MACQUARIE UNIVERSITY | MQ PHOTONICS RESEARCH CENTRE

NEWSLETTER

Issue 21 – 12 August 2009

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 <lizb@physics.mq.edu.au> by 9 a.m. every 3rd Tuesday. **Next due date: Tue 1 September '09.**

Focal Points

Climb every mountain ...

http://en.wikipedia.org/wiki/Ingleborough

I am back from my 8-week (largely holiday) trip to Europe. I guess that the "high point" (literally) was my walk up Ingleborough (elevation: 723 m, 2373 ft) – one of the Three Peaks in the Yorkshire Dales. In fact, I had been much higher up in the Swiss Alps a few weeks before that, but got there by train rather than on two legs. Ingleborough is supposed to look like this ► on a clear day. However, I chose the wrong day! By the time our group got to the summit, it was blanketed in thick fog with a cold wind and persistent rain. The trig point and wind "shelter" actually looked something like this ► and our guide had to use a compass to find our way off the top of the hill.

Of course, my many years of scientific research prepared me well for such an experience! Now that I am back down (almost) at sea level, I am looking forward to undertaking tasks that lie ahead of us in *MQ Photonics*. Finally, many thanks to Mick Withford for holding the fort while I have been away.

... till you find your dream

It may seem a bit trite to be quoting Julie Andrews's *schmaltzy* song (at least we found much better things to do in Salzburg than go on a *Sound of Music* tour!), but I think it may sum up the process in which many of us are currently engaged as we seek to fulfil our assorted research aspirations. Our "dream" may comprise much-sought-after killer results, or acceptance of a paper in a top-ranking journal, or performing well at a prestigious scientific conference, or obtaining a long-awaited research grant, or finishing a thesis, or securing the next job in our career path, or being challenged by fresh ideas, or simply feeling satisfied with one's attainments and seeming (at least for a while!) to have things under control. Whatever your dream, this is a good time of year for us all to be taking stock of forthcoming research opportunities, goals and tasks. In fact, we are dedicating this issue of the *Newsletter* to that theme ...

Brian Orr

Citations – for what they are worth

Thanks to Graham Marshall for drawing our attention to an interesting article in the *British Medical Journal*. It raises some questions about the perils of over-reliance on scientific citations. It is as follows:

> "How citation distortions create unfounded authority: analysis of a citation network" by Steven A Greenberg (Children's Hospital Informatics Program and Department of Neurology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA 02115, USA) *BMJ* 2009;339:b2680

The paper can be accessed via <http://dx.doi.org/10.1136/bmj.b2680>. Its objective is "to understand belief in a specific scientific claim by studying the pattern of citations among papers stating it." By analysing a complete citation network, the author reaches the following cautionary conclusion:

> "Citation is both an impartial scholarly method and a powerful form of social communication. Through distortions in its social use that include bias, amplification, and invention, citation can be used to generate information cascades resulting in unfounded authority of claims. Construction and analysis of a claim-specific citation network may clarify the nature of a published belief system and expose distorted methods of social citation."

However, even if we have justifiable misgivings about the absolute validity of citations of published work, it is hard to avoid being a slave to them in our professional lives. This derives from the increasing emphasis that is placed on citations and journal "prestige" by research-funding authorities such as the ARC and by institutions on which we may rely for promotion or for our next job.

It was useful to receive an e-mail addressed to <physics@science.mq.edu.au> and entitled "Journal Impact Factors 2008" from Martin Ams last month (Fri, 10 Jul 2009 11:47:30 +1000). For what it is worth, here is a cut-down version of the table circulated by Martin, emphasising "optics & photonics" and "physics" journals:

Abbreviated Journal Title	ISSN	Impact Factor	Immediacy Index	Cited Half-Life
REV MOD PHYS	0034-6861	33.985	7.028	>10.0
NAT PHOTONICS	1749-4885	24.982	4.608	1.4
NAT MATER	1476-1122	23.132	5.326	3.6
PHYS REP	0370-1573	18.522	3.959	8.7
NAT PHYS	1745-2473	16.821	4.484	2
REP PROG PHYS	0034-4885	12.09	2.735	8.4
PHYS REV LETT	0031-9007	7.18	1.974	7.3
SMALL	1613-6810	6.525	0.856	2.5
STRUCTURE	0969-2126	5.397	1.462	6.6
PROG ELECTROMAGN RES	1559-8985	4.735	3.071	1.8
LASER PART BEAMS	0263-0346	4.42	0.627	3
LASER PHOTONICS REV	1863-8880	4.357	0.862	
PHYS LETT B	0370-2693	4.034	1.814	9.2
OPT EXPRESS	1094-4087	3.88	0.684	2.9
OPT LETT	0146-9592	3.772	0.677	6
APPL PHYS LETT	0003-6951	3.726	0.688	5.4
PHYS TODAY	0031-9228	3.674	1.048	8.9
NANOTECHNOLOGY	0957-4484	3.446	0.507	2.9
NEW J PHYS	1367-2630	3.44	0.795	2.8
FEBS LETT	0014-5793	3.264	0.647	8.8
ANN PHYS-NEW YORK	0003-4916	3.171	0.93	>10.0
J ELECTROMAGNET WAVE	0920-5071	3.134	0.425	2.5
BIOMECH MODEL MECHAN	1617-7959	3.129	0.35	3.3
RADIAT RES	0033-7587	3.043	0.631	8.5
PHYS REV A	1050-2947	2.908	0.775	8.2
ADV ATOM MOL OPT PHY	1049-250X	2.762	1.231	9.2
J LIGHTWAVE TECHNOL	0733-8724	2.736	0.315	6.2
IEEE T ELECTRON DEV	0018-9383	2.73	0.428	7.7
IEEE J SEL TOP QUANT	1077-260X	2.518	0.48	6.3
PHYS REV E	1539-3755	2.508	0.472	6.1
J PHYS CHEM REF DATA	0047-2689	2.424	0.737	>10.0
IEEE J QUANTUM ELECT	0018-9197	2.413	0.559	>10.0
EPL-EUROPHYS LETT	0295-5075	2.203	1.125	6.1
J APPL PHYS	0021-8979	2.201	0.391	8.2
J OPT SOC AM B	0740-3224	2.181	0.527	8.7
PHYS LETT A	0375-9601	2.174	0.425	7.5
IEEE PHOTONIC TECH L	1041-1135	2.173	0.407	4.8
APPL PHYS B-LASERS O	0946-2171	2.167	0.436	5.7
J PHYS D APPL PHYS	0022-3727	2.104	0.378	5.8
J PHYS B-AT MOL OPT	0953-4075	2.089	0.617	9.1
CONTEMP PHYS	0010-7514	2.073	0.05	7.5
J PHYS SOC JPN	0031-9015	2.058	0.795	>10.0

It is interesting to see how tightly bunched Optics Express, Optics Letters and Applied Physics Letters are (see yellow highlights). Journals with a 2008 Impact Factor below 2.0 have been excluded.

Let's hope this helps a few people to select the "most appropriate" journal for their future papers.

Brian Orr

STOP PRESS: The "*Reader's Digest*" version of the AUQA Report on its audit of MQ

Just as the *Newsletter* was going to "press", the University released the much-anticipated AUQA Report. I have extracted the following elements that relate to research, research centres, COREs and HDR issues. The report can be viewed at: **http://www.auqa.edu.au/qualityaudit/reports/auditreport_macquarie_2009.doc**

Brian Orr

1.1.1 Main Points

The University has set a bold vision to be ranked in the world's top 200 universities and in the top eight research-intensive universities in Australia. Significant progress has been made in setting research goals, including the establishment of Concentrations of Research Excellence areas, acquiring new researchers and consolidating research centres. It has also made significant gains in increasing higher degree by research (HDR) enrolments and improving HDR doctoral completion rates.

1.1.3 Theme 1: Research and Research Training

The University research strategy is focused on improved national and international rankings, is linked to other University strategic plans, and is supported by operational plans. By self-election, the University benchmarks itself with the Group of Eight. Working off a low base (relative to its 'top 8' aspirations), the University is increasing its research income, has significantly increased average researcher productivity, and made significant progress in establishing a pervasive research culture across the University. AUQA commends the University for the substantial improvement in performance in the areas of research and research training. These developments have also led to a confident and positive research environment for many staff. The University is also commended for developing and conducting an external engagement and knowledge transfer audit for reporting and improvement purposes.

Areas for attention include matching the pace of research growth with increased infrastructure and professional staff resourcing, and making use of financial modelling to ensure that the research strategy is sustainable in the long term.

The University has made significant progress in increasing HDR enrolments, and is progressively improving completion rates. The University has committed substantial funds to HDR scholarships, and has exceeded its own targets for enrolments. AUQA finds that research supervision workloads will need to be closely monitored to support student success.

