16th Annual Workshop

Handbook

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19 - 22 February 2017
Mercure Kooindah Waters
Wyong, NSW, Australia
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It is with both great pleasure and sadness that I welcome you to the 16th and final Annual CUDOS Workshop, to be held again at the Kooindah Waters Resort, Wyong, NSW. As we enter the final year of the Centre, this Workshop will provide staff, students & our local and international guests opportunities to report on their latest research, explore ideas, views and experiences, and create new spaces for collaboration.

Over 150 participants will be attending this Workshop and our Partner Institutions are again well represented. I would like to particularly thank PIs John Sipe and Thomas Krauss who have attended all seven workshops since CUDOS was refunded in 2011. We also acknowledge and welcome our formal collaborators from Institute Fresnel, Marseille and the Friedrich Schiller University in Jena.

Yuri and I invite you to join us for four days of discussion, debate and knowledge sharing in a variety of forums that include keynote addresses, presentations, Hot Topic sessions, poster displays, social events and a Buzz Panel.

The featured keynote speaker is Dr Katherine Woodthorpe, current member of the CUDOS Advisory Board, who has held a broad range of management and board positions, in Australia and overseas, and has been cited in various media as one of Australia’s most influential people in innovation. Katherine will enlighten us with her perspective on the exciting opportunities ahead and how we should be transitioning to the next phase.

Our highly popular Hot Topics sessions will be delivered by Shanhui Fan from Stanford and Dirk Englund from MIT. Thomas Krauss from York University will delve into the new emerging area of Nanostructured Photonic Biosensors and Steve Frisken will reflect on his entrepreneurial career: “Had I known back then what I now know.....”.

Flagship presentations chaired by the Science and Project Leaders will focus on what is hoped to be achieved by year end and post 2017 arrangements. The presentations will be framed around a series of questions designed to stimulate discussion about the next phase of the Centre’s research programs and strategic priorities for the future.

Education & Training and Outreach activities carried out in 2016 and exciting events planned for 2017 in this portfolio will be addressed during the Workshop Dinner where the Challenge winner[s] and the recipients of the Outreach & Community Engagement award will be announced. In the 2017 Challenge, staff and students were asked to consider the question “What is the CUDOS Legacy?” and compile a portfolio of images representing what they believe to be the most important aspect of our Centre.

The Poster Sessions for both staff and students will again prove popular and highly competitive. This year student posters will be grouped by Flagship/Other categories with an award for Best Poster made in each category. Posters will be judged by the CUDOS Partner Investigator and / or Collaborator who is an expert in that category. A final award of Best Workshop Poster from the category Winners will be selected by all judges. This new approach will ensure that all students will have an opportunity to engage with their relevant PI and receive constructive feedback on their research.

Finally, I would like to thank Shelley and her team for pulling together this event. It will be an amazing workshop.
## PROGRAM - AT - A - GLANCE

### Sunday, 19 February 2017
- **15:00** Arrival, Registration & Room Access
- **16:00 - 18:00** Student Poster Display
- **18:00 - 21:00** Dinner
- **20:00 - 21:00** Student Meet & Greet

### Monday, 20 February 2017
- **07:00 - 09:00** Breakfast
- **07:30 - 09:00** Women in CUDOS Breakfast Session
- **09:00 - 10:00** Director’s Opening Address
- **10:00 - 10:45** Keynote Address: Katherine Woodthorpe
- **10:45 - 11:15** Networking Break
- **11:15 - 12:35** On-chip Nanoplasmonics
- **12:35 - 13:30** Lunch
- **13:30 - 14:15** Hot Topics I: Shanhui Fan
- **14:15 - 14:45** New Ideas: Thomas Krauss
- **14:45 - 15:15** Networking Break
- **15:15 - 16:45** Functional Metamaterials and Devices
- **16:45 - 17:00** Quick Networking Break
- **17:00 - 17:45** Commercialisation and Entrepreneurship
- **18:00 - 19:15** Staff Poster Display
- **19:15 - 21:30** Dinner

### Tuesday, 21 February 2017
- **07:00 - 08:30** Breakfast
- **08:30 - 09:50** Hybrid Integration
- **09:50 - 10:15** Networking Break
- **10:15 - 11:00** Hot Topics II: Dirk Englund
- **11:00 - 12:20** Nonlinear Quantum Photonics
- **12:20 - 13:00** Lunch
- **13:15** Departure for Glenworth Valley and The Entrance
- **13:45 - 17:00** Social Afternoon at Glenworth Valley, The Entrance and Kooindah Waters Golf Club
- **18:00** Group Photo on the Resort Grounds
- **18:30 for 19:00** Gala Dinner & Awards

### Wednesday, 22 February 2017
- **07:00 - 09:00** Breakfast & Checkout
- **09:00 - 10:20** Terabit per second Photonics
- **10:20 - 10:30** Quick Networking Break
- **10:30 - 11:00** Mid-Infrared Photonics
- **11:00 - 11:45** Panel Buzz
- **11:45 - 13:00** Lunch
- **12:30** Delegate Departure: Newcastle Airport
- **13:00** Delegate Departure: Sydney
WELCOME TO MERCURE KOOINDAH WATERS GOLF & SPA RESORT!

