AT & Zhang, Y 2015, 'Analytical BER performance in differential n-PSK coherent transmission system influenced by equalization enhanced phase noise' Optics communications, vol 334, pp. 222-227., 10.1016/j.optcom.2014.07.094
- Osipov, V, Doskolovich, LL, Bezus, EA, Drew, T, Zhou, K, Sawalha, K, Swadener, G & Wolffsohn, JSW 2015, 'Application of nanoimprinting technique for fabrication of trifocal diffractive lens with sine-like radial profile' Journal of biomedical optics, vol 20, no. 2, 025008., 10.1117/1.JBO.20.2.025008
- Kalashnikov, VL & Sergeyev, SV 2015, 'Stochastic anti-resonance in a fibre Raman amplifier'. in Spatiotemporal Complexity in Nonlinear Optics, SCNO 2015 . IEEE, 2015 Spatiotemporal Complexity in Nonlinear Optics, Como, Italy, 31-4 September., 10.1109/SCNO.2015.7324003
- Kalashnikov, VL & Sergeyev, S 2015, 'Stochastic calculations for fibre Raman amplifiers with randomly varying birefringence' 8th Chaotic Modeling and Simutation international conference, Paris, France, 26/05/15 - 29/05/15, pp. 54.
- Zhang, W, Abang, A, Webb, DJ & Peng, G-D 2015, 'Wavelength drift of PMMA-based optical fiber bragg grating induced by optical absorption' IEEE photonics technology letters, vol 27, no. 4, pp. 336-339., 10.1109/LPT.2014.2371066
- Zhang, W, Webb, DJ & Peng, G-D 2015, 'Enhancing the sensitivity of poly(methyl methacrylate) based optical fiber Bragg grating temperature sensors' Optics letters, vol 40, no. 17, pp. 4046-4049., 10.1364/OL.40.004046
- Zhang, W, Chen, X, Liu, C, Lu, Y, Cardoso, M & Webb, DJ 2015, 'Improved response time of laser etched polymer optical fiber Bragg grating humidity sensor'. in HJ Kalinowski, JL Fabris & WJ Bock (eds), 24th international conference on Optical Fibre Sensors., 96343K, SPIE proceedings, vol. 9634, SPIE, Bellingham, WA (US), 24th international conference on Optical Fibre Sensors, Curitiba, Brazil, 28-2 October., 10.1117/12.2194108
- Chen, X, Liu, C, Hughes, MD, Nagel, DA, Hine, AV & Zhang, L 2015, 'EDC-mediated oligonucleotide immobilization on a long period grating optical biosensor' Journal of biosensors and bioelectronics, vol 6, no. 2, 1000173., 10.4172/2155-6210.1000173
- Wang, X, Yan, Z, Wang, F, Sun, Z, Mou, C, Zhang, X & Zhang, L 2015, 'SNR enhanced distributed vibration fiber sensing system employing polarization OTDR and ultraweak FBGs' IEEE photonics journal, vol 7, no. 1, 6800511., 10.1109/JPHOT.2015.2396010
- Wang, X, Yan, Z, Wang, F, Hua, J, Mou, C, Sun, Z, Zhang, X & Zhang, L 2015, 'An OTDR and gratings assisted multifunctional fiber sensing system' IEEE sensors journal, vol 15, no. 8, pp. 4660-4666., 10.1109/JSEN.2015.2427194
- Liu, X, Wang, H, Wang, Y, Yan, Z & Zhang, L 2015, 'Single-polarization, dual-wavelength mode-locked Yb-doped fiber laser by a 45°-tilted fiber grating' Laser physics letters, vol 12, no. 6, 065102., 10.1088/1612-2011/12/6/065102
- Hu, X, Sáez Rodríguez, D, Bang, O, Webb, DJ, Mégret, P & Caucheteur, C 2015, 'Polarization effects in polymer FBGs: study and use for transverse force sensing' Optics express, vol 23, no. 4, pp. 4581-4590., 10.1364/OE.23.004581
