MACQUARIE UNIVERSITY | MQ PHOTONICS RESEARCH CENTRE

NEWSLETTER

Issue 50 – 24 July 2012

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

As previously advised, this issue of the *MQ Photonics Newsletter* has special significance, being **our fiftieth**. After discussing this occasion with **Mick Withford**, Director of the *MQ Photonics* Research Centre and with the *MQ Photonics* Management Committee, I offered to come out of "retirement" as far as the *MQ Photonics* Newsletter is concerned, to help ensure that this fiftieth issue is something special. Thanks to all who have made an effort to do this ... and a special word of thanks to **Liz Bignucolo**, who always pulls things together.

The *MQ Photonics Newsletter* has come a long way since we published the first issue on 18 June 2008 – just over four years ago, well before the University introduced its "logo laws", effectively outlawing our own custom-designed *MQ Photonics* logo. ⇒

MACQUARIE UNIVERSITY ~ SYDNEY

MQ Photonics
Macquarie University Research Centre
... incorporating the Centre for Lasers and Applications

In case nostalgia appeals to you, back issues of the *MQ Photonics Newsletter* (all 49 of them!) can be found at <http://web.science.mq.edu.au/groups/mqphotonics/> . Furthermore, in the following "From the archives" section, a couple of *Newsletter* extracts that appeal to me are included. These comprise a happy snap taken on our April 2008 Graduation Day and my "first anniversary" comments which still remain current today. Also, there is an extract from **Jim Piper**'s 1987 application to establish the Centre for Lasers and Applications (CLA) as an ARC Special Research Centre – which got a lot of good things started.

Brian Orr (Guest Editor)

STOP PRESS:

We are delighted to report that MQ Photonics PhD student Tom Meany's presentation "Building Nature" has just won the Faculty of Science Three-Minute Thesis contest (including People's Choice)!

A cordial farewell to Stephen Thurgate

We wish to express our appreciation for support and encouragement that our retiring Executive Dean, Professor **Stephen Thurgate**, has provided for the *MQ Photonics* Research Centre, the preceding CLA and Lasers & Photonics CORE, our BioFocus, QSciTech and Astro colleagues, and others elsewhere in the Faculty. We wish Stephen well in his new ventures.

Mick Withford and Brian Orr (on behalf of *MQ Photonics*)

From the archives

... a few reminiscences from Brian Orr

The first of these archival extracts is one of my favourite group photos – a graduation ceremony including a number of MQ Photonics members who have gone on to even greater things than a PhD or BSc Hons!

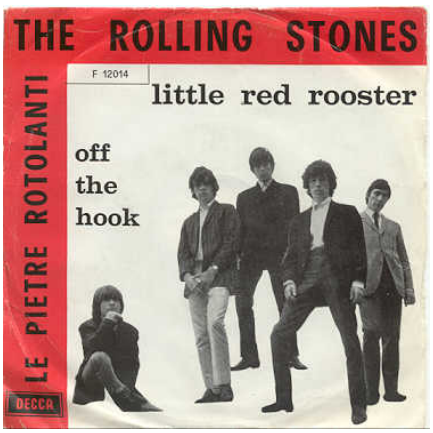
A big Graduation Day for *MQ Photonics*: *... Issue 16, 10 May 2008*

Graduates & staff (L–R): Jim Piper; Mick Withford; Ben Johnston (PhD); Martin Ams (PhD); David Coutts; Coeus Lu (PhD); Graham Town; Nick Cvetojevic (BSc Hons); Greg Staib (BSc Hons); Matthew Clark (BSc Hons); Jennifer Gray (BTech – now doing Hons); Judith Dawes; Brian Orr. **Absent:** Aaron McKay (PhD); Jinjun Sun (PhD); Fang Xie (PhD).

The following comments were made prior to the MQ Photonics Newsletter's "first anniversary." They still remain current (including the Rolling Stones, who have just attained 50 years of activity). We should again ask ourselves whether the Newsletter is worth the effort and, if so, what we all need to do to make it work!

MQ Photonics Newsletter approaching its first anniversary ... *... Issue 18, 10 May 2008*

Our *Newsletter* is approaching its first anniversary, given that Issue 1 was released on 18 June 2008. In introducing that first *Newsletter*, I wrote that it is intended to "keep us up-to-date and in touch with what is going on" and "a popular initiative when it was suggested at a *MQ Photonics* staff meeting". I also expressed the "hope that everyone who wants it to be successful will do their bit by contributing copy to Liz Bignucolo ... I trust that she will not get to feel like the Little Red Hen (if you recall the story) …". I could add that I was not keen myself to feel like the Little Red Rooster! In fact, *Newsletter* production has proved to be rather time-consuming and to divert us from getting a few other things done in a timely fashion. The central question is whether it is all worth doing. We did a bit of soul-searching in this regard in August/September 2008 (Issues 6 & 7) and concluded that it was. Unless we hear otherwise, we presume that this is still the case!



en.wikipedia.org/wiki/Little_Red_Rooster

Finally, I managed to find my copy of Jim Piper's original (mid-1987) five-page application (yes, only five!) to establish the Centre for Lasers and Applications (CLA) as an ARC Special Research Centre. The Centre was duly funded and got underway in mid-1988, with Jim as CLA Director and myself (in my first year at Macquarie University) as Deputy Director. A lot of us will thank the CLA for greatly boosting our research opportunities (and eventually leading to the MQ Photonics Research Centre and lots of other good things).

A historic document ... *... page 0.5 of the original 5-page CLA application ~25 years ago*

COMMONWEALTH TERTIARY EDUCATION COMMISSION
COMMONWEALTH SPECIAL RESEARCH CENTRES PROGRAM

SELECTION OF NEW CENTRES FOR 1988-90 TRIENNIUM

PROPOSAL FORM
SUMMARY PAGE

INSTITUTION AND ADDRESS: MACQUARIE UNIVERSITY, NSW, 2109

NAME OF PROPOSED CENTRE: CENTRE FOR LASERS AND APPLICATIONS

NAME OF PRINCIPAL RESEARCHER(S): Professor J.A. Piper, School of Mathematics, Physics, Computing & Electronics. (NOTE: It is proposed Professor B.J. Orr, School of Chemistry will also be seconded full-time to the program in the 4th to 6th years).

CLASSIFICATION OF AREA OF RESEARCH (Where appropriate use ARCC or NHMRC classifications)

Main area:	Laser Physics	Category No.:	8603/604/605/606/607/610
Other areas:	Laser Chemistry	Category No.:	C201/202/203/210
	Laser Medicine		145/670/935

BRIEF DESCRIPTION AND SIGNIFICANCE OF PROPOSAL:

The program is aimed at development of laser devices and systems and their application in a variety of fields with special emphasis on medicine and industrial diagnostics. Development of both lasers and applications will be undertaken through studies of the fundamental physical processes involved encompassing atomic and molecular spectroscopy, gaseous electronics, conventional and non-linear optics, chemical physics, and theoretical laser physics including computer modelling, as well as the technological issues involved including special materials, power supply and control systems and optical technology. The program will be based on existing studies of gas and liquid lasers and applications but will expand to include investigations of new-generation solid state lasers (semiconductor diode-pumped lasers in particular) and their applications. It is anticipated the program will yield new results concerning the physics (chemistry) of particular lasers and applications and at the same time lead to development of the technology of devices and systems. Laser systems and associated technologies form a crucial element in modern technology and enjoy a rapidly expanding international market. The Centre will focus on developments most appropriate to Australia's potential role in the international high-tech market, with special emphasis on complementing existing strengths such as in medical technology. An integrated approach will be employed where the basic science of the laser device and the application is used to tailor the technology of the system to the application and in a manner appropriate to manufacture within Australia. The Centre will also play a significant role in postgraduate training so as to overcome the present difficulties experienced by the expanding Australian Laser industry with availability of expert personnel.

Conference Reports – and congratulations …

Congratulations to **Lu Yiqing** and **Tim Zhao** for winning 2012 Congress Awards of ISAC (International Society of Advancement for Cytometry)! The CYTO 2012 – XXVII ISAC Congress was held in Leipzig, Germany on 21–27 June, 2012, with over 1,000 international participants. Lu won one of the two outstanding poster awards in recognition of his two papers, one an oral presentation: Lu, Y., Goldys, E.M., Piper, J.A., Leif, R.C., Huo, Y., Jin, D., "Investigation of lifetime decoding strategies towards time-resolved luminescence cytometry in μs-to-ms regime" and the other a poster presentation: Lu, Y., Lu, J., Martin, J., Zhao, J., Ostrowski, M., Paulsen, I.T., Piper, J.A., Jin, D., "Quantitative cell antigen analysis by automated time-gated scanning cytometer and europium nanoparticles". Tim was nominated for one of four ISAC President Awards finalists for his work presented orally: Zhao, J., Lu, Y., Lu, J., Dawes, J., Piper, J.A., Goldys, E.M., Jin, D., "Implementation of upconversion luminescence in flow and scanning cytometry". Well done!

Jin, Dayong

OSA Advancing the Science and Technology of Light

Advanced Photonics Congress ***17–21 June 2012, Cheyenne Mountain Resort, Colorado Springs, CO, USA***

OSA's Advanced Photonics Congress, incorporated a suite of meetings including Bragg gratings, Photo-sensitivity and Poling in glass waveguides (BGPP), Nonlinear Photonics (NP) and Specialty Optical Fibres and applications (SOF). It was held recently at the Cheyenne Mountain Resort in Colorado Springs, Colorado, near the famous NORAD aerospace defence command facility. **Mick Withford** and I attended BGPP and gave two contributed talks: I presented my recent Q-switched laser and apodized grating results and Mick presented Simon's Überstructure waveguide Bragg gratings. Both talks received plenty of interest and questions, particularly as this was a specialist audience including many players in the femtosecond direct-write field. We also caught up with some of our CUDOS colleagues from the University of Sydney who were presenting papers in collocated meetings, and with our friends from the Friedrich-Schiller University in Jena, Germany. Many of you will remember Jens Thomas who visited us for 3 months a few years ago, working closely with **Nem Jovanovic** and **Mike Steel**. The conference location offered some nice scenery (see the view from the dining room below), and the nearby 'Garden of the Gods' and Pike's Peak provided a worthy break from the conference (the summit of Pike's Peak is at an altitude of 4.3 km – almost exactly double that of Mt Kosciuszko – and can be comfortably reached by car along a typical wide, paved American road!).