Please read the following information which will assist you during your stay.

Reception & Housekeeping
Reception is open 24 hours daily.

Workshop Location
All workshop sessions will be held in the Kooindah Function Rooms inside the main building.

Identification
Please wear your name tag at all times whilst in the resort during the workshop, particularly at all meal times. This will enable resort staff to identify you as part of the CUDOS group.

Meals
Breakfast and Lunches will be served in Karinya’s Restaurant.
Morning and afternoon tea will be served in the Breakout Area of Karinya’s Restaurant.
Dinner locations vary and will be advised on the day.

Buffet-style dining caters for vegans, vegetarians and pescetarians. Special meals have been arranged for those who requested them when registering & will be made available individually. If you have any concerns regarding food service, please see Vera Brinkel.

Internet Access
Wireless internet is available throughout the resort.

Mobile handbook version
The program is also available through any web/mobile browser: http://au.eventscloud.com/ehome/2017workshop
Search and browse the program, speaker bios, and more!

Resort Facilities
Facilities include an 18-hole championship golf course, Endota Day Spa, a heated indoor 20-metre lap pool, an outdoor recreational pool, gym, sauna and spa, tennis courts and a walking and running track.

Additional Charges
Purchase of additional food, alcohol or services should be settled directly at the time of purchase with the resort; i.e. these items are not to be charged to your room. The resort will accept credit cards and cash (please note, there is no ATM at the resort).

Checkout
Checkout time is 9.00am. Your luggage will be stored in a location to be advised until departure.

Parking
Parking is complimentary and available outside hotels rooms.

Local Facilities
The resort is located a 5-minute drive from the town centre of Wyong, which features small shops and a Coles supermarket, a chemist and doctor. In case of an emergency, Wyong Hospital is a 10-minute drive from the resort. Please ask reception staff for directions.

ENJOY YOUR STAY AT MERCURE KOOINDAH WATERS!
# List of Participants

## ANU Laser Physics Centre

<table>
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<tr>
<th>Chief Investigators</th>
<th>Research Staff and Affiliates</th>
<th>Students</th>
</tr>
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<tbody>
<tr>
<td>Luther-Davies, Barry</td>
<td>Choi, Duk-Yong</td>
<td>Kenchington Goldsmith, Harry-Dean</td>
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<td>Madden, Steve</td>
<td>Ma, Pan</td>
<td>Vu, Khu</td>
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## ANU Nonlinear Physics Centre

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<tr>
<td>Kivshar, Yuri</td>
<td>Liu, Mingkai</td>
<td>Comacho Morales, Maria del Rocio</td>
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<td>Neshev, Dragomir</td>
<td>Powell, David</td>
<td>Chen, Haitao</td>
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<td>Rahmani, Mohsen</td>
<td>Rahmani, Alexander</td>
<td>Chung, Hung-Pin</td>
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<td>Admin &amp; Support</td>
<td>Sukhorukov, Andrey</td>
<td>Cole, Michael</td>
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<td>Hicks, Kathy</td>
<td>Xu, Lei</td>
<td>Marino, Giuseppe</td>
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<td>Melik-Gaykazyan, Elizaveta</td>
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<td>Suchkov, Sergey</td>
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<td>Tanovska, Maya</td>
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<td>Titchener, James</td>
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## Macquarie University

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<th>Research Staff and Affiliates</th>
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<tr>
<td>Dawes, Judith</td>
<td>Arriola, Alexander</td>
<td>Antipov, Sergey</td>
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<td>Steel, Michael</td>
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<td>Ross-Adams, Andrew</td>
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<td>Schmidt, Mikolaj</td>
<td>Whitford, Michelle</td>
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## Monash University

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<tr>
<td>Lowery, Arthur</td>
<td>Corcoran, Bill</td>
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<td>Kong, Deming</td>
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<td>Zhuang, Leimeng</td>
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<td>Lillieholm, Mads</td>
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## RMIT - Mitchell Group

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<th>Students</th>
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<tr>
<td>Mitchell, Arnan</td>
<td>Boes, Andreas</td>
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<td>Yudistira, Didit</td>
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## RMIT - Gu Group

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<td>Gu, Min</td>
<td>Cumming, Ben</td>
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<tr>
<td>de Sterke, Martijn</td>
<td>Bell, Bryn</td>
<td>Aryanfar, Iman</td>
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<td>Eggleton, Benjamin</td>
<td>Blanco-Redondo, Andrea</td>
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<td>Kuhlmeey, Boris</td>
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<td>Bacchiella, Christina</td>
<td>Giacoumidis, Elias</td>
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<td>Brinkel, Vera</td>
<td>Li, Guangyuan (Clark)</td>
<td>Marini, Loris</td>
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<td>Kingston, Simone</td>
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<td>Martin, Shelley</td>
<td>Marpaung, David</td>
<td>Merklein, Moritz</td>
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<td>Walsh, Chris</td>
<td>Palomba, Stefano</td>
<td>Morrison, Blair</td>
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<td>Weiss, Silke</td>
<td>Pelusi, Mark</td>
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<td>Smith, Mike</td>
<td>Zarfie, Aliyeh</td>
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<td>Stefani, Alessio</td>
<td>Zhang, Xiang (Bruce)</td>
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<td>Stiller, Birgit</td>
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<tr>
<td>Poulton, Christopher</td>
<td>Aharonovich, Igor</td>
<td>Mimaziry, Sayyed</td>
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<td>Dossou, Kokou</td>
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<td>Lapine, Mikhail</td>
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<td>Wolff, Christian</td>
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### Alumni