- Liu, Y, Li, J, Yan, Z, Li, Z & Zhang, L 2015, '2 μm mode-locked thulium doped fiber laser using tilted fiber grating'. in ICOCN 2015 - 14th International Conference on Optical Communications and Networks, Proceedings. IEEE, 14th International Conference on Optical Communications and Networks, Nanjing, China, 3-5 July., 10.1109/ICOCN.2015.7203600
- Yan, Z, Mou, C, Sun, Z, Zhou, K, Wang, H, Wang, Y, Zhao, W & Zhang, L 2015, 'Hybrid tilted fiber grating based refractive index and liquid level sensing system' Optics communications, vol 351, pp. 144-148., 10.1016/j.optcom.2015.04.038
- Yan, Z, Sun, Z, Zhou, K, Luo, B, Li, J, Wang, H, Wang, Y, Zhao, W & Zhang, L 2015, 'Numerical and experimental analysis of sensitivity-enhanced RI sensor based on Ex-TFG in thin cladding fiber' Journal of lightwave technology, vol 33, no. 14, pp. 3023-3027., 10.1109/JLT.2015.2422076
- Xu, Z, Sun, Q, Li, B, Luo, Y, Lu, W, Luo, H, Liu, D & Zhang, L 2015, 'Multifunctional, tunable and wideband all-fiber filter based on ńshaped microfiber resonator'. in CLEO: applications and technology 2015., JTu5A.64, OSA technical digest, Optical Society of America, Conference on Lasers and Electro-Optics 2015, San Jose, United States, 10-15 May., 10.1364/CLEO_AT.2015.JTu5A.64
- Sun, Z, Mou, C, Yan, Z, Zhou, K, Wang, X, Li, J & Zhang, L 2015, 'Optical loading sensor based on ring-cavity fiber laser incorporating a 45°-tilted fiber polarizing grating' Applied optics, vol 54, no. 13, pp. 4267-4272., 10.1364/AO.54.004267
- Zhang, Z, Mou, C, Yan, Z, Wang, Y, Zhou, K & Zhang, L 2015, 'Switchable dual-wavelength Q-switched and mode-locked fiber lasers using a large-angle tilted fiber grating' Optics express, vol 23, no. 2, pp. 1353-1360., 10.1364/OE.23.001353

- T. Allsop, et al, “Photonic gas sensors exploiting directly the optical properties of hybrid carbon nanotube localized surface plasmon structures”, Light: Science & Applications, 2015
- A.J.Walsh, J.Mountjoy, H. Shams, A.Fagan, A.D. Ellis, L.P. Barry, L.P., “Highly Robust Dual-Polarization Doubly Differential PSK Coherent Optical Packet Receiver for Energy Efficient Reconfigurable Networks”, Vol. 33, No. 24, pp5128-5226, (2015) .
- Zhang, Z, Yan, Z, Zhou, K & Zhang, L 2015, ‘All-fiber 250 MHz fundamental repetition rate pulsed laser with tilted fiber grating polarizer’ Laser physics letters, vol 12, no. 4, 045102., 10.1088/1612-2011/12/4/045102
- T. Allsop, et al, “Photonic gas sensors exploiting directly the optical properties of hybrid carbon nanotube localized surface plasmon structures”, Light: Science & Applications, 2015
- Sergei K. Turitsyn, Anastasia E. Bednyakova, Mikhail P. Fedoruk, Serguei B. Papernyi & Wallace R. L. Clements Inverse four-wave mixing and self-parametric amplification in optical fibre, Nature Photonics, 9, 608-614 (2015)
- D.V. Churkin, I.V. Kolokolov, E.V. Podivilov, I.D. Vatnik, M.A. Nikulin, S.S. Vergeles, I.S. Terekhov, V.V. Lebedev, G.
