



MQ Photonics Newsletter is an informal internal publication of the *MQ Photonics Research Centre* <<http://web.science.mq.edu.au/groups/mqphotonics/>>. We aim to distribute it by e-mail every 3 weeks. Please send copy to <Elizabeth.Bignucolo@mq.edu.au> by 9 a.m. on the due date. **Next due date: to be advised**


Focal Points

Macquarie University is likely to undergo significant change in the next few years as the new Framing Futures vision is rolled out. Consequently, in order to ensure we are both aligned with the directions of the University and positioned to capitalise on new funding opportunities, it is a good time for MQ Photonics to evaluate its current Research Focus Areas, which were established in 2007, and consider whether new research directions should be adopted (eg. medical photonics, THz photonics etc). Operational aspects of the Centre such as governance, professional training etc will also be discussed. To do so we will be holding a Strategic Workshop at an off-campus venue. Unfortunately to keep the discussions manageable we need to restrict attendance to Senior Research members and those members holding independent Research Fellowships. However, all Centre members are encouraged to express an opinion on aspects of Centre life that could be changed, modified or kept as is. You can email any recommendations to Liz and I. Alternatively, students can direct input via their supervisors if they prefer to remain anonymous.

The Workshop is planned for early October. I plan to advise all members of the outcome at one of our “State of the Union” addresses before the end of the year.

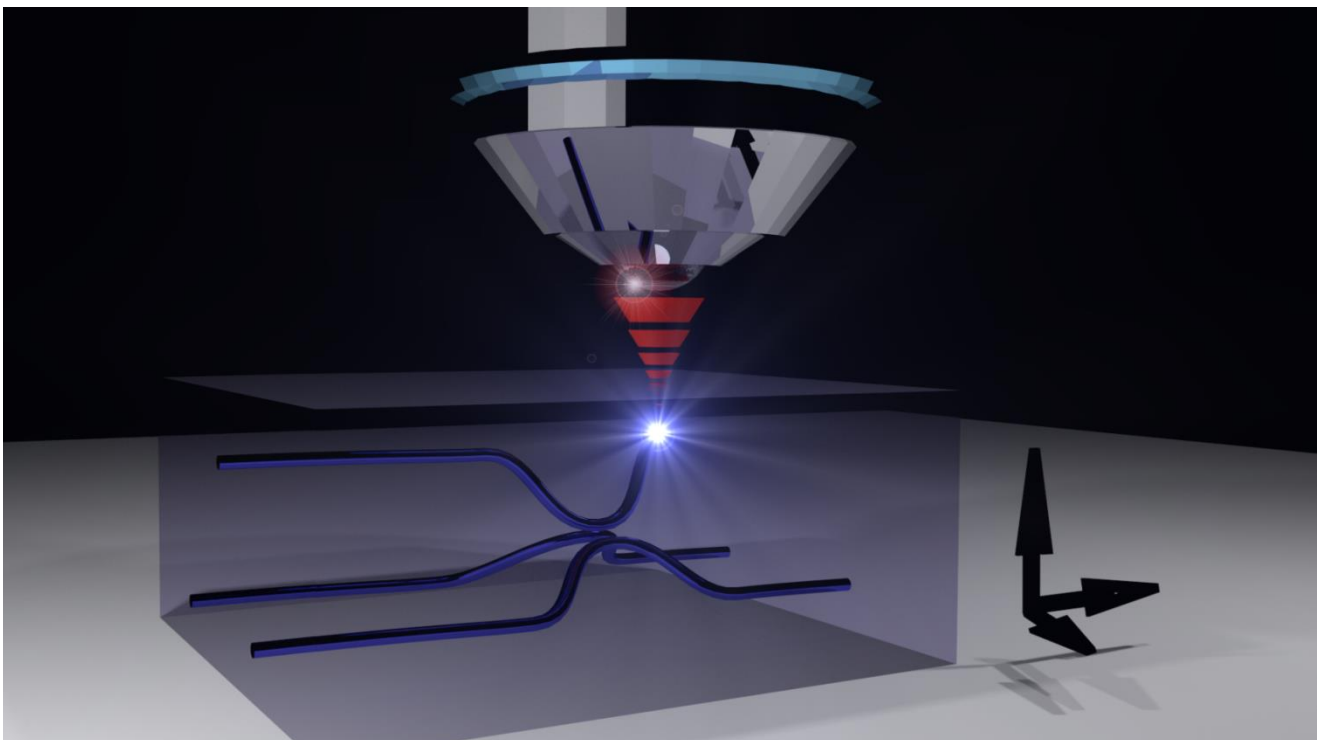
Mick Withford

Follow Us on Twitter

Follow MQPhotonics on twitter to expand your network and receive updates on our latest research, late-breaking news, events and other photonics info. The simplest way to get involved is to select to Follow Us by clicking on the  button on our webpage at <http://web.science.mq.edu.au/mqphotonics/>.