<table>
<thead>
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<th>Name</th>
<th>Affiliation</th>
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<tr>
<td>Decker, Manuel</td>
<td>Zeiss Jena, Germany</td>
</tr>
<tr>
<td>Diaz, Fernando</td>
<td>Baraja Pty Ltd, Australia</td>
</tr>
<tr>
<td>Hu, Tomonori</td>
<td>NSSN, Australia</td>
</tr>
<tr>
<td>Moss, David</td>
<td>Swinburne University of Technology, Australia</td>
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<tr>
<td>Tuniz, Alessandro</td>
<td>Leibniz Institute of Photonic Technology, Jena, Germany</td>
</tr>
<tr>
<td>Xiong, Chunle</td>
<td>Australian National University, Australia</td>
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### Partner Investigators & Representatives from Partner Organisations

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>Bogaerts, Wim</td>
<td>Ghent University - IMEC, Belgium</td>
</tr>
<tr>
<td>Booth, Martin</td>
<td>University of Oxford, UK</td>
</tr>
<tr>
<td>Frisken, Steve</td>
<td>Finisar Australia &amp; Cylite</td>
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<tr>
<td>Hess, Ortwin</td>
<td>Imperial College London, UK</td>
</tr>
<tr>
<td>Krauss, Thomas</td>
<td>University of York, UK</td>
</tr>
<tr>
<td>Kuipers, L (Kobus)</td>
<td>Technical University Delft, Netherlands</td>
</tr>
<tr>
<td>Marshall, Graham</td>
<td>University of Bristol, UK</td>
</tr>
<tr>
<td>Namiki, Shu</td>
<td>National Institute of Advanced Industrial Science and Technology (AIST), Japan</td>
</tr>
<tr>
<td>Oxenløwe, Leif</td>
<td>DTU Fotonik, Denmark</td>
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<tr>
<td>Sipe, John</td>
<td>University of Toronto, Canada</td>
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### Collaborators

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<th>Name</th>
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<tr>
<td>Enoch, Stefan</td>
<td>CNRS, Aix-Marseille Université, Centrale Marseille - Institut Fresnel, France</td>
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<tr>
<td>Staude, Isabelle</td>
<td>Friedrich Schiller University Jena, Germany</td>
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<td>Stout, Brian</td>
<td>CNRS, Aix-Marseille Université, Centrale Marseille - Institut Fresnel, France</td>
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<td>Vo, Trung</td>
<td>DSTO Group</td>
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### Invited Guests

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<tr>
<td>Brener, Igal</td>
<td>Sandia National Laboratories, USA</td>
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<tr>
<td>Englund, Dirk</td>
<td>Massachusetts Institute of Technology, USA</td>
</tr>
<tr>
<td>Fan, Shanhui</td>
<td>Stanford University, USA</td>
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<tr>
<td>Kurosu, Takayuki</td>
<td>National Institute of Advanced Industrial Science and Technology (AIST), Japan</td>
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<td>Poole, Simon</td>
<td>Finisar Australia</td>
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<tr>
<td>Schuller, Jon</td>
<td>University of California Santa Barbara, USA</td>
</tr>
<tr>
<td>Szameit, Alexander</td>
<td>University of Rostock, Germany</td>
</tr>
<tr>
<td>Woodthorpe, Katherine</td>
<td>Chair &amp; Non-Executive Director, Finance Sector</td>
</tr>
</tbody>
</table>
**WIM BOGAERTS** is professor in the Photonics Research Group at Ghent University - imec. His research focuses on large-scale integration of silicon photonics, looking into new design methodologies and new scaling architectures and waveguide topologies. Wim Bogaerts did a PhD in the group of Professor Roel Baets, where he started up the activities in silicon photonics on imec’s 200mm CMOS pilot line, resulting in his PhD in 2004. The work on silicon fabrication technology, and the many collaborations with other research groups for joint fabrication planted the seed for the multi-project-wafer service ePIXfab. As a postdoc, Wim continued his silicon photonics activities at Ghent University and imec. As the technology development gained more traction, he gradually shifted his research focus to the design challenges that come with silicon photonics: circuit complexity, tolerances, parasitics, verification and multiphysics. This led to the IPKISS photonic design tools. In June 2014, Wim co-founded Luceda Photonics, a spin-off company of Ghent University, IMEC and the University of Brussels (VUB). Luceda Photonics now further develops IPKISS and other software solutions for silicon photonics design. In October 2016, Wim left the thriving company and returned to his academic interests, supported by a Consolidator Grant of the European Research Council. His research focus now moves towards the operation of large-scale silicon photonics, where the combination of photonics, electronics and software leads to programmable and self-configuring photonic circuits. Aside his scientific interest, Wim is a strong believer in Lean and Agile methodologies, and actively explores how such methods, proven in the manufacturing and software industry, can benefit academic research. He also keeps a strong interest in telecommunications, information technology and applied sciences. He is a senior member of IEEE Photonics Society, and a member of the Optical Society of America (OSA) and SPIE.