Robert Williams

View from dining room

Enjoying the evening view at the 'Garden of the Gods'

Road climbing Pike's Peak

Conference Reports *(continued)*

The annual CLEO (Conference on Lasers and Electro-Optics) conference in the USA provides a traditional opportunity for *MQ Photonics* researchers to present their research results and hear the latest news from their colleagues around the world. CLEO:2012 in San Jose (6–11 May 2012) was no exception. The following is a (belated) review of contributed papers from the *MQ Photonics* Research Centre, reflecting our international standing over a broad range and our widely spread collaborative portfolio.
For full information, visit **www.cleoconference.org/home/program.aspx** Brian Orr

JW4A.19
Sub-Doppler two-photon excitation spectra of atomic xenon: characterization of hyperfine structure and isotope shifts

Ken G. Baldwin[1], Mitsuhiko Kono[1], **Yabai He**[3,2], **Brian J. Orr**[2]

[1]Australian National University, Australia; [2]Macquarie University, Australia;[3]National Measurement Institute, Australia.

Sub-Doppler two-photon excitation spectra are recorded for high-energy Rydberg levels of atomic xenon, using narrowband nanosecond pulses of coherent radiation at 206–210 nm. The diverse hyperfine and isotopic structure is assigned and analyzed.

CTh1B.7 High power cw diamond Raman laser: Analysis of efficiency and parasitic loss

Ondrej Kitzler[1]

[1]Macquarie University, Australia.

We report an investigation into a 8.2 W diamond Raman laser with conversion efficiency of 27% pumped by a cw Nd:YVO_4 laser. Power analysis enables determination of the factors limiting conversion efficiency.

As reported in the previous issue of the *MQ Photonics Newsletter*, Macquarie University PhD student Ondrej Kitzler's talk won him a prestigious Newport Student Travel Grant. Well done, Ondra!

CTh4A.2 Analog and all-digital frequency distribution *via* optical fiber links

Ken G. Baldwin[1], **Yabai He**[2,3], Magnus Hsu[2], Michael Wouters[2], Malcolm Gray[2], **Brian J. Orr**[3], Andre Luiten[4], Sascha Schediwy[4], Jong Chow[1], Daniel Shaddock[1], Guido Aben[5], Peter Fisk[2], Bruce Warrington[2]

[1]RSPE, ANU, Australia; [2]National Measurement Institute, Australia; [3]Macquarie University, Australia; [4]University of Western Australia, Australia; [5]AARNet, Australia.

We present two optical fiber-based radio-frequency signal distribution systems based on analog and all-digital electronics. The achieved fractional frequency transfer stabilities are similar: ~6×10^{-17} (over 10^4 s) for analog using a 20 km fiber spool.

CTh4G.1 Femtosecond induced fiber mode filter

Christian Voigtländer[1], **Robert J. Williams**[2], **Michael Withford**[2], Jens U. Thomas[1], Stefan Nolte[1], Andreas Tünnermann[1]

[1]Friedrich-Schiller-University Jena, Germany; [2]Macquarie University, Australia.

We demonstrate a mode filter by inducing a short distance refractive index increase around the fiber core. The guidance of the fiber is modified and higher order modes can be suppressed.

QTh4F.3 Photon Helicity changes in Nanohole Scattering

Ivan Fernandez-Corbaton[1]

[1]Macquarie University, Australia.

The scattering of circularly polarised Gaussian beams impinging on a cylindrical nanohole in a metallic thin film contains phase singularities. These experimental observations are due to changes in the helicity of the scattered photons.

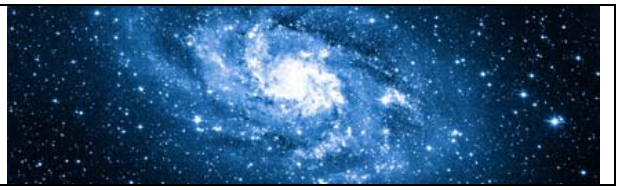
Conference Reports *(continued)*

SPIE Astronomical Telescopes + Instrumentation

1 - 6 July 2012

Amsterdam RAI Convention Ctr.

Amsterdam, Netherlands



The SPIE conference on "Astronomical Telescopes and Instrumentation" was held in Amsterdam in early July. In all, it included **26 papers with co-authors from Macquarie University**. A sample of 8 of these 26 papers, selected on the basis of their close association with the *MQ Photonics* Research Centre, is listed below.
More information: **http://spie.org/x13662.xml** Brian Orr (advised by Jon Lawrence & Mike Ireland)

Nemanja Jovanovic, Peter G. Tuthill, Barnaby Norris, **Simon Gross**, Paul Stewart, Ned Charles, Sylvestre Lacour, **Jon Lawrence**, Gordon Robertson, **Alexander Fuerbach** and **Michael J. Withford**,
"Progress and challenges with the Dragonfly instrument: an integrated-photonic pupil-remapping interferometer", *Proc. SPIE* 8445-04, 2012.

Michael J. Ireland, "Detecting extrasolar planets with sparse aperture masking", *Proc. SPIE* 8445-05, 2012.

S.C. Ellis, **M. Ireland**, **J.S. Lawrence**, J. Tims, N. Staszak, J. Bland-Hawthorn, J. Brzeski, S. Case, M. Colless, S. Croom, W. Couch, **O. De Marco**, K. Glazebrook, **Q.A Parker**, R. Sharp, W. Saunders, R. Webster, **D. Zucker**,
"KOALA: a wide-field 1000 element integral field unit for the Anglo-Australian Telescope" *Proc. SPIE* 8446-29, 2012.

Izabela Spaleniak, **Nemanja Jovanovic**, **Simon Gross**, **Michael Ireland**, **Jon Lawrence**, and **Michael Withford**,
"Exploration of integrated photonic lanterns fabricated by femtosecond laser inscription", *Proc. SPIE* 8450-40, 2012.

Yitping Kok, **Michael J. Ireland**, Peter G. Tuthill, James G. Robertson, Benjamin A. Warrington, William J. Tango,
"Self-phase-referencing interferometry with SUSI", *Proc. SPIE* 8445-72, 2012.

Michael J. Ireland, "Aperture masking behind AO systems", *Proc. SPIE* 8447-79, 2012.

Michael J. Ireland, Stuart Barnes, David Cochrane, Matthew Colless, Peter Connor, Anthony Horton, Steve Gibson, **Jon Lawrence**, Sarah Martell, Peter McGregor, Tom Nicolle, Kathryn Nield, David Orr, J. Gordon Robertson, Stuart Ryder, Andrew Sheinis, Greg Smith, Nick Staszak, Julia Tims, Pascal Xavier, Peter Young and Jessica Zheng,
"The AAO's Gemini high resolution optical spectrograph (GHOST) concept", *Proc. SPIE* 8446-80, 2012.

Nick Cvetojevic, **Nemanja Jovanovic**, **Jon S. Lawrence**, **Michael J. Withford**, and Joss Bland-Hawthorn,
"Redesign of the Integrated Photonic Spectrograph for Improved Astronomical Performance", *Proc. SPIE* 8446-130, 2012.

Preparing for the next big conference …

20th Australian Institute of Physics Congress — 9-13 December 2012 — Sydney

Incorporating the 37th Australian Conference on Optical Fibre Technology

Associated event: Australian Optical Society Conference

It never lets up, with many of us busy over the last few days finalising our abstract submissions for the forth-coming 2012 AIP Congress (incorporating ACOFT) at UNSW in December 2012. Watch this space …

… and then there is the 2013 conference circuit to think about, for instance:

Photonics West, 2–7 February 2013, San Francisco, CA, USA **… abstracts were due 23 July 2012**
CLEO®Europe-IQEC 2013, 12–16 May 2013, Munich, Germany ***… abstracts probably due Nov/Dec 2012?
CLEO 2013, 9–14 June 2013, San Jose, CA, USA * **…** abstracts probably due Nov/Dec 2012?
CLEO Pacific Rim 2013, 1–14 June 2013, Kyoto, Japan **…** abstracts probably due early 2013?
AOS Conference 2013, December 2013, Perth, W.A. **…** abstracts probably due mid-2013?

* Note that the dates of CLEO®Europe-IQEC 2013 and CLEO 2013 have been changed substantially.