- Falkovich, S.A. Babin, S.K. Turitsyn, Wave kinetics of random fibre lasers, Nature Communications 6:6214 (2015)
- D.V. Churkin1, S. Sugavanam, N. Tarasov, S. Khorev, S.V. Smirnov, S.M. Kobtsev and S.K. Turitsyn, Stochasticity, periodicity and localized light structures in partially mode-locked fibre lasers , Nature Communications 6:7004 (2015)
- A. Bednyakova and S. K. Turitsyn, Adiabatic soliton laser, Phys. Rev. Lett., 114, 113901 (2015)
- D.V. Churkin, S. Sugavanam, I.D. Vatnik, Z. Wang, E.V. Podivilov, S.A. Babin, Y. Rao, and S.K. Turitsyn, Recent advances in fundamentals and applications of random fiber lasers,, Advances in Optics and Photonics, 7(3), 516-569 (2015)
- L. Hadzievski, A. Maluckov, A.M. Rubenchik and S.K.Turitsyn, Stable optical vortices in nonlinear multicore fibers, Light: Science & Applications, e314 (2015)
- Son Thai Le, Jaroslaw E. Prilepsky, and Sergei K. Turitsyn, Nonlinear inverse synthesis technique for optical links with lumped amplification, Opt. Express, 23, 8317-8328 (2015)
- M. A. Sorokina, S. Sygletos, A. Ellis and S. K. Turitsyn, Regenerative Fourier transformation for dual-quadrature regeneration of multilevel rectangular QAM, Opt. Lett. 40, 3117-3120 (2015)
- J. Li, H. Luo, L. Wang, Y. Liu, Z. Yan, K. Zhou, L. Zhang and S. K. Turistsyn, Mid-infrared passively switched pulsed dual wavelength Ho3+-doped fluoride fiber laser at 3 micron and 2 micron, Scientific Reports 5, Article number: 10770 (2015)
- Sonia Boscolo, Christophe Finot and Sergei. K. Turitsyn Bandwidth programmable optical Nyquist pulse generation in passively mode-locked fiber laser, IEEE Photonics Journal, 7(5) 7082008 (2015)
- A. Tonello, A. Bartholomy, K. Krupa, V. Kermene, A. Desfarges-Berthelemot, B.M. Shalaby, S. Boscolo, S.K. Turitsyn, J.D. Ania-Castanon, Secret key exchange in ultra-long lasers by radio-frequency spectrum coding, Light: Science & Applications 4(4) e276 (2015)
- E. G. Shapiro, D. A. Shapiro, and S. K. Turitsyn, Method for computing the optimal signal distribution and channel capacity, Opt. Express, 23, 15119-15133 (2015)
- O.V. Shtyrina, I.A. Yarutkina, A. Skidin, M.P. Fedoruk, and S. K. Turitsyn Impact of the Order of Cavity Elements in All-Normal Dispersion Ring Fiber Lasers, IEEE Photonics Journal, 7(2) 1501207 (2015)
- S.T. Le, M.E. McCarthy, N. Mac Suibhne, M.A.Z. Al-Khateeb, E. Giacoumidis, N. Doran, A.D. Ellis, and S.K. Turitsyn, Demonstration of Phase-Conjugated Subcarrier Coding for Fiber Nonlinearity Compensation in CO-OFDM Transmission, JLT, 33, 2206 (2015)
- S.T. Le, M.E. McCarthy, N. Mac Suibhne, A.D. Ellis, and S.K. Turitsyn, Phase-Conjugated Pilots for Fibre Nonlinearity Compensation in CO-OFDM Transmission, JLT, 33(7), 1308 (2015)
- A. M. Rubenchik, I. S. Chekhovskoy, M. P. Fedoruk, O. V. Shtyrina, and S. K. Turitsyn,, Nonlinear pulse combining and pulse compression in multi-core fibers, Opt. Lett. 40, 721-724 (2015)
- Alejandro B. Aceves, Olga V. Shtyrina, Alexander M. Rubenchik, Mikhail P. Fedoruk, and Sergei K. Turitsyn, Spatiotemporal optical bullets in two-dimensional fiber arrays and their stability, Phys. Rev. A, 91, 033810 (2015);
- C. Mou, R. Arif, A.S. Lobach, D. V. Khudyakov, N. G. Spitsina, V. A. Kazakov, S. K. Turitsyn, and A.Rozhin, Poor fluorinated graphene sheets carboxymethylcellulose polymer composite mode locker for erbium doped fiber laser , Applied Physics Letters, 106(6), 061106 (2015)
- A. J. Martinez, M. I. Molina, S. K. Turitsyn, and Yu. S. Kivshar, Nonlinear multicore waveguiding structures with balanced gain and loss, Phys. Rev. A, 91(2), [023822] (2015); Archive version 2014
- S. Sygletos, S. Fabbri, E. Giacoumidis, M. Sorokina, D. M. Marom, M.F.C. Stephens, D. Klonidis, I. Tomkos, Blind PhaseOFDM signals”, Optics Express, Vol. 23, pp.5888-5897 (2015).