**MARTIN BOOTH** is a Professor of Engineering Science and is based jointly in the Department of Engineering Science and the Centre for Neural Circuits and Behaviour, at the University of Oxford, UK. He is also a Guest Professor at the University of Erlangen-Nürnberg, Germany. His research interests cover methods and applications of dynamic optics to a range of interdisciplinary applications. In particular, his work involves the development of adaptive optics for biomedical microscopy and laser-based nano-fabrication of photonic devices. Professor Booth read for a degree in Engineering Science at Hertford College, Oxford, from 1993-7. Following this he spent three months at the Max Planck Institute for Biophysical Chemistry in Goettingen, Germany, researching methods for multi-photon microscopy. His doctoral work in adaptive optics for confocal microscopy took place in the Department of Engineering Science at the University of Oxford from 1997-2001, during which time he was also a member of Jesus College. In 2001, Professor Booth was elected to a Junior Research Fellowship at Christ Church and in 2003 was appointed a Royal Academy of Engineering/EPSRC Research Fellow. In 2007 he was awarded a five-year EPSRC Advanced Research Fellowship and was concurrently elected to a Hugh Price Fellowship at Jesus College. He became Professor of Engineering Science in 2014.

**IGAL BRENER** received the BSc degree in Electrical Engineering, the BA degree in Physics, and the DSc degree in Physics from the Technion - Israel Institute of Technology, Haifa, Israel, in 1983, 1983 and 1991, respectively. From 1983 to 1986 he worked for National Semiconductors in microprocessor VLSI design. He was with Bell Laboratories from 1991 until 2000, with Tellium Inc from 2000 until 2002, and with Praelux/Amersham Biosciences/GE Healthcare from 2003 until 2004. He joined Sandia National Laboratories, Albuquerque, NM, in 2004 where he is active in nanophotonics, THz science, optoelectronics and metamaterials. He currently holds a dual appointment as thrust leader for nanophotonics at the DOE Center for Integrated Nanotechnologies. He has authored more than 150 publications and proceedings, and has received 13 patents. Dr Brener is a fellow of the Optical Society of America, and has served in several conference committees (OSA, IEEE and SPIE) and government panels.
SHANHUI FAN is an Associate Professor of Electrical Engineering at the Stanford University. He received his PhD in 1997 in theoretical condensed matter physics from the Massachusetts Institute of Technology (MIT), and was a research scientist at the Research Laboratory of Electronics at MIT prior to his appointment at Stanford. His research interests are in computational and theoretical studies of solid state and photonic structures and devices, especially photonic crystals, plasmonics, and meta-materials. He has published over 230 refereed journal articles that were cited near 14,400 times, has given over 180 invited talks, and was granted 39 US patents. Dr Fan is a Fellow of IEEE, APS, OSA and SPIE. He received a National Science Foundation Career Award (2002), a David and Lucile Packard Fellowship in Science and Engineering (2003), the National Academy of Sciences Award for Initiative in Research (2007), and the Adolph Lomb Medal from the Optical Society of America (2007).

STEVE FRISKEN is a serial technology entrepreneur and inventor. Steve has founded several successful start-ups in optical communications and medical imaging and holds over 25 granted US patents. He is most recognised for his invention of the Dynamic Wavelength Processor, which was commercialised by Engana and later acquired by Finisar Corp. These products have helped to shape the evolution of Flexible Grid optical WDM optical transport networks. His latest venture Cylite is developing a Hyper-parallel Optical Coherence Tomography imaging and metrology platform with initial applications in the Ophthalmology.

ORTWIN HESS currently holds the Leverhulme Chair in Metamaterials in the Blackett Laboratory (Department of Physics) at Imperial College London. He obtained the PhD degree from the Technical University of Berlin (Germany) in 1993 and the Habilitation at the University of Stuttgart in 1997. From 2003 to 2010 he was professor at the University of Surrey (Guildford, UK) and visiting professor at Stanford University (1997/98) and at the Ludwig-Maximilians University of Munich (1999/2000). Ortwin’s research interests bridge theoretical condensed matter physics with photonics and are focused on light-matter interaction in nano-photonics, metamaterials and spatio-temporal nano-laser dynamics. He discovered the ‘trapped-rainbow’ principle, had the idea of stopped-light lasing and made defining contributions to the fields of spatio-temporal dynamics of semiconductor lasers, ultraslow light in metamaterials, complex quantum dot photonics and photonic crystals and strong coupling in nanoplasmonics. Ortwin pioneered active nanoplasmonics and optical metamaterials with quantum gain for which he has been awarded the 2016 Royal Society Rumford Medal. This medal is awarded for important discoveries in the field of thermal or optical properties of matter and their applications. Notable recipients include Faraday, Pasteur, Maxwell, Kirchhoff, Lorentz, Lord Rayleigh, Bragg, Paschen and Debye.
THOMAS KRAUSS is a full professor at the University of York, UK, where he leads the Photonics research group and the cleanroom facility in the York Nanocentre. He has published 280 refereed journal articles, with 12000 lifetime citations and an “h” factor of 59, as well as 5 patents. His expertise is in the design and fabrication of photonic crystals and photonic nanostructures where he has made pivotal contributions that turned photonic crystals from an academic curiosity into the ubiquitous concept in Photonics that they are today. Prof Krauss is a Fellow of the Institute of Physics, the Royal Society of Edinburgh and the Optical Society. In 2015, he was awarded a Royal Society Wolfson Merit Award. At York, he was recently appointed Strategy Champion “Technologies for the Future” with the remit to enhance technology research university-wide.