Fresh vistas

Methane is in the Air … … *but from which bovine orifice?*

This is a postscript to what was written in the previous issue of the the *MQ Photonics Newsletter*, concerning our role in the CSIRO's Flagship Livestock Methane Research Cluster, in which we are preparing for cavity-ringdown spectroscopy measurement of emission of the greenhouse gas methane (CH_4) from cattle. It seems, however, from a recent item in the UK's Daily Mail ⇒ that at least one journalist is not aware that ruminant animals "release CH_4 from their gut by belching (rather than by another route!)", as we wrote. I trust that the poor cow found 2004 to be a good year! You can read this mistaken (but otherwise credible) article, entitled "Australian scientists aim to battle cows' methane emissions – using a laser beam," *via* MailOnline at www.dailymail.co.uk/sciencetech/article-2144215/Recipe-barbecue-Australian-scientists-aim-battle-cows-methane-emissions--using-laser-beam.html

Brian Orr

Seminars

MQ Photonics Seminars / Visitors

Time / Date: 11am / Fri 27th July Room: E7B 200 Speakers: **Xavier Zambrana Puyalto** *and* **Dr Andrew Lee**

Topics: 'Excitation of single electromagnetic modes in dielectric spheres using cylindrically symmetric beams' and 'Generation of frequency-tunable THz radiation using solid-state lasers'

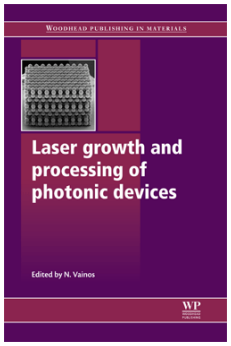
Time / Date: 11am / Fri 31st August Room: TBA Speaker: **Prof Dr Johannes Roth**
Institut für Theoretische und Angewandte Physik, Universität Stuttgart, Germany

Topic: Molecular dynamics simulations of laser ablation

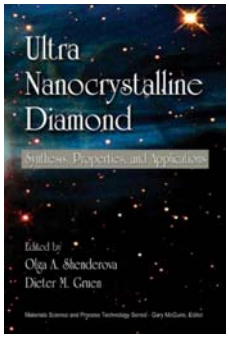
Publications

Recently published articles

Book Chapters



Laser growth and processing of photonic devices
ed. N. Vainos (Woodhead Publishing, Cambridge, UK);
ISBN 1 84569 936 X ISBN-13: 978 1 84569 936 9; July 2012;
http://www.woodheadpublishing.com/en/book.aspx?bookID=2072
Woodhead Publishing Series in Electronic & Optical Materials No. 27
Part 3 Laser fabrication and manipulation of photonic structures and devices
Laser-induced refractive index manipulation of photonic devices
M Ams, D J Little and M J Withford, Macquarie University, Australia



Ultrananocrystalline Diamond, 2nd Edition
– Advances in Nanodiamond Science and Technology
(ed. Olga Shenderova and Dieter Gruen)

Publisher: Elsevier (in press, July 2012)

Chapter 10: A. V. Zvyagin and N. B. Manson**,**

"Optical and Spin Properties of Nitrogen-Vacancy Color Centers in Diamond Crystals, Nanodiamonds, and Proximity to Surfaces"

R J Williams, N Jovanovic, G D Marshall, G N Smith, M J Steel, M J Withford, "Optimizing the net reflectivity of point-by-point fiber Bragg gratings: the role of scattering loss", *Optics Express*, 20 (12), 13451-13456 (2012) http://dx.doi.org/10.1364/OE.20.013451

Abstract: We present an experimental and theoretical analysis of the influence of scattering losses on the net reflectivity of fiber Bragg gratings inscribed with a femtosecond laser and the point-by-point technique. We demonstrate that the ratio of the coupling strength coefficient to the scattering loss coefficient varies significantly with the inscribing laser pulse energy, and highlight that an optimal pulse-energy range exists for achieving high-reflectivity gratings. These results are critical for exploiting high power fiber laser opportunities based on point-by-point gratings.

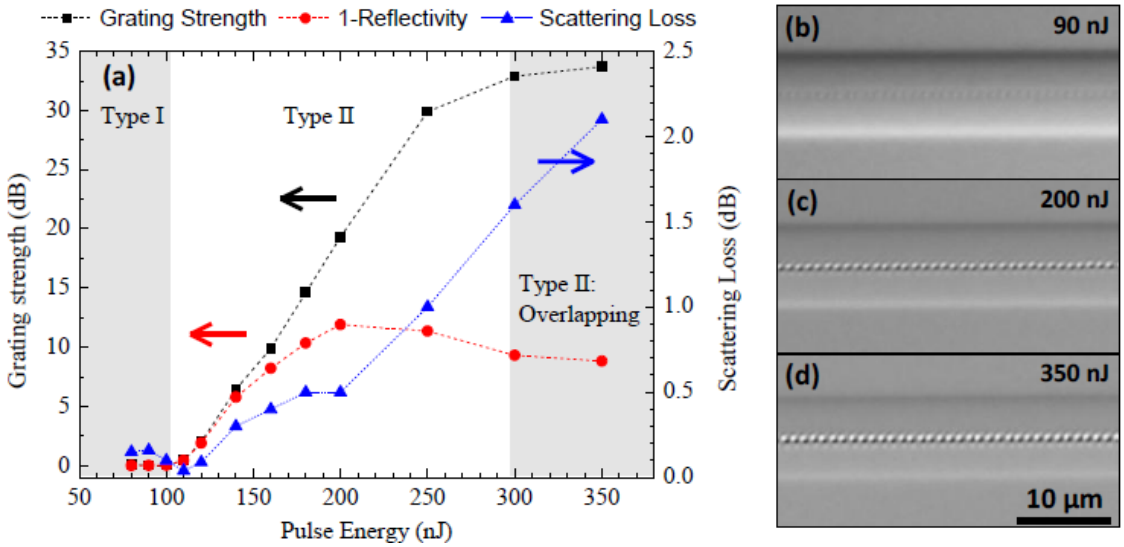


Fig. 2. (a) Grating strength (black squares), scattering loss (blue triangles) and net reflectivity (red circles) of 5 mm-long PbP gratings inscribed with different pulse energies. Each grating has a 2nd order resonance in the C-band. Differential-interference-contrast micrographs of the PbP gratings inscribed with (b) 90 nJ, (c) 200 nJ and (d) 350 nJ are shown on the right (viewed from the direction of the inscribing beam). The measurement uncertainty of the data in (a) is 0.02 dB due to splices between the grating and the swept wavelength system.

N Jovanovic, I Spaleniak, S Gross, M Ireland, J S Lawrence, C Miese, A Fuerbach, M J Withford, "Integrated photonic building blocks for next-generation astronomical instrumentation I: the multimode waveguide", *Optics Express*, 20 (15), 17029-17043 (2012) http://dx.doi.org/10.1364/OE.20.017029

Abstract: We report on the fabrication and characterization of composite multimode waveguide structures that consist of a stack of single-mode waveguides fabricated by ultrafast laser inscription. We explore 2 types of composite structures; those that consist of overlapping single-mode waveguides which offer the maximum effective index contrast and non-overlapped structures which support multiple modes via strong evanescent coupling. We demonstrate that both types of waveguides have negligible propagation losses (to within experimental uncertainty) for light injected with focal ratios >8, which corresponds to the cutoff of the waveguides. We also show that right below cutoff, there is a narrow region where the injected focal ratio is preserved (to within experimental uncertainty) at the output. Finally, we outline the major application of these highly efficient waveguides; in a device that is used to reformat the light in the focal plane of a telescope to a slit, in order to feed a diffraction-limited spectrograph.

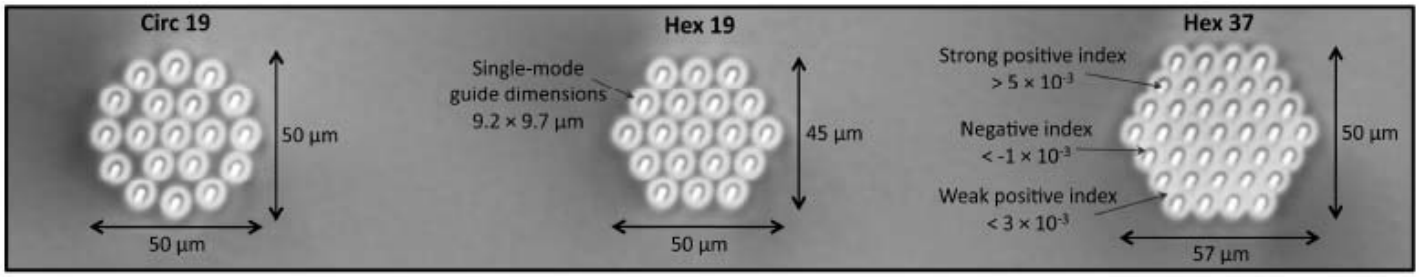


Fig. 4. Cross-sectional micrograph of the three types of composite MM waveguides fabricated and characterized. The SM waveguide tracks were written with 35 nJ and a translation speed of 1750 mm/minute. The dimensions of the waveguides written under these conditions are marked in the figure and the three main regions of index change, typically seen under cumulative heating in Eagle2000 glass, are highlighted for the reader.

M Collins, A Clark, J He, DY Choi, **R Williams**, A Judge, S Madden, **M Withford, M Steel**, B Luther-Davies, C Xiong, B Eggleton, "Low Raman-Noise Correlated Photon-Pair Generation in a Dispersion Engineered Chalcogenide As2S3 Planar Waveguide", *Optics Letters* accepted 07/03/2012; posted online 07/03/2012; Doc. ID 169919

Abstract: We demonstrate low Raman-noise correlated photon-pair generation in a dispersion-engineered 10 mm As2S3 chalcogenide waveguide at room temperature. We show a coincidence-to-accidental ratio (CAR) of 16.8, a 250 times increase compared with previously published results in a chalcogenide waveguide, with a brightness of 10^5 pairs per second at maximum CAR operation. Dispersion engineering of our waveguide enables photon passbands to be placed in the low spontaneous Raman scattering (SpRS) window at 7.4 THz detuning from the pump. This work shows the potential for As2S3 chalcogenide to be used for nonlinear quantum photonic devices.

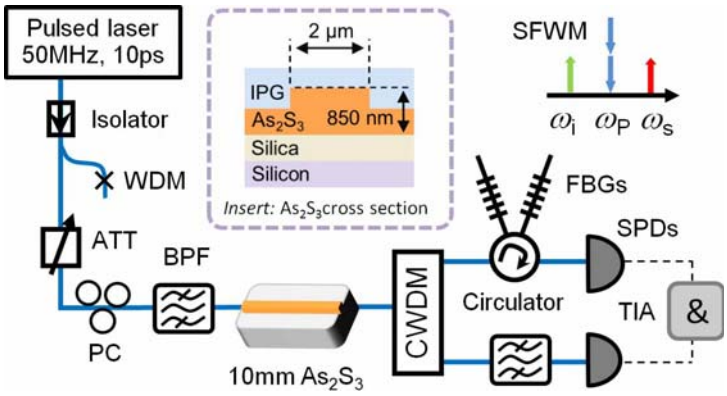


Fig. 1. Experimental setup for correlated photon-pair generation via SFWM. ATT: attenuator, PC: olarization controller, SPD: single photon detector, TIA: time interval analyzer, remaining acronyms defined in text. Insert: cross section of As2S3 waveguide. IPG: inorganic polymer glass.