1.3 Commendations, Affirmations and Recommendations

Commendations

1. AUQA commends Macquarie University's leadership for articulating in Macquarie@50 a bold vision which is widely understood and supported by staff and students. ..... page 8
2. AUQA commends Macquarie University for the substantial improvements in research performance, as evidenced by a range of indicators. ..... page 17
3. AUQA commends Macquarie University for its research goals, strategies and leadership, which have resulted in a positive institutional research environment. ..... page 19
4. AUQA commends Macquarie University for the successful recruitment of research staff through the Concentrations of Research Excellence strategy. ..... page 20
6. AUQA commends Macquarie University for the success of its higher degree research strategy as evidenced by significant increases in both enrolments and completions. ..... page 24
7. AUQA commends Macquarie University for the effective strategies used to engage international students in the social and community life of the University. ..... page 30

Affirmations

3. AUQA affirms Macquarie University's development of a commercialisation model based on good practice in the sector and encourages its implementation across the University. ..... page 25
5. AUQA affirms Macquarie University's recognition of the need to strengthen the quality and consistency of supervision and support for higher degree by research students across the University. ..... page 26

Recommendations

5. AUQA recommends that Macquarie University implement a University-wide system for workload allocation that is aligned with the University's goals, and which ensures application of consistent principles and approaches. ..... page 11
7. AUQA recommends that Macquarie University monitor the sustainability of its research strategy through detailed economic analyses to consider the impact and opportunity costs for activities other than research. ..... page 19
8. AUQA recommends that Macquarie University strengthen the definition of 'research active' to include a more comprehensive set of quality indicators. ..... page 20
9. AUQA recommends that Macquarie University review professional staffing levels to ensure optimal support for the research and higher degree research functions, both centrally and in the faculties. ..... page 21

3.2.4 Achieving Research Prominence in Selected Concentrations of Research Excellence

The University's aim to be a global leader in its areas of strength is being pursued through the recruitment of top-flight researchers through the CORE strategy, restructuring the Macquarie University Research Centres (MQRC), providing funding for new avenues of research, and supporting bids for external research funding. In 2008, there were 16 CORE areas, and it is intended that the University will eventually have about 20 world-class research groups. There have been two rounds of recruitment under the CORE strategy with 41 appointments made in the 2006 round and 43 positions advertised in the 2008 round. In 2008, the ARC Future Fellowship scheme was pursued with vigour, with a University commitment to sustain the appointments after the fellowship period was completed.

CORE researchers are positive about their experiences at Macquarie University. On the other hand, there are some pockets of dissatisfaction from non-CORE academic staff about the new appointment conditions. University management has taken steps to address the situation. The Panel concurs that the University needs to remain vigilant to questions of staff morale, while at the same time ensuring that the CORE strategy is, and should remain, central to the University's approach for achieving research prominence.

The impressive gains in research performance brought about by the recruitment of accomplished researchers do not appear to have been matched by appropriate administrative support for research and HDR either in the Research Office or within the faculties. A number of people interviewed by the Panel commented that their research productivity could be greatly enhanced with additional administrative support, especially while grant applications are being constructed.

... and there is much more in the full report!

Fresh vistas

Research funding opportunities – internal schemes

- MQ Vice Chancellor's Innovation Fellowships (MQVCIF) ... due 23 Aug
- MQ Strategic Infrastructure Scheme (MQSIS) – Research Infrastructure Block Grants (RIBG) ... due 23 Sep
- MQ Research Innovation Fund (MQRIF) ... due 28 Oct

Research funding opportunities – external schemes

- ARC Linkage Projects (Round 2) for funding commencing July 2010 ... due 21 Oct
- ARC Centres of Excellence – *next round still to be announced* ... due late 2009?
- National Security Science and Technology (NSST) grants – *still to be announced* ... due late 2009?

AINSE Awards

AINSE provides funds to assist researchers from member universities to gain access to ANSTO and other AINSE facilities. Awards are awarded for one year commencing in January.

Applications for 2010 are now open. (Closing date 15 September)

For more details, see: http://www.ainse.edu.au/ainse/for_academic_researchers/ainse_awards.html

NSF Solicits Proposals for Electronic and Photonic Materials Program

(Applications Due: October 31, 2009)

The U.S. National Science Foundation (NSF) is soliciting proposals for its Electronic and Photonic Materials program, which aims "to advance the field of electronics and photonics through basic, potentially transformative materials science research." The focus "is on identification and understanding of fundamental atomic and molecular level mechanisms and phenomena associated with synthesis and processing of electronic and photonic materials." The full proposal window is September 1, 2009, to October 31, 2009, and the same span annually thereafter.