- F. M. Ferreira, N. Mac Suibhne, S. Sygletos, A. D. Ellis, “On the Statistics of Group Delays in Few-Mode Fibres for the Intermediate Coupling Regime”, ECOC 2015, paper Th.1.6.1 (2015).
- E. Giacoumidis, S.T. Le, M.E. McCarthy, A.D. Ellis, B.J. Eggleton, “Record Intrachannel Nonlinearity Reduction in 40-Gb/s 16QAM Coherent Optical OFDM using Support Vector Machine based Equalization”, Australian Conference on Optical Fiber Technology, Adelaide, Australia, postdeadline paper 5, (2015).
- E. Giacoumidis, S. T. Le, M. Ghanbarisabagh, M.E. McCarthy, I. Aldaya, S. Mhatli, M. A. Jarajreh, P. A. Haigh, N. J. Doran, A. D. Ellis, and B. J. Eggleton, “Fiber Nonlinearity-Induced Penalty Reduction in Coherent Optical OFDM by Artificial Neural Network based Nonlinear Equalization”, Optics Letters, vol 40, no 21, pp 5113-5116 (2015).
- O. Yushko, M. Fedoruk, K. Blow, A. Redyuk, S. Turitsyn, N. Doran, A. Ellis, “Digital back propagation in soliton coherent transmission”, Digital Communications (TIWDC), 2015 Tyrrhenian International Workshop on, pp20-23, (2015).

Invited talks

- J.E. Prilepsky, S.A. Derevyanko, S.K. Turitsyn, “Channel Model and Lower Capacity Bound for the Transmission Based on Nonlinear Fourier Transform (Invited)” , Progress In Electromagnetics Research Symposium (PIERS), Prague, Czech Republic, July 6-9, 2015
- S. Wahls, S. T. Le, J. E. Prilepsky, H. V. Poor, and S. K. Turitsyn, ``Digital Backpropagation in the Nonlinear Fourier Domain,''iProceedings of IEEE 16th International Workshop in Signal Processing Advances in Wireless Communications (SPAWC), Stockholm, Sweden, June 28-July 3, 2015.
- C. Mou, S.Sergeyev, R. Arif, A. Rozhin, T. Habruseva, V. Tsatourian and S.K. Turitsyn, “Polarisation Dynamics in Carbon Nanotube Mode Locked Ultrafast Fibre Lasers”,
- C. Mou “All-fibre Mode-locked fibre laser based on Carbon Nanomaterials and Fibre Gratings”, Aston Institute of Photonic Technologies (AiPT), Aston University, Birmingham, UK, B4 7ET
- Carlos A. F. Marques, David J. Webb, “Perspective work on optical fibre sensors”, Oral presentation, 21st annual International Conference on Advanced Laser Technologies (ALT 2015), September, 2015, Faro, Portugal. (invited talks).