D M Kane, R J Chater, D S McPhail, "Evaluation of imperfections in silica and chalcogenide glass microspheres using focussed ion beam milling and imaging", *Journal of Microscopy*, 247 (2), 186-195 (2012) doi: 10.1111/j.1365-2818.2012.03631.x

Abstract: Microspheres made from optical glasses such as silica and chalcogenide are used as both passive and active optical elements in micro-optics systems and devices. The homogeneity of the microspheres is crucial to their optical quality and performance in such devices and so it is essential, in optimizing such systems, that techniques with nanometer scale resolution are developed to measure the internal structure and homogeneity of such spheres. In this work an analytical protocol based on focussed ion beam milling, combined with secondary ion and secondary electron imaging, has been developed to study the internal homogeneity of glass microspheres. The results have shown that silicamicrospheres with diameters of three to five microns, fabricated by a sol–gel method, have internal inhomogeneities and voids that will lead to non-uniform optical properties. The FIB milling and imaging technique developed has been found to be a very useful method of studying such inhomogeneities, which have been proposed, but never previously observed, in glass microspheres. The FIB based technique has also been used on larger chalcogenide glass (Ga_2S_3:La_2S_3)microspheres (diameter of order 70 microns) but no inhomogeneities have been observed at the spatial resolution of a few microns so far achieved for these larger microspheres. This study suggests that the FIB based milling and imaging technique may have potential for quantitative use in the measurement of morphological variations in such systems as well as in the study of aging processes in micron-sized glass spheres.

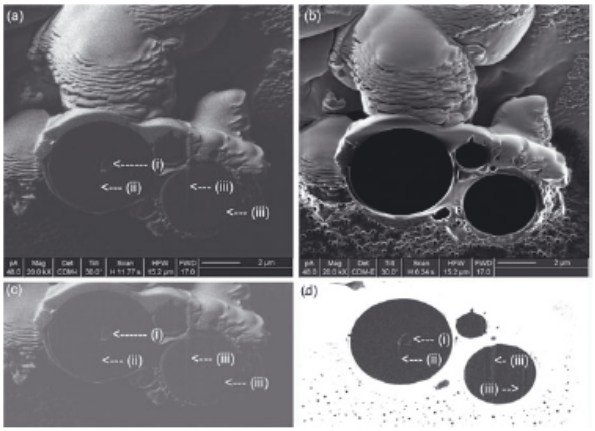


Fig. 2. The SI (a) and SE (b) images, as-recorded for the most central cross section of a 6 micron diameter Fusokk silica microsphere. SI (c) and SE (d) are images (a) and (b), respectively, after brightness and contrast enhancement. The SI image, as-recorded, shows a topographical internal inclusion (arrow (i) in (a)). This is not visible in the SE image as-recorded (b), but is visible in both images after enhancement (arrow (i) in (c) and (d)). Arrows labelled (ii) and (iii) point to curtaining striations initiated at a topographical discontinuity (ii), or a change in material (iii). Scale bars 2 μm.

D M Kane, R J Chater, D B Gore and D S McPhail, "Corrosion at the surface of chalcogenide glass microspheres", *J. Opt.* 14, 055401-9 (2012) doi:10.1088/2040-8978/14/5/055401

Abstract: Glasses used in photonics research and industry are required to be homogeneous and stable. Our study of chalcogenide microspheres indicates that significant deterioration can take place at the surface of such micro-optics in a few years at normal environmental conditions. Chalcogenide glass (Ga2S3:La2S3, 70:30 (GLS)) microspheres of order one hundred microns in diameter have been focused ion beam (FIB) milled and imaged to show material and morphological changes at the surface. Such microspheres are used as whispering gallery mode cavities for micro-sensors, for devices in optical communications and, with rare earth doping, for micro-lasers. It is the optical quality of the glass at, and near, the surface, that is most important in these applications. With the surface corrosion shown, the Q of a whispering gallery mode resonator based on such a microsphere will reduce dramatically over time. More generally, the result may have significant implications for the production, storage, and usage of uncoated chalcogenide micro-optics. The FIB technique emerges as an additional tool for characterizing glass morphology and homogeneity.

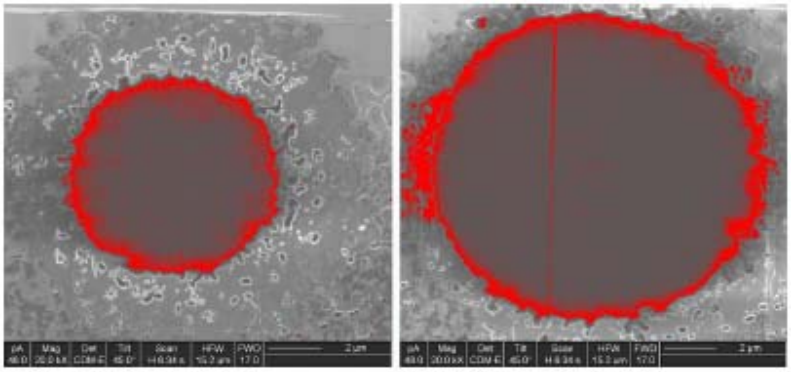


Figure 6. The SE images (two sequential FIB milled slices) are shown after brightness and contrast enhancement followed by thresholding to visualize the altered layer. The strong vertical in the rightmost image is due to curtaining and is an artifact [4]. Scale bars 2 _m.

J P Toomey, C Nichkawde, D M Kane, K. Schires, I. D. Henning, A. Hurtado, and M. J. Adams, "Stability of the nonlinear dynamics of an optically injected VCSEL," *Optics Express* 20(9), 10256-10270 (2012).

Abstract: Automated protocols have been developed to characterize time series data in terms of stability. These techniques are applied to the output power time series of an optically injected vertical cavity surface emitting laser (VCSEL) subject to varying injection strength and optical frequency detuning between master and slave lasers. Dynamic maps, generated from high resolution, computer controlled experiments, identify regions of dynamic instability in the parameter space.

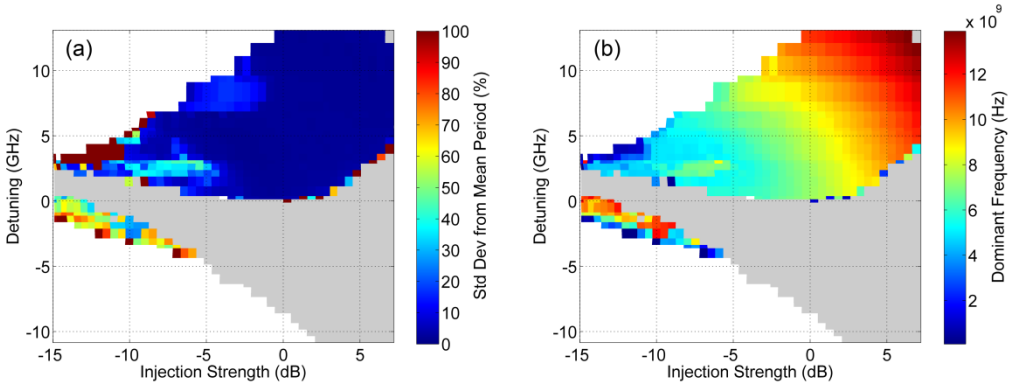


Fig. 8. (a) Map of the standard deviation in time interval between local maxima as a percentage of the average time interval, and (b) map of the dominant frequency as determined by the average time interval (period) between local maxima. The grey region represents injection locked dynamics.

J P Toomey, D M Kane, K Schires, **C Nichkawde**, A Hurtado, I D Henning, M J Adams, "Mapping transients in the nonlinear dynamics of an optically injected VCSEL", *Proc. SPIE* 8432, 843219 (2012); http://dx.doi.org/10.1117/12.922168

Abstract: Optical injection is one of the key methods for invoking nonlinear dynamical outputs in laser systems. The system parameters that are used to control the nature of the output from such a system are the injection strength and the frequency detuning between the optical frequency of the free running master and slave lasers. A map of the dynamics can be generated using a number of measurands to facilitate identifying the fundamentally different dynamical regions in the injection-strength/frequency-detuning parameter space. Herein we describe a set of automated algorithms used to establish several measures to identify transients and instabilities in the nonlinear dynamical output of an optically injected vertical cavity surface

emitting laser (VCSEL), for set and unchanging driving parameters.

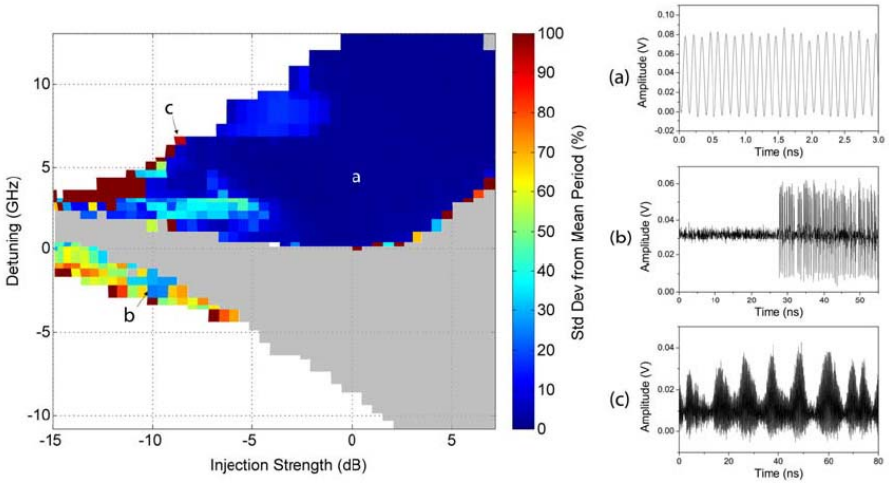


Figure 3. Map of the standard deviation in peak period, as a percentage of the mean period, in the output power time series of the orthogonal polarization mode of the injected slave laser. The grey shaded area represents the injection locked region (reproduced with permission16). Examples of some types of the dynamics produced by the system are shown in (a)-(c) and their location in the parameter space is indicated on the main map.