Rich Mildren

MQ Photonics - Image of the month (August)



This image taken from the recent feature article in the July issue of laser focus world shows the laser inscription of 3D quantum circuits. This method has been exploited in many recent quantum information science advances and this introductory article highlights the achievements in the area.

Please read the article at: <http://www.laserfocusworld.com/articles/print/volume-50/issue-07/features/optical-manufacturing-femtosecond-laser-direct-written-waveguides-produce-quantum-circuits-in-glass.html>

Contributor: Thomas Meany

Conferences

2014 OSA Optics & Photonics Congress

Call for Papers

The OSA Light, Energy and the Environment Optics Congress

2–5 December 2014 | Canberra, Australia
Energy Change Institute, Australian National University

www.osa.org/EnergyOPC

IMPORTANT DATES:

Abstract and Summary Submission Deadline:
3 September 2014
12:00 EDT (16:00 GMT)

Advance Registration Deadline:
4 November 2014

If you have questions, please email cstech@osa.org or call +1 202.416.1907 (outside the US) or +1 800.766.4672 (US/Canada)



Host Organization:



ENERGY CHANGE INSTITUTE

This comprehensive Congress examines frontiers in the development of optical technologies for energy production, transmission and use. It also examines the use of optical and photonic approaches to monitor both energy usage and the effect of energy production on the environment. It is designed to bring together researchers, engineers and managers to foster timely information exchange between the disciplines involved in these fields.



PLENARY SPEAKER:
Steven Chu, *Stanford University, USA*

KEYNOTE SPEAKERS:
James G. Anderson, *Harvard University, USA (E2)*
Martin Green, *Australian Centre for Advanced Photovoltaics, University of New South Wales, Australia (PV)*
Toshihiko Iwasaki, *Konica Minolta, Japan (SOLED)*
Roland Winston, *University of California Merced, USA (SOLAR)*

OPTICS AND PHOTONICS FOR ENERGY AND THE ENVIRONMENT (E2)
E2 focuses on monitoring and controlling the generation of energy and its impact on the environment. The conference will showcase optical techniques and instrumentation used in monitoring, sensing and transmitting information relating to energy and the environment. It will bring together people from industry, university and government to address environmental impacts of energy production and policies to guide its management. Special emphasis will be on sensor devices for energy, environment and pollution monitoring, energy usage and transmission (including smart grid technology) and energy efficiency in industry.

OPTICAL NANOSTRUCTURES AND ADVANCED MATERIALS FOR PHOTOVOLTAICS (PV)
PV brings together experts in nanophotonics, materials science and photovoltaics to discuss the latest developments in nanophotonic enhancement and nanostructured materials for the next generation of solar cells. Nanostructured materials and photonic enhancement schemes offer unprecedented opportunities to control both the optical and electrical properties of next-generation solar cells. This meeting covers all aspects of optical nanostructures for photovoltaic applications, from surface textures and diffraction gratings through to emerging topics such as plasmonic enhancement, nanowires, quantum dots, novel materials and spectral flux management in multi-junction solar cells.

OPTICS FOR SOLAR ENERGY (SOLAR)
SOLAR focuses on optics for solar energy applications including design, modeling, integration of novel materials, manufacture, field-testing and deployment, and economics. All forms of solar energy generation, transmission and storage – from thermal to photovoltaic to novel methods – will be covered. The program will highlight presentations spanning technology, public policy and finance.


SOLID STATE AND ORGANIC LIGHTING (SOLED)
SOLED focuses on new materials (both organic and inorganic) and new devices for lighting, their manufacture and lighting policy. The conference will showcase the latest inorganic and organic materials developed for solid-state lighting, novel lighting structures, theory and modelling, and manufacturing and lighting issues. It aims to bring together people from along the research, development and manufacturing pipeline with presentations from industry and academia.

Of the four collocated Conferences within the 2014 OSA LEE Congress, many of us in *MQ Photonics* are likely to find that on “Optics and Photonics for Energy and the Environment (E2)” particularly relevant.