- C. Mou, S. Sergeyev, R. Arif, A. Rozhin, Z. Yan, K. Zhou, Z. Zhang, V. Tsatourian, T. Habruseva, L. Zhang, S. Turitsyn, “All fibre-mode locked fibre laser and its polarisation dynamics,” Aston Institute of Photonic Technologies
- S.V. Sergeyev, V. Kalashnikov, Ch. Mou, S. Popov, G. Jacobsen, Polarisation phenomena in mode locked fibre lasers and fibre Raman amplifiers, ICTON’2015, Budapest 5-9 July, 2015 (tutorial)
- S. V. Sergeyev, S. A. Kolpakov, Ch. Mou, V. Kalashnikov, G. Jacobsen, S. Popov, and S. K. Turitsyn Polarisation dynamics of mode locked fibre lasers, Northern Optics & Photonics 2015 (NOP 2015), 2-4 June 2015, Lappeenranta, Finland (invited talk)
- K. Krupa, A. Tonello, S. Boscolo, A. Barthélémy, V. Kermène, A. Desfarges-Berthelemot, B. M. Shalaby, S. K. Turitsyn, and J. D. Ania-Castanõn, “Radio-frequency spectrum coding in ultra-long fibre laser based cryptography,” 17th International Conference on Transparent Optical Networks (ICTON 2015), Jul 5-9, 2015, Budapest, Hungary (invited talks).
- C. Finot and S. Boscolo, “Parabolic similaritons in optical fibres,” Conference: Physics and Mathematics of Nonlinear Phenomena 2015 (PMNP 2015), Jun 20-27, 2015, Gallipoli (Lecce), Italy (invited talks).
- Dmitry Churkin, Srikanth Sugavanam, ‘Spatio-temporal intensity dynamics of passively mode-locked fiber laser’, at SPIE Photonics West, San Francisco, 16th February 2016, Paper no. 9732-17.
- S. K. Turitsyn, “Nonlinear world of fibre lasers”, Max Planck Workshop, May 2015, Germany
- S. K. Turitsyn, “Optical Wave Turbulence in Fibre Lasers”, CLEO-Europe, June 2015, Munich
- S. K. Turitsyn, International Workshop on Digital Communications 2015; Fiber Nonlinearities in Coherent Optical Communications, Florence, Convitto della Calza, September 2015
- S. K. Turitsyn, Waves and Solitons in Turbulent Optical Systems” (WASTOS 15), October 2015, WIAS Berlin.
- S. K. Turitsyn, FiO2015, Technical Conference:18-22 October 2015, The Fairmont San Jose, San Jose, CA USA
- S. K. Turitsyn, “Celebrating Solitons – 50 years of Nonlinear Science with Light”
- S. K. Turitsyn, ACP (Asia Communications and Photonics Conference) 2015, November 2015, Hong Kong
- S. K. Turitsyn, M. Sorokina, S. Sygletos, A. Ellis, and S. Turitsyn, ”Advanced 3R regenerative scheme,” International Conference on Transparent Optical Networks 2015 (invited).
- A.D.Ellis, M.E.McCarthy, M. A. Sorokina, N.J. Mac Suibhne, S.K.Turitsyn, S.Sygletos, ”Potential solutions to overcome the capacity crunch,” CLEO 2015 CI-1.3 (invited).
- A.D. Ellis, S.T. Le, M.A.Z. Al-Khateeb, S.K. Turitsyn, G. Liga, D. Lavery,
- S. K. Turitsyn, “Nonlinear world of fibre lasers”, Max Planck Workshop, May 2015, Germany
- S. K. Turitsyn, “Optical Wave Turbulence in Fibre Lasers”, CLEO-Europe, June 2015, Munich

- S. K. Turitsyn, International Workshop on Digital Communications 2015; Fiber Nonlinearities in Coherent Optical Communications, Florence, Convitto della Calza, September 2015
- S. K. Turitsyn, Waves and Solitons in Turbulent Optical Systems" (WASTOS 15), October 2015, WIAS Berlin.
- S. K. Turitsyn, FiO2015, Technical Conference:18-22 October 2015, The Fairmont San Jose, San Jose, CA USA
- S. K. Turitsyn, "Celebrating Solitons – 50 years of Nonlinear Science with Light"
- S. K. Turitsyn, ACP (Asia Communications and Photonics Conference) 2015, November 2015, Hong Kong
- S. K. Turitsyn, M. Sorokina, S. Sygletos, A. Ellis, and S. Turitsyn, "Advanced 3R regenerative scheme," International Conference on Transparent Optical Networks 2015 (invited).