D M Kane, R J Chater, D S McPhail, "Focused ion beam sectioning of micro-optics as a tool for destructive testing for optical material", *Proc. of SPIE* Vol. 8428, 84280U, pp. 12, (2012) SPIE, doi: 10.1117/12.922154

Abstract: In previous research we introduced an experimental methodology in which focused-ion-beam (FIB) sectioning, followed by secondary ion (SI) and secondary electron (SE) imaging, was used for testing the internal material homogeneity of silica and chalcogenide glass microspheres. The methodology is readily applied to micro-optics with dimensions of a few microns. The use of both SI and SE imaging of the sequentially sectioned samples was shown to allow accurate assignment of inhomogeneities, voids and other imperfections as being within the footprint of the micro-optic. On larger micro-optics FIB sectioning can become prohibitively time intensive and can require the use of too much platinum in sample preparation for evaluation of the bulk of the micro-optic. However, improved sample preparation and image analysis has enabled high magnification and high sensitivity study of the glass near the surface of chalcogenide microspheres with diameter of order 70μm. The chalcogenide glass is Ga2S3/La2S3, in a 70/30 weight percent ternary (GLS) and the microspheres had been kept in air, in normal laboratory conditions, for about two years prior to testing. Evidence of an altered layer with a width of the order of 0.1μm near the surface and then an outer porous layer at the surface was found. Lower resolution studies are then reappraised in light of the high resolution measurements.

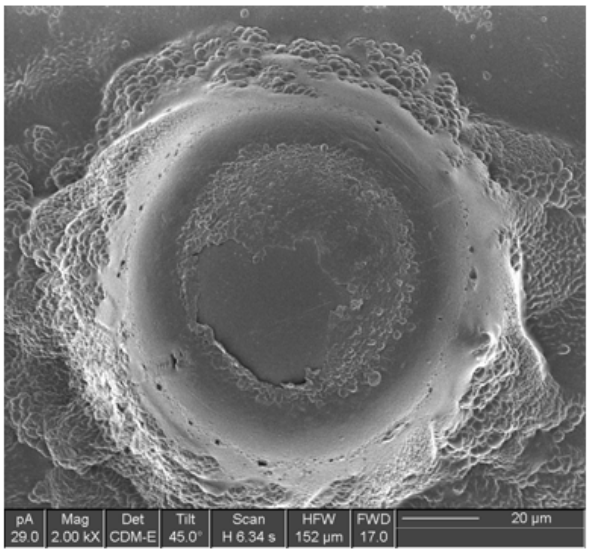


Figure 5. A microsphere as imaged 2 July 2010 which shows the possible delamination and removal of the modified, corroded layer from a section of the surface of the microsphere. This suggests the possibility that a smooth glass finish of the GLS microspheres may be recovered by a relatively gentle, mill polishing or washing process.

D. M. Kane, **N. Naidoo**, **D. J. Little**, "Micro-optical elements and optical materials of certain spider webs", Proc. of SPIE Vol. 8428, 84280T, pp. 13, © 2012 SPIE doi: 10.1117/12.922327

Abstract: Certain spider webs are composed of several types of micro-optical elements made from transparent optical materials. The silks (radial and capture) are almost exclusively protein. The nearly cylindrical silks have diameters in the range 0.1 to several microns and cross-sectional morphology that is cylindrical-multi-layered, as studied by transmission electron microscopy. The capture threads are coated with aqueous adhesive that also forms into nearly elliptical micro-lenses (adhesive droplets) mounted on the near cylindrical silks. The remaining elements of the web are the cement junctions tying the radial and the capture threads of the web together. These are irregularly shaped platelets. Progress to date on our research characterizing the optical properties and function of these transparent orb webs has been to interpret the reflection and transmission properties of the elements of the web, and the web as a whole, in natural

lighting; to evaluate the optical finish of the surface of the silks and capture droplets; and to measure the principal refractive indices of radial silks using new immersion based methods developed for application to micron-sized, curved optical elements. Here we report the principal refractive indices, birefringence, dispersion and morphology of transparent spider silk subject to various chemical treatments. The morphology is measured using TEM. Insight into the physical origin of the refractive index properties will be discussed.

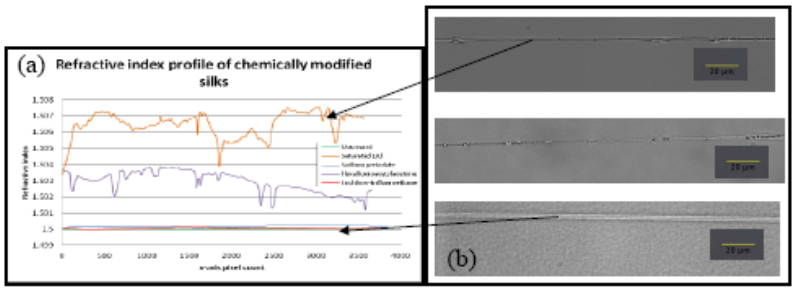


Figure 10. (a) Refractive index of chemically treated radial silk of P. eburnus measured by quantitative phase microscopy, correlated with the brightfield microscopy images of the silks immersed in a closely matched index matching oil (b). The central image is of HFAA treated silk. Two chemical treatments that did not affect the silk are also shown. The refractive index is not differentiated from that of the untreated silk in these two cases.

Y Ding, T Peng, H Xie, **Y Lu, D Jin**, J Ten, Q Ren, P Xi, Laser Oblique Scanning Optical Microscopy (LOSOM) for Phase Relief Imaging, *Opt. Exp.* **20**, 14100-14108 (2012) http://dx.doi.org/10.1364/OE.20.014100

Abstract: The visualization of optical phase can provide abundant information when imaging transparent specimen. We present a novel phase sensitive imaging design capable of obtaining phase contours of transparent biological cells through laser oblique scanning optical microscope (LOSOM). LOSOM is based on the introduction of a fluorescent medium behind the specimen to generate a differential phase-sensitive image, thus, the complicated phase retardation alignment procedure associated with differential interference contrast (DIC) microscopy can be eliminated. Moreover, multi-modality fluorescence and phase relief imaging can be attained in a single system with fluorescently labeled specimens.

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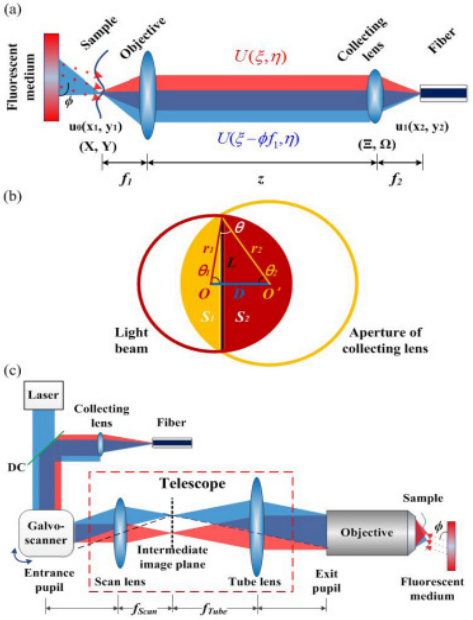
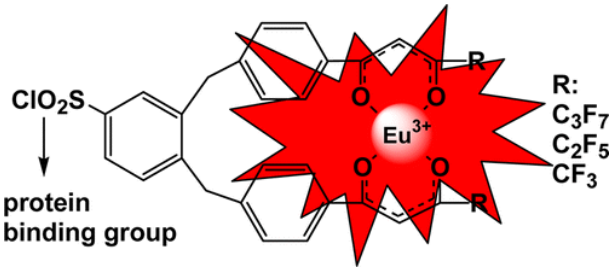


L Zhang, Y Wang, Z Ye, **D Jin**, J Yuan, "New Class of Tetradentate β-Diketonate-Europium Complexes That Can Be Covalently Bound to Proteins for Time-Gated Fluorometric Application", *Bioconjugate Chem.*, 23 (6), 1244–1251 (2012) DOI: 10.1021/bc300075t



Abstract: Luminescent lanthanide complexes that can be covalently bound to proteins have shown great utility as biolabels for highly sensitive time-gated luminescence bioassays in clinical diagnostics and biotechnology discoveries. In this work, three new tetradentate β-diketonate–europium complexes that can be covalently bound to proteins to display strong and long-lived Eu^{3+} luminescence, 1,2-bis[4′-(1″,1″,1″,2″,2″,3″,3″-heptafluoro-4″,6″-hexanedion-6″-yl)-benzyl]-4-chlorosulfobenzene-Eu^{3+} (BHHBCB-Eu^{3+}), 1,2-bis[4′-(1″,1″,1″,2″,2″-pentafluoro-3″,5″-pentanedion-5″-yl)-benzyl]-4-chlorosulfobenzene-Eu^{3+} (BPPBCB-Eu^{3+}), and 1,2-bis[4′-(1″,1″,1″-trifluoro-2″,4″-butanedion-4″-yl)-benzyl]-4-chlorosulfobenzene-Eu^{3+} (BTBBCB-Eu^{3+}), have been designed and synthesized as biolabels for time-gated luminescence bioassay applications. The luminescence spectroscopy characterizations of the aqueous solutions of three complex-bound bovine serum albumin reveal that BHHBCB-Eu^{3+} has the strongest luminescence with the largest quantum yield (40%) and longest luminescence lifetime (0.52 ms) among the complexes, which is superior to the other currently available europium biolabels. The BHHBCB-Eu^{3+}-labeled streptavidin was prepared and used for both the time-gated luminescence immunoassay of human prostate specific antigen and the time-gated luminescence microscopy imaging of a pathogenic microorganism *Cryptosporidium muris*. The results demonstrated the practical utility of the new Eu^{3+} complex-based biolabel for time-gated luminescence bioassay applications.