You can find out more about the 2014 OSA LEE Congress in general at www.osa.org/EnergyOPC and about 2014 OSA E2 Conference at www.osa.org/EnergyOPC. **– ABSTRACTS DUE 3 SEPTEMBER**

Note that these events will be in Canberra during the week immediately preceding the 2014 AIP Congress.

Brian Orr, Co-Chair, 2014 OSA E2 Conference



2014 OSA Optics & Photonics Congress:
Light, Energy and the Environment

Optics and Photonics for Energy & the Environment (E2)

2–5 December 2014 | Canberra, Australia
Energy Change Institute, Australian National University
www.osa.org/E2

IMPORTANT DATES:

Abstract and Summary Submission Deadline:
3 September 2014
12:00 EDT (16:00 GMT)

Advance Registration Deadline:
4 November 2014

If you have questions, please email

Submit a paper to the OSA Optics and Photonics for Energy & the Environment (E2) Meeting.

E2 focuses on monitoring and controlling the generation of energy and its impact on the environment. The conference will showcase optical techniques and instrumentation used in monitoring, sensing, and transmitting information relating to energy and the environment. It will bring together people from industry, university, and government to address environmental impacts of energy production and policies to guide its management. Special emphasis will be on sensor devices for energy, environment, and pollution monitoring, energy usage and transmission (including smart grid technology), and energy efficiency in industry.

TOPIC CATEGORIES

- ▶ Optics and photonics in environment and pollution monitoring
- ▶ Optics and photonics in monitoring services related to other industries
- ▶ Optics and photonics in research on high-energy materials and processes

2014 E2 MEETING CHAIRS

Brian Orr, *Macquarie University, Australia*
Liu Wenqing, *Anhui Inst of Optics Fine Mechanics, China*
Gerard Wysocki, *Princeton University, United States*

Visit www.osa.org/E2 for a comprehensive list of topics, invited speakers and complete meeting details.

OSA[®]

E2 is one of four collated meetings at the 2014 OSA Light, Energy and the Environment Congress.



Dear fellow student,

On behalf of the Organizing Committee, I cordially invite you to attend [the IONS-KOALA Conference on Optics, Atoms and Laser Applications](#) that will be held at the **University of Adelaide** in Adelaide, Australia, **November 23-28, 2014**.

KOALA is an annual conference held in Australia or New Zealand that is organised for students, by students, and brings together a large group of Honours, PhD and Masters students performing research related to Optics, Atoms or Laser Applications.

Registration fees are kept as low as possible, in keeping with KOALA's aim of providing an open, relaxed environment for students to present and discuss their research. All students who attend have the opportunity to present a poster or a 20 minute talk.

Registration is open until 30 September.

Registration costs \$170 which will include accommodation, food, and conference activities. Travel grants are available.

This year, final year undergraduate and honours students are invited to apply for the New Horizons in Science Award, which cover both conference registration and travel costs.

Visit the [official KOALA website](#) to for more details and to register. If you have any questions, have a look at the attached flyer and feel free to contact us at info@koala2014.com.

Please circulate this announcement among your friends and fellow students.

We hope to see you in Adelaide during this workshop!

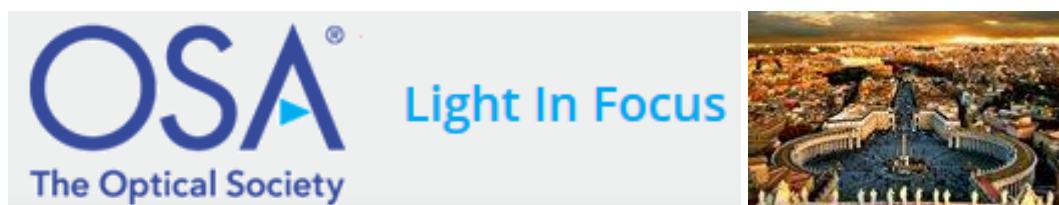
Sebastian Ng,
On behalf of the students of the KOALA Organising Committee.
OSA Student Chapter, The University of Adelaide,

Conference report



The 19th OptoElectronics and Communications Conference (OECC) and the 39th Australian Conference on Optical Fibre Technology (ACOFT) was held in Melbourne 6–10 July 2014. OECC/ACOFT is the foremost international conference in the Asia-Pacific region for engineers and researchers working in the fields of photonics and optical communication systems. MQ Photonics was represented by 9 contributed papers with those members present expressing to me the value they gained from the program content and networking opportunities. I was particularly excited by the number of papers within the spatial division multiplexing domain that clearly identified ultrafast laser inscription, my area of expertise, as a genuine technique to progress telecom applications. MQ Photonics members also strengthened Australia's economy via the neighbouring DFO shopping centre and cocktail lounges.