KOBUS KUIPERS has a broad interest in light at the nanoscale. In recent years he has mainly focused on ultrafast nanophotonics and the vectorial nature of nanoscale light fields, incl. their magnetic field. The local topology of structured light at the nanoscale, incl. its optical singularities and their potential application to novel quantum technology, is a key current interest. Since November 2016 Kobus is a professor at Delft University of Technology and the head of the Quantum Nanoscience department of the Delft Kavli Institute of Nanoscience and the Faculty of Applied Sciences. Between 2006-2016 he was a scientific group leader and head of the Center for Nanophotonics at the FOM institute AMOLF. He currently also holds part-time professor appointments at the Universities of Twente and Utrecht.

SHU NAMIKI is the Director of Data Photonics Project Unit of the National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan. He is also serving as Chair of the Executive Committee of a national project called “Vertically Integrated Center for Technologies of Optical Routing toward Ideal Energy Savings (VICTORIES)” in collaboration with ten telecom-related companies, and Chair of Photonics Engineering Innovation Consortium (PHOENICS) aiming at establishing an eco-system for photonics. He was previously a Principal Research Scientist at Furukawa Electric Co. Ltd., where he developed award-winning high-power pump lasers, and patented multi-wavelength-pumped fiber Raman amplifiers. From 1994 to 1997, he was a Visiting Scientist at the Massachusetts Institute of Technology, Cambridge, where he studied mode-locked fiber lasers and ultra-short pulses in fiber. His current research interests include software defined dynamic optical path networking and their enabling devices such as nonlinear fiber-optics and silicon photonics. He has co-authored more than 450 conference presentations, papers, book chapters, articles, and patents. Dr. Namiki is a Fellow of OSA and IEEE Photonics Society and Communications Society, and a member of IEICE, JSAP.

LEIF KATSUO OXENLøWE is the group leader of the High-Speed Optical Communications group at DTU Fotonik, Department of Photonics Engineering, at the Technical University of Denmark (DTU), and the Centre Leader of the Research Centre of Excellence SPOC [Silicon Photonics for Optical Communications] supported by the Danish National Research Foundation. He is the recipient of a Top-Researcher grant from the Danish Research Council (DFF) for the project NANO-SPECs. He is also the recipient of a European Research Council grant (project SOCRATES) focusing on the use of ultra-high-speed serial data for Ethernet networks, and he is involved in several other national and international projects exploring nonlinear optics in fibres and devices for optical signal processing. He has authored or co-authored more than 280 peer reviewed publications, including 15 postdeadline papers at major conferences, 5 book chapters and he holds 7 patents. In 2009 he was awarded the Elektropris from Elektrofondet, and he has received 4 best paper awards. He received the BSc degree in physics and astronomy from the Niels Bohr Institute, University of Copenhagen, Denmark in 1996. In 1998 he received the International Diploma of Imperial College, London, UK and the MSc degree from the University of Copenhagen. He received the PhD degree in 2002 from DTU and is since 2009 Professor of Photonic Communication Technologies.
**Invited Speakers**

**Alexander Szameit** was born in 1979, studied physics, math, and astronomy in Halle/Saale and Jena, Germany. In 2002, Alex Szameit visited the University of Hawaii as a guest astronomer, and in 2007, he worked as a guest scientist at the Australian National University. He received his Diploma and PhD in 2004 and 2007, respectively, from the University of Jena. From 2009-2011, he worked as a postdoctoral fellow at the Technion, Israel. From 2011-2016, he was assistant professor at the Friedrich-Schiller-University Jena, Germany. In December 2016, he was appointed Full Professor at the University of Rostock and holds the chair for Experimental Solid-State Optics. His work was awarded several times, in particular with the dissertation prize of the German Physical Society (2010), the Science Award of the German Society of Laser Technology (2012), the Adolph Lomb Medal of the Optical Society of America (2014), and the Rudolph Kaiser Award for experimental physics (2016).

**John Sipe** currently holds the position of Professor, Department of Physics at the University of Toronto and is a Partner Investigator in CUDOS. His expertise is in the areas of theoretical physics of quantum and nonlinear optics, optical and spin properties of semiconductors, and the optical properties of artificially structured materials. His current research focuses on coherent control and transport of carriers, spins, currents, and spin currents in bulk and nanostructure semiconductors; optical properties of ring resonators and other artificially structured materials, and their use in quantum and nonlinear optics; application of structures with optical resonances to problems in biosensing; foundational problems in quantum mechanics.