Y Liu, Y Ding Y, E Alonas, W Zhao, P J Santangelo, **D Jin, J A Piper**, J Teng, Q Ren, P Xi, "Achieving λ/10 Resolution CW STED Nanoscopy with a Ti:Sapphire Laser from a Two-photon Fluorescence Microscope" *PLoS ONE* 7(6): e40003 (2012) DOI:10.1371/journal.pone.0040003

Abstract: In this report, a Ti:Sapphire oscillator was utilized to realize synchronization-free stimulated emission depletion (STED) microscopy. With pump power of 4.6 W and sample irradiance of 310 mW, we achieved super-resolution as high as 71 nm. With synchronization-free STED, we imaged 200 nm nanospheres as well as all three cytoskeletal elements (microtubules, intermediate filaments, and actin filaments), clearly demonstrating the resolving power of synchronization-free STED over conventional diffraction limited imaging. It also allowed us to discover that, Dylight 650, exhibits improved performance over ATTO647N, a fluorophore frequently used in STED. Furthermore, we applied synchronization-free STED to image fluorescently-labeled intracellular viral RNA granules, which otherwise cannot be differentiated by confocal microscopy. Thanks to the widely available Ti:Sapphire oscillators in multiphoton imaging system, this work suggests easier access to setup super-resolution microscope via the synchronization-free STED.

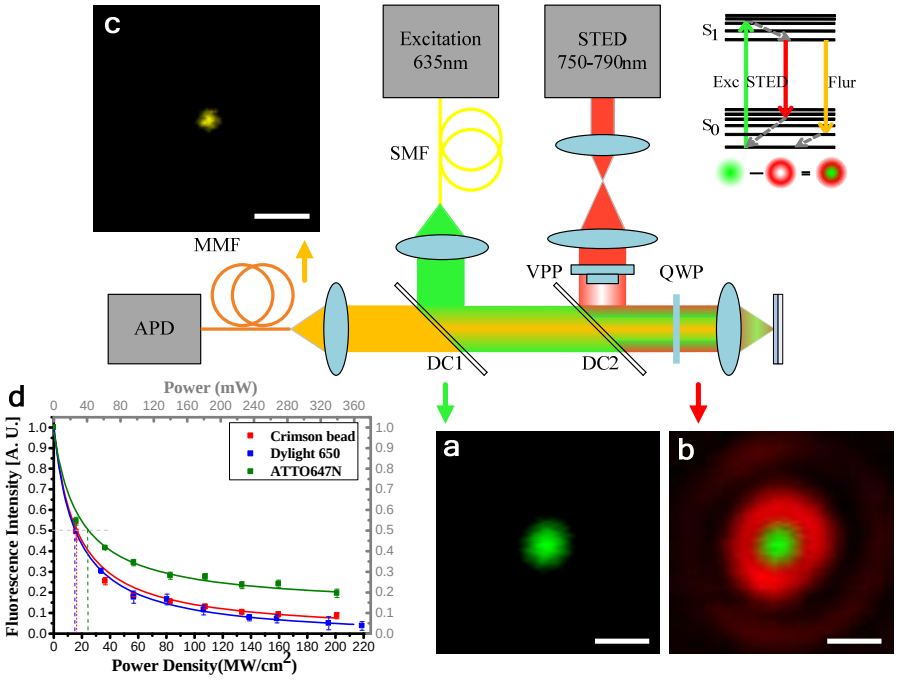
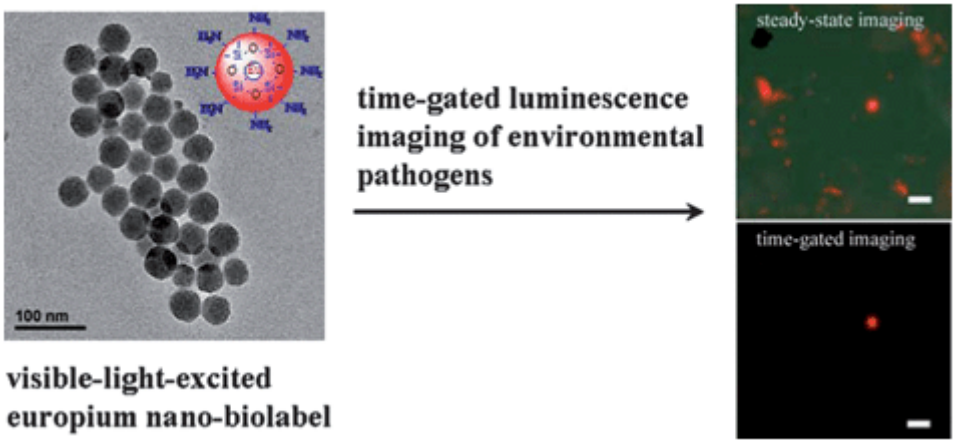


Figure 1. Schematic of the CW STED system for far-field super-resolution optical nanoscopy. The green line represents the excitation 635 nm laser, red line is the CW Ti: Sapphire STED beam, and the yellow line represents the fluorescence signal. SMF: single mode fiber; MMF: multi-mode fiber; DC1 and DC2 are dichotic filters. VPP: vortex 0–2π phase plate; QWP: quarter waveplate. The excitation PSF (a), doughnut depletion PSF overlapped with excitation PSF (b), and STED PSF (c) clearly shows the process of achieving super-resolution. Scale bar: 500 nm. The modulation efficiency versus the depletion intensity was measured with crimson beads, DyLight 650 and ATTO 647N solution (d). The STED wavelengths are 763 nm for crimson beads and ATTO 647N, and 783 nm for DyLight 650.

L Tian , Z Dai , L Zhang , R Zhang , Z Ye , J Wu , **D Jin**, J Yuan, "Preparation and time-gated luminescence bioimaging applications of long wavelength-excited silica-encapsulated europium nanoparticles", *Nanoscale*, 4, 3551-3557 (2012) DOI: 10.1039/C2NR30233K

Abstract: Silica-encapsulated luminescent lanthanide nanoparticles have shown great potential as biolabels for various time-gated luminescence bio-detections in recent years. The main problem of these nano-biolabels is their short excitation wavelengths within the UV region. In this work, a new type of silica-encapsulated luminescent europium nanoparticle, with a wide excitation range from UV to visible light in aqueous solutions, has been prepared using a conjugate of (3-isocyanatopropyl)triethoxysilane bound to a visible light-excited Eu^{3+} complex, 2,6-bis(1′,1′,1′,2′,2′,3′,3′-heptafluoro-4′,6′-hexanedion-6′-yl)-dibenzothiophene–Eu^{3+}-2-(*N*,*N*-diethylanilin-4-yl)-4,6-bis(pyrazol-1-yl)-1,3,5-triazine (IPTES–BHHD–Eu^{3+}–BPT conjugate), as a functionalized precursor. The nanoparticles, which are prepared by the copolymerization of the IPTES–BHHD–Eu^{3+}–BPT conjugate, tetraethyl orthosilicate and (3-aminopropyl)triethoxysilane in a water-in-oil reverse microemulsion consisting of Triton X-100, *n*-octanol, cyclohexane and water in the presence of aqueous ammonia, are monodisperse, spherical and uniform in size. Their diameter is 42 ± 3 nm and they are strongly luminescent with a wide excitation range from UV to ~475 nm and a long luminescence lifetime of 346 μs. The nanoparticles were successfully used for streptavidin labeling and the time-gated luminescence imaging detection of two environmental pathogens, *cryptosporidium muris* and *cryptosporidium parvium*, in water samples. The results demonstrated the practical utility of the new nanoparticles as visible light-excited biolabels for time-gated luminescence bioassay applications.



W Zhang, R Zhang, J Zhang, Z Ye, **D Jin**, J Yuan, "Photoluminescent and electrochemiluminescent dual-signaling probe for bio-thiols based on a ruthenium(II) complex", *Analytica Chimica Acta* available online June 2012 DOI: 10.1016/j.bbr.2011.03.031. www.sciencedirect.com/science/article/pii/S0003267012008963?v=s5

Abstract: Photoluminescence (PL) and electrochemiluminescence (ECL) detection techniques are highly sensitive and widely used methods for clinical diagnostics and analytical biotechnology. In this work, a unique ruthenium(II) complex, $[Ru(bpy)_2(DNBSO\text{-}bpy)](PF_6)_2$ (bpy: 2,2′-bipyridine; DNBSO-bpy: 2,4-dinitrobenzenesulfonate of 4-(4-hydroxyphenyl)-2,2′-bipyridine), has been designed and synthesized as a highly sensitive and selective PL and ECL dual-signaling probe for the recognition and detection of bio-thiols in aqueous media. As a thiol-responsive probe, the complex can specifically and rapidly react with bio-thiols in aqueous solutions to yield a bipyridine-Ru(II) complex derivative, $[Ru(bpy)_2(HP\text{-}bpy)]^{2+}$ (HP-bpy: 4-(4-hydroxyphenyl)-2,2′-bipyridine), accompanied by the remarkable PL and ECL enhancements. The complex was used as a probe for the PL and ECL detections of cysteine (Cys) and glutathione (GSH) in aqueous solutions. The dose-dependent PL and ECL enhancements showed good linear relationships against the Cys/GSH concentrations with the detection limits at nano-molar concentration level. Moreover, the complex-loaded HeLa cells were prepared for PL imaging of the endogenous intracellular thiols. The results demonstrated the practical utility of the complex as a cell-membrane permeable probe for PL imaging detection of bio-thiols in living cells.