- A.D.Ellis, M.E.McCarthy, M. A. Sorokina, N.J. Mac Suibhne, S.K.Turitsyn, S.Sygletos, "Potential solutions to overcome the capacity crunch," CLEO 2015 CI-1.3 (invited).
- A.D. Ellis, S.T. Le, M.A.Z. Al-Khateeb, S.K. Turitsyn, G. Liga, D. Lavery, T.Xu, P. Bayvel, "The Impact of Phase Conjugation on the Nonlinear-Shannon Limit, The Difference between Optical and Electrical Phase Conjugation", IEEE Summer Topical, 2015 (invited)
- Sander Walhs, Son T. Le, J. E. Prilepsky, H. Vincent Poor and S. K. Turitsyn, "Digital Back Propagation in the Nonlinear Fourier Domain", SPAWC2015 (invited)
- Son T. Le, M.E. McCarthy, S. K. Turitsyn, I. Phillips, D. Lavery, T.Xu, P. Bayvel, A.D. Ellis, "Optical and Digital Phase Conjugation Techniques for Fiber Nonlinearity Compensation", OECC 2015, Shanghai (invited)
- Son T. Le and Sergei. Turitsyn, "Techniques for Noise and Nonlinear Impairments Compensation in CO-OFDM Transmission", ICTON 2015, paper Tu.A1.5 (invited).
- A. D. Ellis, S. T. Le, M.E. McCarthy, S. K. Turitsyn, "The impact of parametric amplification in long-haul transmission throughput", ICTON 2015, (invited)
- J. E. Prilepsky, S. A. Derevyanko, and S. K. Turitsyn, Channel Model and Lower Capacity Bound for the Transmission Based on Nonlinear Fourier Transform, Progress In Electromagnetics Research Symposium, PIERS 2015 in Prague, Czech Republic, 06-09 July, 2015 (Invited).
- G. Lee, T. Allsop, Changle Wanga, R Neal, P. Culverhouse, S. Turitsyna, D. Webb, "Fiber optic sensing of magnetic fields utilizing femtosecond laser sculpted microslots and long period gratings coated with Terfenol-D", INVITED TALK, 24th International Conference on Optical Fibre Sensors, Curitiba, Brazil, 2015
- F. Guitierrez, et al., "All-Analogue Real-Time Broadband Filter Bank Multicarrier Optical Communications System", Vol. 33, No. 24, pp 5073-5083, (2015)
- S.T. Le, M.E. McCarthy, N. Mac Suibhne, A.D. Ellis and S.K. Turitsyn, "Phase-conjugated Pilots for Fibre Nonlinearity Compensation in CO-OFDM Transmission", IEEE Journal of Lightwave Technology, Vol. 33, No. 7, pp 1308-1314, (2015).
- S. Fabbri, S.Sygletos, A.Perentos, E. Pincemin, K. Sugden, A.D.Ellis, "Experimental implementation of all-optical interferometric drop, add, and extraction multiplexer for optical superchannels", IEEE Journal of Lightwave Technology, Vol.33, No.7, pp1351-1357, (2015).
- S.T. Le, M.E. McCarthy, S. K. Turitsyn, I. Phillips, G. Liga, D. Lavery, T.Xu, P. Bayvel, A.D. Ellis, "Optical and Digital Phase Conjugation Techniques for Fiber Nonlinearity Compensation", OECC 2015, Invited paper, (2015).
- A.D.Ellis, M.E.McCarthy, M.A.Sorokina, N.J. Mac Suibhne, S.K.Turitsyn, S.Sygletos, "Potential solutions to overcome the capacity crunch", CLEO Europe 2015, paper CI-1.3.
- S. Sygletos, S. Fabbri, F. Ferreira, M. Sorokina, A. Perentos, and A.D. Ellis, "All-optical add-drop multiplexer for OFDM signals", Proc ICTON 2015, invited paper WeA1.1, (2015).