Martin Ams



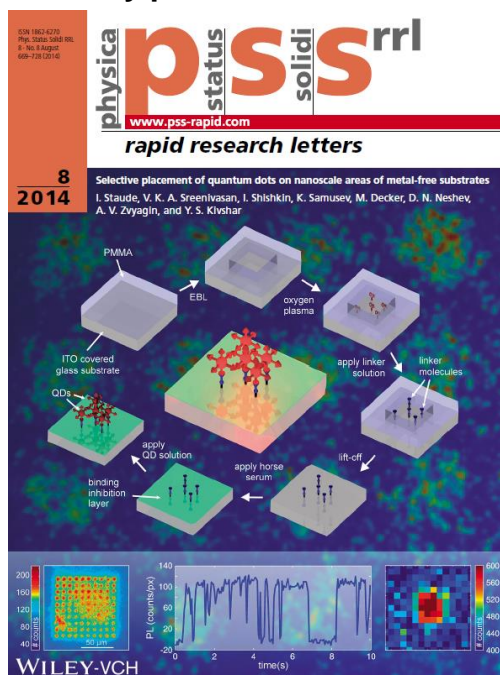
2014 OSA Advanced Photonics Congress, 27 - 31 July in Barcelona Spain

I recently had the honour of delivering an invited talk at the OSA's Advanced Photonics conference in Barcelona. In my paper I showcased our recent demonstrations of 3D integrated photonics in the fields of quantum photonics, astro-photonics and mode selectors for mode division multiplexing. The conference also offered a snapshot into the state-of-the-art in fibre sensing and integrated diamond photonics.

Mick Withford

Publications

Recently published articles



Congratulations to Varun Sreenivasan and Andrei Zvyagin for getting onto the back cover of *Physica Status Solidi RRL* (August 2014).

I Staude, **V K A Sreenivasan**, I Shishkin, K Samusev, M Decker, D N Neshev, **A V Zvyagin**, Y S Kivshar, “Selective placement of quantum dots on nanoscale areas of metal-free substrates”, *Physica Status Solidi (RRL) - Rapid Research Letters* 8 (8), 710–713 (2014)

Abstract: We demonstrate a novel approach for selectively immobilizing semiconductor core-shell quantum dots directly on metal free substrates with nanoscale resolution. This is accomplished by defining a mask via electron-beam lithography (EBL) followed by the functionalization of only the exposed areas of the substrate with quantum dots using a heterobi-functional linker. Non-specific binding is suppressed by a binding inhibitor.

Congratulations to Thomas Meany for getting onto the cover of Laser Focus World (July 2014).



T Meany, “Optical Manufacturing: Femtosecond-laser direct-written waveguides produce quantum circuits in glass”, *Laser Focus World*, 50 (7), 25-28 (2014).

Abstract: Integrated photonics can be written in glass via nonlinear absorption by focusing a short-pulse-duration laser into the glass; quantum-integrated-photonics (QIP) devices are being fabricated using this technique.

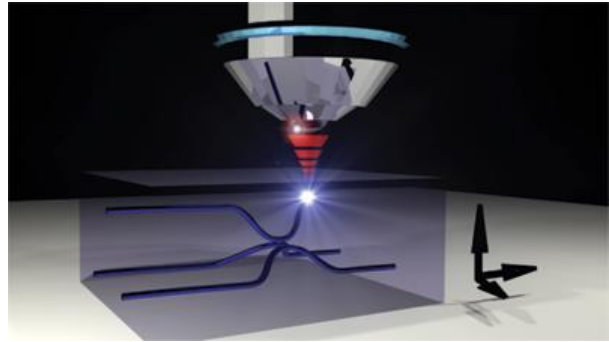


Fig 1. A conceptual image shows the laser-inscription process; nonlinear absorption occurs at the laser focus, resulting in white-light emission and highly localized energy deposition. A laser can effectively draw a waveguide in a bulk-glass material.

R J Williams, O Kitzler, A McKay, R P Mildren, "Investigating diamond Raman lasers at the 100 W level using quasi-continuous-wave pumping", *Optics Letters* 39, 4152-4155 (2014).