From "Electronic and Photonic Materials (EPM)"

National Science Foundation (04/07/09)

http://emessaging.vertexcommunication.com/ct/4786354:2137016384:m:1:177197802:8847777A1F484BCAC538400070F2CAC4

DARPA Solicits Proposals for CIPhER Program

(Applications Due: August 25, 2009)

The U.S. Defense Advanced Research Projects Agency (DARPA) is soliciting proposals for its Centers in Integrated Photonics Engineering Research (CIPhER) program. Proposed research "should investigate innovative approaches that enable revolutionary advances in science, devices, or systems." Applications are due by August 25, 2009.

From "Centers in Integrated Photonics Engineering Research (CIPhER)"

U.S. Defense Advanced Research Projects Agency (04/27/09)

http://emessaging.vertexcommunication.com/ct/4786348:2137016384:m:1:177197802:8847777A1F484BCAC538400070F2CAC4

Upcoming conference – Light in Life Sciences Early Registration (closing on 15 August)

More information: **http://www.physics.mq.edu.au/research/fluoronet/LILS09/**

Upcoming conference – ACOLS/ACOFT 09 Call for Papers (extended to 17 August)

More information: **http://www.plevin.com.au/acoftacols2009/**

Upcoming OSA Topical Meetings

Three Collocated Topical Meetings will be featured in an OSA Optics and Photonics Congress on "Lasers, Sources and Related Photonic Devices" on January 31-February 3, 2010 in San Diego, California:

- **Advanced Solid-State Photonics (ASSP)**
- **Applications of Lasers for Sensing and Free Space Communications (LS&C)**
- **Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)**

Submission Deadline: **September 22, 2009**, 12:00 p.m. noon EDT (16.00 GMT)

More information: **http://www.osa.org/meetings/topicalmeetings/**

Koala '09 – abstracts to be in by 15 August.

See here for full details: http://www.physics.usyd.edu.au/osa/index.php?id=90

SPIE Photonics West ***– Abstract due date already passed on 13 July 2009.***

See here for full details: http://spie.org/x2584.xml

Publications

From the July/August 2009 issue of *Optics & Photonics News* (pp.18–19) ...

OPTICS | EDUCATION

Photonic Simulator Stimulates Learning

Adam Strickland, Sam Campbell, Kali Madden, Nemanja Jovanovic, Benjamin F. Johnston, Robert Williams and Judith M. Dawes

Ninth-grade students test the photonic simulator at the Macquarie Siemens Science Experience.

Eduardo Granados/Macquarie OSA student chapter

A virtual learning system shows high school students how to build—and communicate through—their own optical networks.

Recently published articles:

S Tomljenovic-Hanic, A Rahmani, **MJ Steel**, CM de Sterke, "Comparison of the sensitivity of air and dielectric modes in photonic crystal slab sensors", *Optics Express*, 17, 14552-14557 (2009)
http://www.opticsinfobase.org/abstract.cfm?uri=oe-17-17-14552

Abstract: Optical cavities provide a route to sensing through the shift of the optical resonant peak. However, effective sensing with optical cavities requires the optimization of the modal quality factor, Q, and the field overlap with the sample, f. For a photonic crystal slab (PCS) this figure of merit, M=fQ, involves two competing effects. The air modes usually have large f but small Q, whereas the dielectric modes have high-Q and small f. We compare the sensitivity of air and dielectric modes for different PCS cavity designs and account for loss associated with absorption by the sensed analyte or its host liquid. We find that optimizing Q at the expense of f is the most beneficial strategy, and modes deriving from the dielectric bands are thus preferred.

Recently accepted articles:

W Saunders, **JS Lawrence**, JWV Storey, MCB Ashley, S Kato, P Minnis, DM Winker, G Liu, C Kulesa, "Where is the best site on Earth? Domes A, B, C and F, and Ridges A and B", accepted, *Publications of the Astronomical Society of the Pacific*, 2009

Abstract: The Antarctic plateau contains the best sites on earth for many forms of astronomy, but none of the existing bases were selected with astronomy as the primary motivation. In this paper, we try to systematically compare the merits of potential observatory sites. We include South Pole, Domes A, C and F, and also Ridge B (running NE from Dome A), and what we call `Ridge A' (running SW from Dome A). Our analysis combines satellite data, published results and atmospheric models, to compare the boundary layer, weather, aurorae, airglow, precipitable water vapour, thermal sky emission, surface temperature, and the free atmosphere, at each site. We find that all Antarctic sites are likely compromised for optical work by airglow and aurorae. Of the sites with existing bases, Dome A is easily the best overall; but we find that Ridge A offers an even better site. We also find that Dome F is a remarkably good site. Dome C is less good as a thermal infrared or terahertz site, but would be able to take advantage of a predicted `OH hole' over Antarctica during Spring.