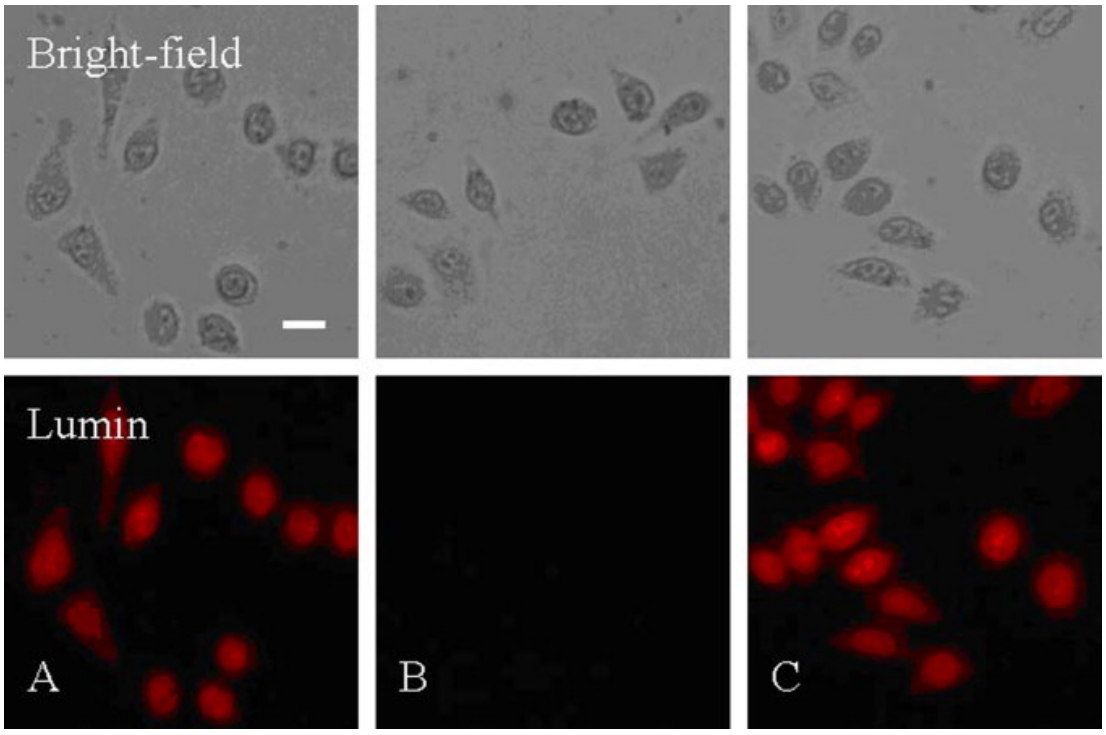


Fig. 8. Bright-field (top) and PL (bottom) images of the $[Ru(bpy)_2(DNBSO\text{-}bpy)]^{2+}$-loaded HeLa cells. (A) The cells were co-incubated with $[Ru(bpy)_2(DNBSO\text{-}bpy)]^{2+}$ (30 μM) for 2 h; (B) the cells were pre-treated with *N*-ethylmaleimide (100 μM) for 1 h, and then incubated with $[Ru(bpy)_2(DNBSO\text{-}bpy)]^{2+}$ (30 μM) for 2 h; (C) the *N*-ethylmaleimide and $[Ru(bpy)_2(DNBSO\text{-}bpy)]^{2+}$ pre-treated cells were further incubated with Cys (50 μM) for 30 min. Scale bar: 10 μm.

J. Lin, **H M Pask**, "Nd:GdVO4 self-Raman laser using double-end polarised pumping at 880 nm for high power infrared and visible output", *Applied Physics B*, available online July 2012
DOI: 10.1007/s00340-012-5093-7

Abstract We report and evaluate a novel double-end polarised 880 nm pumping scheme for a Nd:GdVO4 self-Raman laser, aimed at efficiently generating high output powers in the near-infrared and visible. Compared to conventional single-end pumping, this pump scheme has significant benefits in terms of absorption efficiency, temperature effects in the crystal, and mode-matching between the pumping beam and TEM00 resonator mode. The maximum first-Stokes output powers were 4.1 W for CW operation and 5.63 W for quasi-CW (50 % duty-cycle) operation, with the diode-Stokes conversion efficiency of 11.2 % and 10.3 %, respectively. Visible emission was also realised by intra-cavity frequency-doubling (586.5 nm) or sum-frequency-generation (559 nm) using BBO or LBO crystals. For CW operation, the maximum output power was 3.46 W at 586.5 nm and 4.05 W at 559 nm, with diodevisible conversion efficiency of 10.7 % and 12.5 %; while for quasi-CW operation (50 % duty-cycle), the maximum output peak power was 6.5 W at 586.5 nm and 9.2 W at 559 nm, corresponding to 13.1 % and 18.9 % diode-visible conversion efficiency.

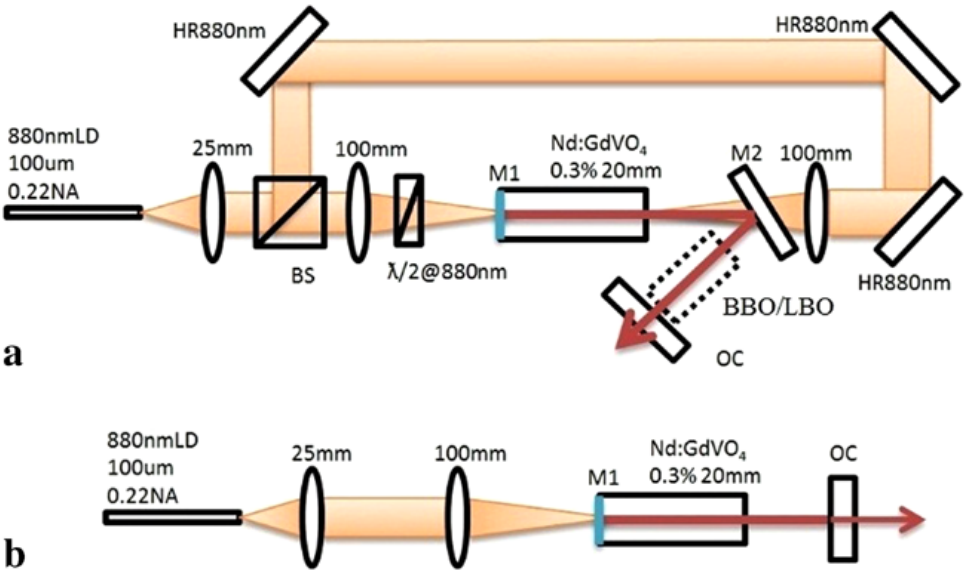


Fig. 1 Schematics of Nd:GdVO4 self-Raman laser with (**a**) double-end polarised pumping scheme; and (**b**) single-end unpolarised pumping scheme

J Lin, H M Pask, "Cascaded self-Raman lasers based on 382 cm−1 shift in Nd:GdVO4", *Optics Express*, 20 (14), 15180-15185 (2012) http://dx.doi.org/10.1364/OE.20.015180

Abstract: We report quasi-continuous-wave, cascaded Nd:$GdVO_4$ self-Raman lasers based on a secondary Raman transition at 382 cm^{-1} for which the Raman gain was estimated to be 0.7cm/GW. Laser output was obtained in the near-infrared at 1108 nm, 1156 nm and 1227 nm. By incorporating intracavity sum-frequency generation (SFG) or second-harmonic generation (SHG), high power output at four discrete visible wavelengths could be selected, specifically 3.4 W at 542 nm, 2.8 W at 554 nm, 1.4 W at 566 nm and 0.8 W at 577 nm, with corresponding diode-to-visible optical conversion efficiencies of 11.7%, 9.7%, 4.8% and 2.7% respectively.

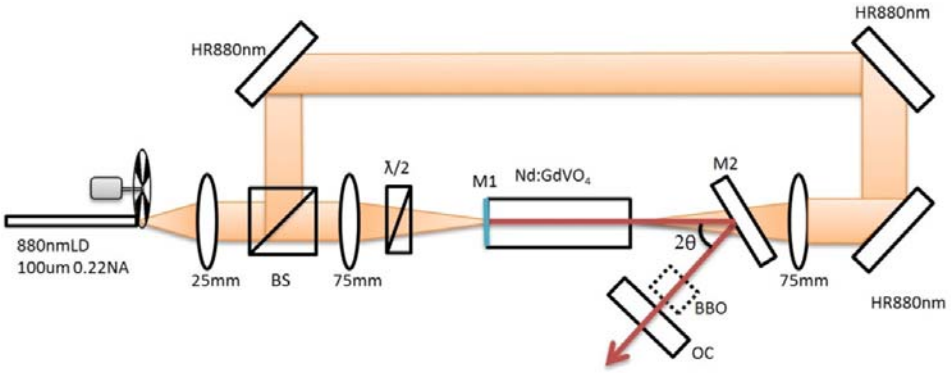
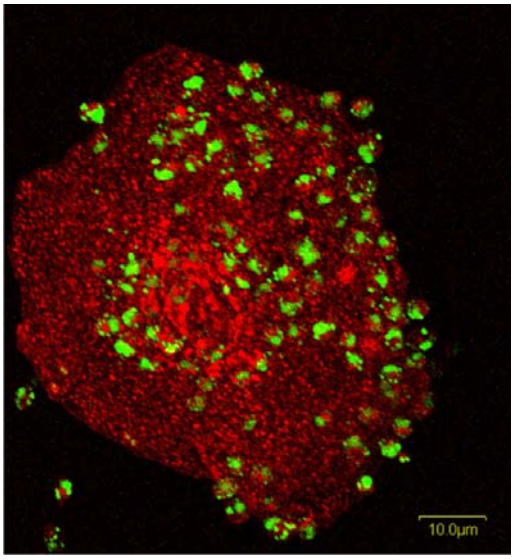


Fig. 2. Schematic diagram of cascaded Nd:GdVO4 self-Raman laser utilizing 382 cm−1 shift.