Abstract: Quasi-cw pumping is used to investigate the high-power characteristics of cw beam conversion in diamond Raman lasers (DRLs). We show that thermal gradients establish in DRLs at approximately 50 μs for a 100 μm pump beam diameter, and thus that the steady state for cw operation can be reached within the 100–300 μs pulse duration of conventional quasi-cw pump laser technology. Using this approach, a steady-state on-time output power of 108 W was obtained from an external-cavity DRL during 250 μs pulses with 34% conversion efficiency. No thermal lens in the diamond was evident, showing excellent prospects for further power scaling.

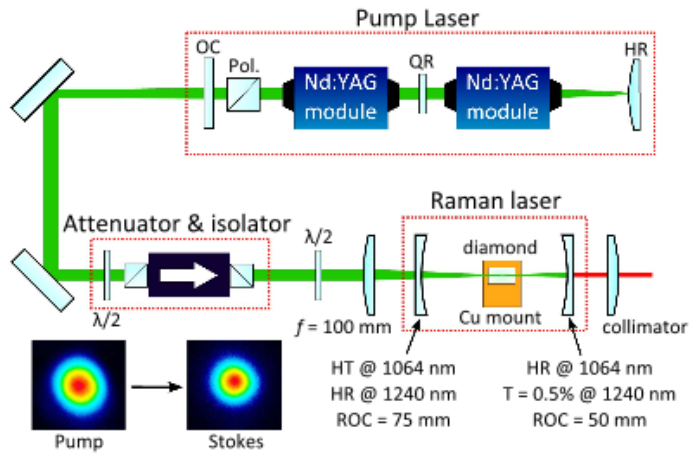


Fig. 2. Illustration of the DRL and the pump laser. Shown in the bottom-left corner are the far-field profiles of the pump (left) and Stokes beams (right). OC, output-coupler; HR, high-reflector; HT, highly transmissive.

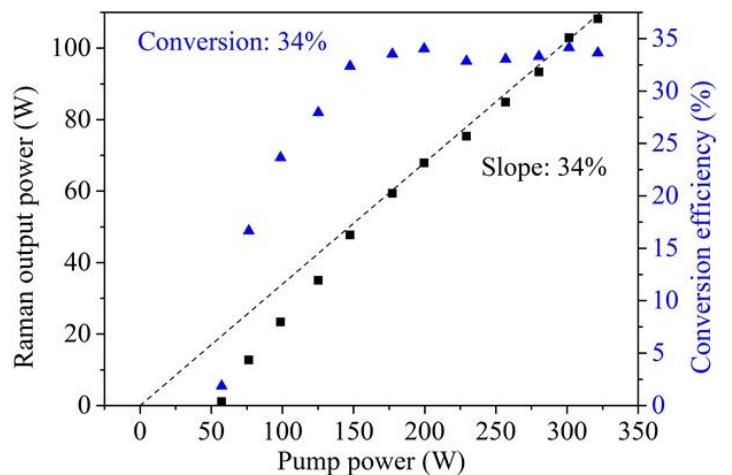


Fig. 3. Output power and conversion efficiency of the diamond Raman laser.

S Gross, N Riesen, J D Love, M J Withford, “Three-dimensional ultra-broadband integrated tapered mode Multiplexers”, *Laser Photonics Reviews*, 1–5 (2014) / DOI 10.1002/lpor.201400078

Abstract: The demonstration of a three-dimensional tapered mode-selective coupler in a photonic chip is reported. This waveguide-based, ultra-broadband mode multiplexer was fabricated using the femtosecond laser direct-write technique in a boro-aluminosilicate glass chip. A three-core coupler has been shown to enable the multiplexing of the LP01, LP11a and LP11b spatial modes of a multimode waveguide, across an extremely wide bandwidth exceeding 400 nm, with low loss, high mode extinction ratios and negligible mode crosstalk. Linear cascades of such devices on a single photonic chip have the potential to become a definitive technology in the realization of broadband mode-division multiplexing for increasing optical fiber capacity.