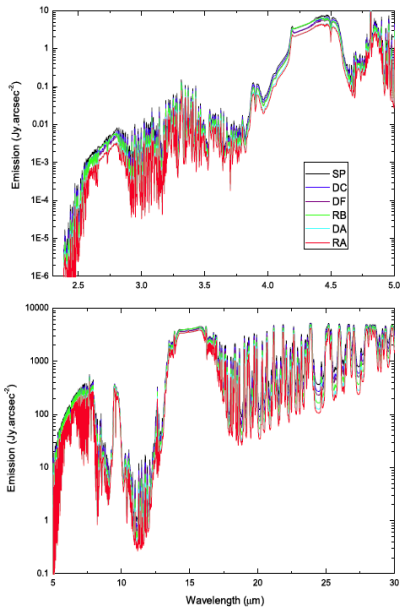

Figure 15. Model infrared sky thermal brightness in K,L,M bands (top) and N and Q bands (bottom) for various Antarctic plateau sites. Note that OH airglow emission is not included.

CS Bonner, MCB Ashley, **JS Lawrence**, DM Luong-Van, JWV Storey, "Snodar: An acoustic radar for atmospheric turbulence profiling with 1m resolution", accepted, *Acoustics Australia*, 2009.

Abstract: Snodar is a 5 kHz monostatic acoustic radar designed to measure the atmospheric turbulence within the first 200 m of the atmosphere with a vertical resolution of 1 m. An in situ calibration target is used to give absolute intensity calibration. The primary motivation for building Snodar is to quantify the site conditions for a future astronomical observatory in Antarctica. Two Snodar instruments are operating at Dome A, Antarctica, during 2009 as part of the completely robotic "PLATO" facility. The instruments are separated by 20 m and sample from 8 m to 200 m with a resolution of 1 m allowing the spatial and temporal characteristics of the atmospheric boundary layer to be investigated. We present here the acoustic design of Snodar and example data demonstrating the performance of the instrument.

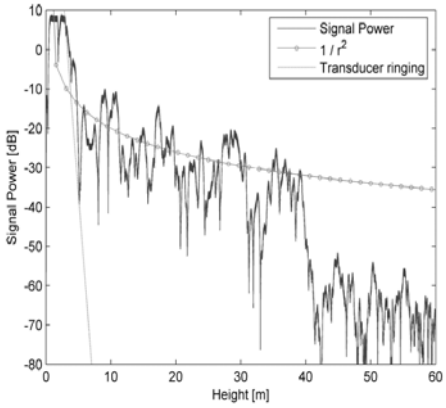

Figure 3. The first 60m of a single 5kHz echo from Snodar while operating at Dome A, Antarctica with a vertical resolution of 1m. The raw signal was filtered to a bandwidth of 500Hz centered at 5kHz. The in-band transducer ringing/antenna reverberation is indicated by the straight line at approximately 5m. $1/r^2$ is shown for comparison with Equation 3.

Seminars and Visitors

MQ Photonics Seminars:

Time: 12Noon, Wed 19th August Place: C5C 498 **Dr. John Arkwright**, CSIRO Materials Science and Engineering, Lindfield

TOPIC: Pressure sensing of the human gut by optical fibre gratings

ABSTRACT: TBA

Physics Colloquia Series:

Time: 11am, Wed 19th August Place: TBA **Dr. Leonardo DiCarlo,** Department of Applied Physics, Yale University

TOPIC: Quantum Algorithms and Entanglement Metrology with a Superconducting Processor