**Isabelle Staudte** leads an Emmy Noether group at the Institute of Applied Physics and the Abbe Center of Photonics at the Friedrich Schiller University Jena. Her group is dedicated to experimental research on functional photonic nanostructures. Before moving to Jena in July 2015, she coordinated the experimental activities on optical nanoantennas at the Nonlinear Physics Centre, Australian National University, where she also served the nano-plasmonics stream in the Australian Centre of Excellence CUDOS as deputy project leader. She received her doctoral degree in Physics from the Karlsruhe Institute of Technology, Germany.

**Jon Schuller** is currently Assistant Professor in the Electrical and Computer Engineering Department at the University of California, Santa Barbara. He graduated from the Physics department at UC Santa Barbara in 2003. Afterwards, he joined the Applied Physics department at Stanford University where he received his PhD working with Professor Mark Brongersma. There, his research interests comprised nanophotonics, plasmonics, metamaterials, and IR spectroscopy. After graduating in 2009, he took a position as a Fellow of the Energy Frontier Research Center, where he applied nanophotonics concepts and techniques towards the fundamental study of solar cell materials and optics. In 2012, he joined the ECE department as Assistant Professor.

**Katherine Woodthorpe** is an experienced non-exec Director, serving on boards ranging from ASX listed companies to research institutions and government entities for over 17 years. She currently serves on six boards as well as an adviser to others and as a Council member of the AICD. She was the Chief Executive of AVCAL, the Australian Private Equity and Venture Capital Association for seven years. Prior to AVCAL, she held a broad range of management and board positions, in Australia and overseas. Katherine has a long experience, expertise and track record in public affairs including media and government relations. She has deep knowledge of the private equity industry and the superannuation industry in the financial sector and a strong track record in a broad range of technology orientated industries including mining and healthcare. She has been cited in various media as one of Australia’s most influential people in innovation and has a track record for commercialisation. Katherine is a member of the CUDOS Advisory Board.
SESSION SCHEDULE

Benjamin Eggleton
Director, CUDOS

Director’s Opening Address

Katherine Woodthorpe
Chair & Non-Executive Director, Finance Sector

Keynote Address:
Where to from here - the exciting road ahead!
HOT TOPICS
Monday, 20 February & Tuesday, 21 February

HOT TOPICS I - MONDAY, 20 FEBRUARY

Shanhui Fan
Professor of Electrical Engineering,
Director, Edward L. Ginzton
Laboratory,
Stanford University, USA

Computational nanophotonics

HOT TOPICS II - TUESDAY, 21 FEBRUARY

Dirk Englund
Assistant Professor of Electrical
Engineering, Electrical Engineering
and Computer Science (EECS),
Massachusetts Institute of Technology,
USA

Semiconductor Quantum Technologies for High-Speed
and Long-Range Quantum Communications

The Internet is among the most important inventions
of the 20th Century. We are now poised for the
development of a quantum internet to exchange
quantum information and distribute entanglement
among quantum memories (and ultimately quantum
computers) that could be great distances apart.
This kind of quantum internet would have a range
of applications that aren’t possible in a classical
world, including long-distance unconditionally-secure
communication, certain types of precision sensing
and navigation, and distributed quantum information
processing. But we still need to develop or perfect many
new types of components and protocols to be able
to build such a quantum internet. This talk will consider
some of these components, focusing on photonic
integrated circuits, diamond spin-based quantum
memories, and prototype networks. Specifically, the
first part of this talk will review our recent progress
in adapting one of the leading PIC architectures—
silicon photonics—for different types of quantum
secure communications protocols. The second part
of the talk will consider how photonic integrated
circuits technology can extend the reach of quantum
communications through all-optical and memory-based
quantum repeaters.
Novel Concepts in Nanostructured Photonic Biosensors

Photonic Crystals are the culmination of many fascinating developments in Physics, such as Bragg mirrors, Bloch modes, and bandstructures. Their ability to control the flow of light has given rise to many applications, ranging from light emission to optical switching and light trapping in photovoltaics. Here, we discuss their use in a novel sensing imaging architecture, whereby the localised guided mode resonances of the photonic crystal can be considered the pixel of an image. This combination allows us to image biofilms and study their response to antibiotics in the important area of antimicrobial resistance (AMR). The resonance also provides a very simple readout mechanism for sensing applications, where we have now demonstrated sensitivities approaching those achievable with surface plasmon resonance with a device that, in principle, can be made for £10. Furthermore, we note that silicon photonic biosensors do not tend to exploit silicon’s obvious ability to conduct electricity, and we demonstrate the first hybrid silicon photonic-electrochemical biosensor.
Simon Fleming  
Professor, School of Physics, The University of Sydney & Chair, CUDOS Commercialisation Committee

Review of Commercialisation activities and preview of Commercialisation Prize

Steve Friskin  
CTO Finisar, Executive Director Light Innovation, CEO Cylite

Ventures in technology - Had I known back then what I now know....
ON-CHIP NANOPLASMONICS
Monday, 20 February