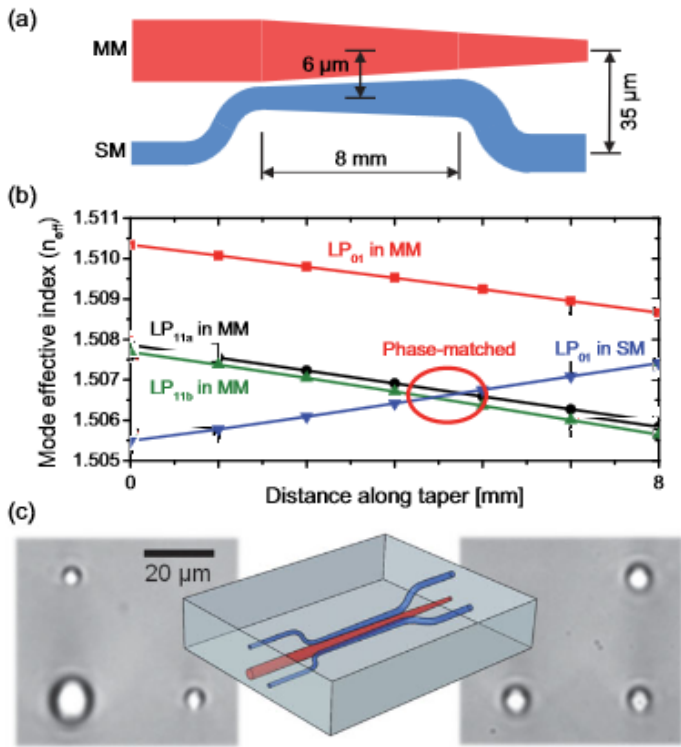


Figure 1 (a) Schematic of a two-core tapered mode-selective coupler comprising a tapered multimode (MM) and a countertapered single-mode waveguide (SM). (b) Evolution of the guided-mode propagation constants along the taper showing the crossover between the LP01 mode of the single-mode waveguide and the LP11 mode of the multimode waveguide. (c) Brightfield microscope images of the end-faces (writing laser incident from the top) and 3D sketch of the fabricated coupler.

Seminars

MQ Photonics Seminars:

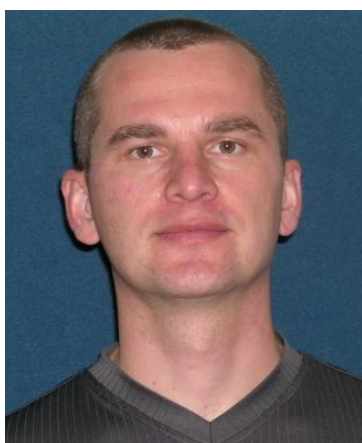
Time: 12 Noon, Fri 5 th Sep	Place: TBA	Presented by: Nick Cvetojevic (University of Sydney)
TOPIC: TBA		
Time: 12 Noon, Fri 12 th Sep	Place: TBA	Presented by: Tobias Feger, Sajad Ghatreh Samani
TOPIC: Searching for extrasolar planets with single-mode spectrographs, TBA		
Time: 12 Noon, Fri 19 th Sep	Conception Day	
TOPIC: TBA		
Time: 12 Noon, Fri 26 th June	Place: TBA	Presented by: Dr Douglas Little
TOPIC: Nanoparticle characterisation using interferometric microscopy		
Time: 12 Noon, Fri 3 rd Oct	Place: TBA	Presented by: Dr Andrew Lee Dr Josh Toomey
TOPIC: TBA		

People and Progress

Chris Artlett gets a big new laboratory!

Helen Pask, Chris Artlett and Caro Derkenne have recently undertaken two field trips on Sydney Harbour to investigate depth-resolved remote sensing of water temperature. We're still analysing the results, but we successfully retrieved signals from at least 6m depth. There are still many things to optimise, but we showed that our retrieved Raman signals are 10 times larger than the ambient light levels. In the photos you will see Chris Artlett, Caro (an undergraduate student looking at fluorescence spectra for various phytoplankton monocultures, an interested pelican (we also saw sea eagles, dolphins and penguins), and some of our apparatus.

Helen Pask



Welcome to **Dr Pawel Sajewicz** joining MQ~Photonics for three months to research nonlinear dynamics of multi-section semiconductor lasers. Pawel has been fabricating lasers at ANU until recently. He was part of the ANU team which includes Dr Lan Fu and Prof Chennupati Jagadish.

Deb Kane

Thank you to our volunteers



Above photo is from **LEAP MQ Mentoring – University Experience Day** on Friday 23 May. A big thank you to the following volunteers: Rajika Kuruwita, Lixin Zhang, Zhizhong Yan, Keith Motes, Alireza Maleki.