ABSTRACT: Quantum computers may one day outperform their modern (classical) counterparts in solving problems of technological impact, such as factoring large numbers and searching databases. A quantum processor executes algorithms by applying a programmed sequence of gates to an initialized register of qubits, harnessing quantum superposition and entanglement to efficiently drive the register to the answer. Simultaneously meeting the conflicting requirements of long quantum coherence, state preparation, universal gate operations, and qubit readout makes building quantum processors challenging. While few-qubit processors have been demonstrated using nuclear magnetic resonance, cold ion trap and optical systems, a solid-state realization has remained an outstanding challenge. In this talk, I will present the experimental implementation of two-qubit quantum algorithms using a superconducting integrated circuit. The processor uses a microwave transmission-line cavity as a quantum bus coupling two qubits several millimeters apart on the chip. Local and fast flux biasing of the qubits allows rapid control of their interaction and a two-qubit conditional phase gate universal for quantum computation. Qubit-state-dependent frequency shifts of the cavity give direct access to qubit-qubit correlations, enabling entanglement metrology and full state tomography. I will present on-demand generation of highly entangled (Bell) states and the implementation of the Grover search and Deutsch-Jozsa quantum algorithms. Finally, I will discuss current efforts to couple more qubits with the bus and detail exciting challenges, possibilities and spin-offs on the road to a fully-fledged quantum computer.

Time: 12Noon, Wed 12th September Place: TBA Dr Susan Law, Physics and Engineering Technical Team Manager, Macquarie University

TOPIC: Sue Law's rambles through Physics

ABSTRACT: Sue is the Department's new Technical Manager. Prior to this appointment she has worked for over 15 years as a contract research associate or assistant. She will talk about some of the recent research in which she has been involved:

Development of Fibre Optic Dosimeters for Radiation Oncology
A novel technique for measuring the mechanical properties of tooth enamel
The material science of cleaving microstructured polymer optical fibres
Aspects of photonic packaging
Other background

Visitors

Dr Alexey Popov (Visiting Research Fellow)

It is a pleasure to welcome Alexey, who is visiting the OBIS group of MQ Photopnics from mid-July to end of August.

Alexey obtained his PhD degree from M. V. Lomonosov Moscow State University (Russia) in Laser Physics in 2006. Within a joint Finnish-Russian graduate school, he continued his research in Optoelectronics and Measurement Techniques Laboratory of the University of Oulu (Finland), which resulted in a Doctor of Science (in technology) degree in 2008. His scientific interests are in the area of NanoBiophotonics, namely, in nanoparticles-skin interaction (penetration, phototoxicity, UV protection) monitored by optical techniques.

Currently Alexey is a researcher in the University of Oulu. In order to strengthen Australian-Finnish-Russian collaboration in the field of nanotechnology and acquire skills in imaging of ZnO nanoparticles in skin by a confocal microscope, Alexey is a Visiting Research Fellow at the Optical Biomedical Imaging and Sensing Lab at Macquarie University in summer 2009.

Alexey's interests include travel, European integration, languages and coin collection. For detailed information about research activity and hobbies, please visit his homepage: http://www.ee.oulu.fi/~popov

Andrei Zvyagin

Macquarie OSA Student Chapter

Incoming President's statement

Welcome to our incoming President Alex and to our outgoing President Nem – Brian Orr

This being my inaugural address as newly elected president of the OSA chapter, I can't proceed without thanking Nem for his hard work in both founding the chapter and leading it through its infancy. It is no mean feat to establish such a sizeable body of postgraduate students and then organise them into arranging and executing the large spectrum of events that was seen here last semester. I am looking forward to building on Nem's success and working with the student chapter members to forward the study of optics both at Macquarie and beyond.

As Nem mentioned in the last newsletter, we have just concluded an eventful 9 months of activity. From the founding of the chapter in December 2008 to our recent optics-themed trivia night, we have had a busy but resoundingly successful start. To build on our solid footings, we are now planning an engagement with the Macquarie undergraduate students on a level which is plainly aimed at the study of optics. Some of the OSA student chapter postgraduates will be opening their lab doors to interested undergraduates as they participate in our new "lab assistant" scheme. Once all necessary safety requirements have been observed, Macquarie undergrads will act as an extra pair of hands for student chapter postgrads as they continue their research projects. From this opportunity, the undergrads will get the chance to witness cutting edge optics research as it happens and also gain experience with some of the more interesting and exotic equipment we hold here at Macquarie. It is hoped that this enterprise will open the eyes of young students to the excitement of state of the art of optics research and heighten their interest in a career in optics.

The OSA student chapter will also be continuing its line of social events throughout the coming semester (details to follow) as well as its outreach programme to high schools. Rob Williams continues his excellent presentation of the photonics simulator, with Varun Kumaraswamy A.S. and Simon Gross taking up the challenge as they head to The Scots College for the upcoming National Science Week. If you wish to join the Macquarie University OSA Student Chapter or have any questions regarding our activities, please don't hesitate to contact us.

Alex Butler