Recently accepted articles

A V Everest-Dass, **D Jin**, M Thaysen-Andersen, H Nevalainen, D Kolarich, N H Packer, "Comparative structural analysis of the glycosylation of salivary and buccal cell proteins: innate protection against infection by C. albicans" *Glycobiology* (2012) - GLYCO-2012000060.R1 , accepted 10 July 2012

Abstract: Mucosal epithelial surfaces, such as line the oral cavity, are common sites of microbial colonization by bacteria, yeast and fungi. The microbial interactions involve adherence between the glycans on the host cells and the carbohydrate binding proteins of the pathogen. Saliva constantly bathes the buccal cells of the epithelial surface of the mouth and we postulate that the sugars on the salivary glycoproteins provide an innate host immune mechanism against infection by competitively inhibiting pathogen binding to the cell membranes. The structures of the N- and O- linked oligosaccharides on the glycoproteins of saliva and buccal cell membranes were analysed using capillary carbon LC-ESI MS/MS. The 190 glycan structures that were characterized were qualitatively similar, but differed quantitatively, between saliva and epithelial buccal cell membrane proteins. The similar relative abundance of the terminal glycan epitope structures (e.g ABO(H) blood group, sialylation and Lewis type antigens) on saliva and buccal cell membrane glycoproteins indicated that the terminal N- and O-linked glycan substructures in saliva could be acting as decoy binding receptors to competitively inhibit the attachment of pathogens to the surface of the oral mucosa. A flow cytometry based binding assay quantified the interaction between buccal cells and the commensal oral pathogen Candida albicans. Whole saliva and released glycans from salivary proteins inhibited the interaction of C.albicans with buccal epithelial cells, confirming the protective role of the glycans on salivary glycoproteins against pathogen infection.



Adhesion of C, albicans to buccal

N Cvetojevic, N Jovanovic, C Betters, **J S Lawrence**, S C Ellis, G Robertson, J Bland-Hawthorn, "First starlight spectrum captured using an integrated photonic micro-spectrograph", *Astronomy & Astrophysics*, accepted 27th June 2012

Abstract: Photonic technologies have received growing consideration for incorporation into next-generation astronomical instrumentation, owing to their miniature footprint and inherent robustness. In this paper we present results from the first on-telescope demonstration of a miniature photonic spectrograph for astronomy, by obtaining spectra spanning the entire H-band from several stellar targets. The prototype was tested on the 3.9 m Anglo-Australian telescope. In particular, we present a spectrum of the variable star _ 1 Gru, with observed CO molecular absorption bands, at a resolving power R = 2500 at 1600 nm. Furthermore, we successfully demonstrate the simultaneous acquisition of multiple spectra with a single spectrograph chip by using multiple fibre inputs.

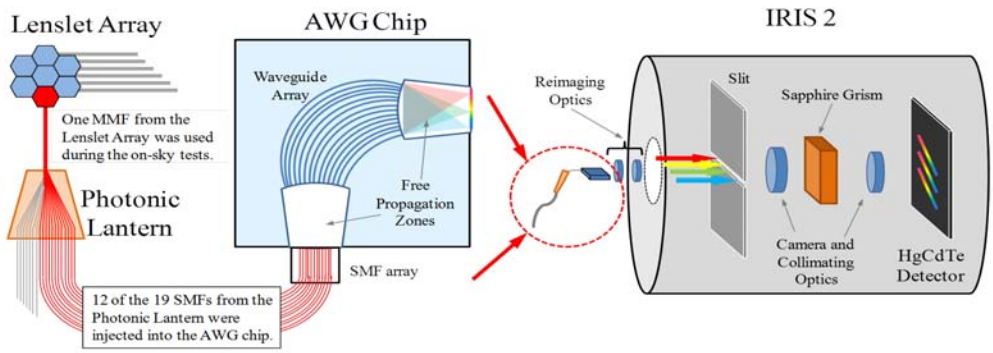


Fig. 1. Schematic of the IPS interface with the telescope. The array of seven lenslets couples the light from the telescope's Cassegrain focal plane into MMFs. For these on-sky results, only one lenslet, and hence one MMF, was used. The light was transported to a photonic lantern, which converts the multimoded light to a series of single modes in multiple SMFs, which were then simultaneously interfaced to the AWG chip. The AWG chip outputs the spectrally dispersed signal from all 12 input SMFs on its output face, which was re-imaged onto the slit. The IRIS 2 imaging spectrograph was used as a cross-disperser, separating the spectra from the multiple input fibres along with the different grating orders.

People and Progress

Welcome to Tristan Temple

Tristan grew up in (old) South Wales, in a small town near the capital Cardiff. He did his PhD at the University of Southampton in the UK, on the topic of plasmonic enhancement of silicon solar cells. After a postdoc at TU-Delft in the Netherlands, he returned to Southampton for another postdoc before moving to Australia. He is now a postdoc (on a prestigious CSIRO John Stocker Fellowship) in **Ewa Goldys**'s group, and is also partly based at CSIRO's West Lindfield labs. Tristan's project involves looking at ways to apply plasmonics (i.e., metal nanoparticles) to light-trapping, spectrum conversion and spectrum splitting for photovoltaics. Outside of work, Tristan enjoys hiking, galleries and the theatre.

Brian Orr

David Coutts and Gabriel Molina-Terriza in Japan …

Gabriel Molina-Terriza and **David Coutts** represented Macquarie University (and *MQ Photonics*) by giving invited talks at the two-day workshop on ***Topological Lightwave Synthesis and its Applications 2012***; see: <http://physics.tp.chiba-u.jp/~omatsu/tlws2012/>. This was held on 5–6 July in Chiba, Japan. It was organised by Prof. **Takashige Omatsu**, who is well known to *MQ Photonics* from his regular visits here. This was a very interesting meeting, bringing together researchers working on different aspects of topological beams, with an emphasis on generation, characterisation and applications of beams whose electric field distribution must be described in full vectorial terms. While Prof. **Miles Padgett** (U of Glasgow) described how to turn a bagel beam into a baguette beam in order to measure the orbital angular momentum of a single photon, I described how, using an optical fibre, to turn a bagel into a danish pastry (the one with the spiral). So far, there is no particularly useful reason for doing this, other than that it was an unexpected, interesting and surprisingly elusive transformation which took me many months to track down and understand, after it had first been observed in **Brian Orr**'s lab some 5 years ago.

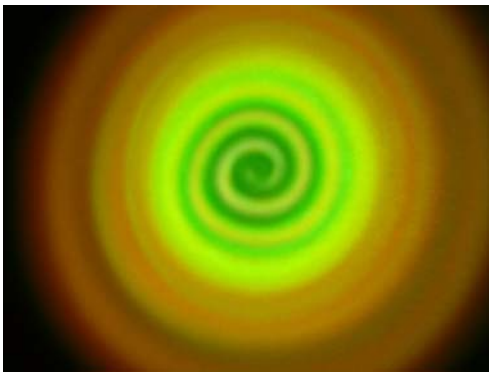
David Coutts

Editor's P.S.:

Having made my own memorable (?) Karaoke rendition of the Beatles' "I saw her standing there" at a previous Chiba workshop, it is notable that David may have been the first *MQ Photonics* visitor to Chiba who has resisted too many unguarded moments at the traditional Karaoke evening. But we're not so sure about Gabriel!

Above: The tall one (not David Coutts) is a *Paraceratherium transouralicum* – the largest known land mammal, now extinct in Tokyo's Science Museum.

Below: David's "Danish pastry" spirals …



"Welcome" to Graham Smith

It has been brought to my attention that we neglected to introduce Graham Smith to the MQ Photonics community when he "recently" started. The following seeks to correct that oversight:

I wish to (*belatedly*) introduce to Dr Graham Smith to *MQ Photonics*. He joins (*joined early 2011*) us from Prof Ian Bennion's research group at Aston University, Birmingham. Graham has a wealth of experience in fs laser microfabrication, skills that he will apply (*is applying*) in his role as Laser Applications Engineer for the Macquarie – Optofab Node of the Australian National Fabrication Facility. Please make (*continue to make / start to make*) him feel welcome.

Mick Withford

Congratulations to Susan Bruck

… our casual Departmental Administrator who shares the office next to the photocopy room with Liz and Amanda Susan tells us that she has just handed in her PhD thesis in Computing. A quick visit to <http://web.science.mq.edu.au/~sbruck/> tells us that Susan's area of expertise concerns things like "cybersickness," "virtual reality therapy," "cybertherapy" and "telemedicine." She should be able to cope with us in Physics and Astronomy, don't you think?

Brian Orr

Macquarie OSA Student Chapter

Recently, the Macquarie University OSA Student Chapter held its annual OSA Soccer tournament, with a number of our *MQ Photonics* members participating. The event was attended by >60 players from all over the Department of Physics & Astronomy, and many spectators. The final was an incredibly close game between the "Quantum Demons" and "No Time for Losers" (*MQ Photonics* representatives), in which the Losers were victorious. A special first place prize for outstanding team costume was awarded to the "Optchicas", a prize which we hope to retain in subsequent tournaments. Great fun was had by all, with friendly competition, bringing the various research groups within the department closer together. More pics are available on request!

In other news, the Laser Maze and Laser Graffiti are still being heavily used to entertain and educate visiting school groups, with a large event scheduled for later this month. While a number of senior members have recently graduated (congratulations!), the chapter continues to grow with fresh recruits. I am continually amazed at the high level of participation and enthusiasm from our newest members.

Nick Cvetojevic
OSA Student Chapter President