SESSION SCHEDULE

PROJECT LEADER

Ben Cumming
Postdoctoral Research Fellow, RMIT

2016 Project Review

PARTNER INVESTIGATORS AND INVITED GUESTS

Martin Booth
Professor of Engineering Science, Department of Engineering Science and the Centre for Neural Circuits and Behaviour, at the University of Oxford, UK

Research Directions & Collaborations

Kobus Kuipers
Professor, FOM Institute for Atomic and Molecular Physics(AMOLF)

Dynamic optics for laser nano-fabrication of electronic and photonic devices in diamond

Direction in a liquid of zero’s
In a chaotic cavity light bounces around at random leading to intriguing interference patterns. Hidden within these patterns are singular points where the amplitude is zero: phase singularities. We experimentally investigate how these singularities are distributed in space. The distribution is reminiscent of that of ions in an ionic liquid as was predicted by Mark Dennis and Michael Berry for scalar waves. On closer look, we find deviations from the theory. These are caused by the vectorial nature of the light. An adapted analytical model excellently describes the experimental observations.

SCIENCE LEADER

Min Gu
Associate Deputy Vice-Chancellor for Research Innovation & Entrepreneurship, Distinguished Professor, RMIT

Project Strategy 2017 and Beyond
The ability to engineer the optical phase at subwavelength dimensions has led to metasurfaces that provide unprecedented control of electromagnetic waves. To reach their ultimate potential, metasurfaces must incorporate reconfigurable functions. The central challenge is achieving large tunability in subwavelength elements. Here, we describe two different approaches for achieving order-unity refractive index shifts: free-carrier refraction and thermo-optic tuning. We experimentally demonstrate wide tuning of single-particle infrared Mie resonances through doping, and demonstrate simulations of electrically reconfigurable III-V heterojunction metasurfaces based on these effects. We conclude with recent experimental demonstrations of dynamic, ultrawide tuning of Mie resonators based on two distinct thermo-optic effects: 1) modifying the electron mass and carrier density in InSb and 2) exploiting the anomalous temperature-dependent bandgap of PbTe.

Nanoparticles consisting of dielectric or semiconductor nanoparticles with a high refractive index support electric and magnetic multipolar Mie-type resonances, which can be tailored by the nanoparticle geometry. Thereby they offer vast engineering options for their near-field and far-field responses, while exhibiting very low absorption losses. Here we report on our recent advances in enhancing and tailoring spontaneous emission in the visible and near-infrared spectral range by arrays of designed Mie-resonant semiconductor nanoparticles. For precise fabrication of the nanoantennas, we rely on electron-beam lithography on high-refractive-index semiconductor thin-films in combination with reactive-ion etching. We investigate various types of emitters, including semiconductor quantum dots, monolayers of transition metal dichalcogenides, as well as the intrinsic photoluminescence and nonlinear response of the constituent semiconductor materials themselves. In order to characterize the emission properties of the hybrid systems, we perform microphotoluminescence imaging, spectroscopy, Fourier imaging, and/or polarimetry for a variety of different nanoantenna architectures. Our results show that tailored Mie-resonances provide a powerful platform for manipulating the spectral, directional, and polarization properties of the emitted light.
SESSION SCHEDULE

PROJECT LEADER

Khu Vu
Postdoctoral Fellow, Laser Physics Centre, ANU

2016 Project Review

PARTNER INVESTIGATORS AND INVITED GUESTS

Wim Bogaerts
Professor in Silicon Photonics at Ghent University-IMEC, Founder of Luceda Photonics, Ghent University

Research Directions & Collaborations

The emerging silicon photonics ecosystem
Silicon Photonics is rapidly going through the transition from a sexy R&D technology to a commercially viable platform that will save the datacenters of the future. Silicon photonics draws (part of) its attractiveness from the fact that it relies heavily on established CMOS manufacturing infrastructure. Now that it’s being taken up by industry, including larger established actors, this reliance on expensive industrial infrastructure is changing the landscape for researchers and startups. On one hand, the momentum behind the technology will translate into a significant increase in resources, but the commercial pressure will at the same time focus those resources on shorter-term objectives. Research activities that do not fit in this picture, but still rely on the same silicon photonics technologies, might not be in such a luxurious position, as they would have to compete for access to the multi-project-wafer fabrication facilities. It is no coincidence that today we see the emergence of smaller-scale silicon photonics prototyping services. Rapid-patterning techniques such as e-beam lithography are now capable of producing silicon photonic chips in (very) small volumes, with good reproducibility and a rapid turn-around-time. Such services will attract a lot of research activities for which the full CMOS-platform is too slow or too costly, or simply not needed. It is however essential that prototyping services maintain a level of compatibility with the larger-scale industrial platforms: any start-up or researcher with the ambition to build a future product will need a migration process that will enable the scaling in volume and maturity. Therefore, prototyping services will have to follow a similar flow as larger-scale foundries, using a PDK-based design flow (on the same or compatible software tools) and supporting the same emerging packaging processes and providers.