- F. Ferreira, D. Fonseca, S. Sygletos, A.D. Ellis, H. Silva, "Impact of Inter-modal Four-Wave Mixing on the Performance of Mode- and Wavelength-Division-Multiplexing Systems", Proc ICTON 2015, invited paper WeD1.4, (2015)
- A.D. Ellis, S.T. Le, M.A.Z. Al-Khateeb, S.K. Turitsyn, G. Liga, D. Lavery, T.Xu, P. Bayvel, "The Impact of Parametric Noise Amplification on Long Haul Transmission Throughput.", Proc ICTON 2015, invited paper WeD1.5, (2015)
- M. Sorokina, S. Sygletos, A. Ellis, S. Turitsyn, "Advanced 3R regenerative scheme for high spectral efficient waveforms", Proc ICTON 2015, invited paper MoD1.5, (2015)
- N. Mac Suibhne, F.M.Ferierra, A.D.Ellis, "Nonlinearity induced limits of few mode fibre", IEEE Photonics Conference, paper MF4.4 (2015).
- S.J. Fabbri, S.Sygletos, A.Perentos, E.Pincemin, K.Sugden, A.D. Ellis, "Experimental demonstration of an All-Optical Interferometric Drop, Add, and Extract Multiplexer for OFDM Super-channel", IEEE Summer Topical Meeting, Nassau, The Bahamas, paper MF1.2, (2015).
- A.D. Ellis, S.T. Le, M.A.Z. Al-Khateeb, S.K. Turitsyn, G. Liga, D. Lavery, T.Xu, P. Bayvel, "The Impact of Phase Conjugation on the Nonlinear-Shannon Limit", IEEE Summer Topical Meeting, Nassau, The Bahamas, paper TuF3.2, (2015).
- S.Sygletos, S.Fabrii, A.Perentos, A.D.Ellis, "All-optical add-drop multiplexing of OFDM signals" in Proc Signal Processing in Photonic Communications (SPPCom), Boston, USA, Invited paper (2015).
- A.D.Ellis, S. Sygletos, "The Potential for Networks with Capacities Exceeding the Nonlinear Shannon Limit", in Photonic Networks and Devices (PND), Boston, USA, Invited Paper, (2015).
- C. Sanchez, M. Mccarthy, A. D. Ellis, P. Wright, A. Lord, "Optical-phase conjugation nonlinearity compensation in Flexi-Grid optical networks", WSEAS conference on Recent Advances on Systems, Signals, Control, Communications and Computers, Budapest, Hungary, (2015).

- N. Mac Suibhne*, M. E. McCarthy, S. T. Le, S. Sygletos, F. M. Ferreira and A. D. Ellis, “Optical Fibre Limits: An approach Using ASE Channel Estimation”, Proc PIERS 2015 (Progress in Electromagnetics Research Symposium), Invited Paper, 2015
- C.Mou, M. Chernysheva, R. Arif, S.K. Turitsyn, A.G.Rozhin “Carbon Nanomaterials in Ultrafast Photonics” PHOTONICA 201,5 Belgrade (August 24 - 28, 2015). Keynote Lecture.
- Peer Reviewed National conferences:
- A.D.Ellis, “Viability of SDM for Addressing the Bandwidth Capacity Crunch”, in Proc. Next Generation Optical Networking, (2015).
- “Multimodality in photo-diagnostics: dealing with human complexity” Midlands Innovation Photonics Event at Aston University, Birmingham, UK
- “Cancer Photo-Diagnostics and Treatment” Opening Doors seminar “Optical Technologies for Societies”, by British Council in Spain and Spanish Council for Scientific Research, Madrid, Spain.
- “Modern Photonics Technologies for Multimodal Medical Diagnostics: the Way towards Personalised Medicine “Photonics meets Biology” Summer School” Crete, Greece

Notes

Aston Institute of Photonic Technologies
Aston University
Aston Triangle, Birmingham
B4 7ET, UK

Website: aston.ac.uk/aipt
Twitter: @AstonPhotonics