Igal Brener
Distinguished Member of Technical Staff at Sandia National Labs, Center for Integrated Nanotechnologies, USA

Ultrafast and Nonlinear Metasurfaces

SCIENCE LEADER

Arnan Mitchell
Professor, School of Electrical and Computer Engineering, RMIT

Project Strategy 2017 and Beyond
SESSION SCHEDULE

PROJECT LEADER

Luke Helt
Postdoctoral Research Fellow, Macquarie University

2016 Project Review

PARTNER INVESTIGATOR AND INVITED GUESTS

John Sipe
Professor, University of Toronto

Research Directions & Collaborations

Alexander Szameit
Chair, Experimental Solid-State Optics, University of Rostock, Germany

Super-stuff with micro rings

Non-hermitian topological photonics

SCIENCE LEADER

Mike Steel
Professor, Macquarie University

Project Strategy 2017 and Beyond
## SESSION SCHEDULE

### PROJECT LEADER

**Bill Corcoran**  
Postdoctoral Fellow, Faculty of Engineering, Monash University  

**2016 Project Review**

### PARTNER INVESTIGATOR AND INVITED GUESTS

**Shu Namiki**  
Team Leader of Optical Signal Processing Systems at the Network Photonics Research Center, National Institute of Advanced Industrial Science and Technology (Japan)  

**System scaling, softwarization, and photonics**

**Leif Oxenløwe**  
Professor and Group Leader DTU Fotonik, Department of Photonics Engineering and Centre Leader of the Research Centre of Excellence SPOC (Silicon Photonics for Optical Communications)  

**Horizon 2020 Prize Competition on Breaking the Optical Transmission Barrier - Background and technologies in winning bid**

### SCIENCE LEADER

**Arthur Lowery**  
Professor and Head, Department of Electrical and Computer Systems Engineering, Monash University  

**Project Strategy 2017 and Beyond**
### SCIENCE LEADER

**Steve Madden**  
Associate Professor, Laser Physics Centre, Research School of Physics & Engineering, Australian National University  

| 2016 Project Review  
| 2017 Project Strategy and Beyond |
PANEL BUZZ
Wednesday, 22 February

PANEL BUZZ

This year we are aiming for a provocative if not lively discussion on topics or issues that may arise during the Workshop. A selected number of Partner Investigators and Guests will share differing perspectives, offer opinions and respond to audience questions that have been either crowd sourced through an audience interaction platform or taken from the floor.

Moderator:
Chris Walsh
CUDOS CHALLENGE

The CUDOS challenge is awarded annually to an individual student or early career researcher who demonstrates ingenuity and creativity within the framework of CUDOS research themes.

In the 2017 challenge, staff and students were asked to consider the question “What is the CUDOS Legacy?” and compile a portfolio of images representing what they believe to be the most important aspect of our Centre. Winners will be announced at the Workshop Dinner on 21 February.

CUDOS OUTREACH & COMMUNITY ENGAGEMENT

In this final year of CUDOS, the Outreach & Community Engagement Award is given to a CUDOS member(s) who has demonstrated a record of achievement or commitment to outreach activities in 2015 and 2016. Recipients will be announced at the Workshop dinner on 21 February.

2016 ANNUAL COMMERCIALISATION PRIZE

In recognition of the importance of innovation and commercialisation in meeting the goals for commercial and economic outcomes from the Centre’s research, CUDOS established the Annual CUDOS Innovation Prize in 2012. In the early stages it was critical to focus on innovation. With the exciting progress of CUDOS innovations from ideas to commercial opportunities we refocused the prize on commercialisation in 2014 and 2015. As the start-ups are gaining momentum, for 2016, we will focus on giving them support.

The 2016 Annual Commercialisation Prize will be awarded to the CUDOS start-up that makes the most compelling case for how these funds would assist their business costs and have impact on their business opportunities. Applications for this prize were by invitation only and offered to the following companies/entities.

- Mid-IR spectrometer (Miriad)
- Multimode spatial multiplexer (Modular Photonics)
- Mid-IR OPA (Hotlight Systems)
- Novel Resonators
- Australian Silicon Photonics
- Tunable microwave filter (Luxava)
- RMIT License to Luceda
- Emustack
- Reconfigurable Power Supply

The Winners will be announced at the Workshop dinner on 21 February
SCHEDULE

The dinner will feature brief presentations and the announcement of the winners of the various CUDOS presentations.

Benjamin Eggleton

Student Judging Panel

Alex Fuerbach
Associate Professor, Faculty of Science, Macquarie University & Director, CUDOS Education & Outreach

Presentation of Winners, Student Poster Competition

Student judging Panel Presentation of Winners, Staff Poster Competition

Alex Fuerbach

Review of the events & training programs sponsored by the Education & Training portfolio in 2016 and planned activities for 2017

Presentation of Winner(s), CUDOS Challenge

Judith Dawes
Professor, Faculty of Science, Macquarie University & Coordinator, CUDOS Outreach

Review of 2016 outreach activities across the Centre and initiatives planned for 2017

Presentation of Winner(s), CUDOS Outreach and Community Engagement Award, 2015-2016

Simon Fleming
Professor, School of Physics, The University of Sydney & Chair, CUDOS Commercialisation Committee

Presentation of Commercialisation Prize