

SPIE 
Student Chapter
University College Dublin

SPIE Student Chapter

Annual report

Report submitted: 1 June 2009

Period reported on: January 2008 – December 2008



Elected Officers

Title	Name	email addresses	Member #
President	Dusan Sabol	Dusan.Sabol@ucd.ie	3124896
Vice-President	John Healy	john.healy@ucd.ie	3049735
Secretary	Stephen Crosbie		
Treasurer	Laura Tobin	laura.tobin@ucd.ie	3246337
Women's Officer	Jennifer Ward		
Education Officer	Shui Liu		
Advisor	Prof. John Sheridan	john.sheridan@ucd.ie	

Current Student Chapter Members.

Stephen Crosbie
John Healy
Shui Liu
Dusan Sabol
Laura Tobin
Nektarios Valous
Jennifer Ward

Chapter activities

In April, six members of the chapter took part in a **collage poster session** organised by the UCD Graduate School for postgraduate students in the UCD College of Engineering, Mathematical & Physical Sciences. This event gave us an opportunity to share our research with our peers and with researchers and see the breadth of the research underway in the college. Refreshments were served during the session and informality was the order of the day, making for a great opportunity to let others in the College know about our work.

Photonics Europe 2008 was held in Strasbourg, France. Six chapter members attended. Dusan Sabol gave two talks on different aspects of his work, gratings and photopolymer modelling. Shui Liu gave his first talk at an academic conference, on a new photopolymer model. James Ryle presented a paper on a speckle metrology system and another on measuring ocular micro-tremor. John Healy presented a paper on first order paraxial optical systems simulation and a poster on some optical transform properties. He also chaired Session IV of the Photon Management conference. Karen Molony presented a poster on wavelet analysis techniques in digital holography. Conor McElhinney presented a paper on segmentation of digital holograms.



(l to r) Shui Liu, Dusan Sabol, John Healy and James Ryle at Photonics Europe 2008.

Chapter members attended a number of interesting workshops held at the symposium, including a special session on Entrepreneurship in Photonics for students and early career professionals, and Hands on Optics. Ms Molony spoke very highly of the Women in optics workshop. The student lunch with the experts was a real treat, as the chapter

members ate with Madam President Elect Maria Yzuel and the distinguished expert in biophotonics, Dr Arthur Chiou.

Ms Jennifer Ward worked with Dr Bill Glenn and Prof. William Rhodes at the **Imaging Technology Centre in Florida Atlantic University** from October 2007 until May 2008. She worked on a number of areas, primary imaging through the turbulent atmosphere using lucky imaging and synthetic apertures. Her work there was supported by a bursary from FÁS, Ireland's National Training and Employment Authority. Prof Rhodes has maintained a close collaboration with the group at UCD for the past number of years. Of the experience, Jennifer writes, "This program has been truly inspirational to me. I am full of new ideas for my thesis now based on my experiences in Florida. Although I had already completed two years of my PhD program, the opportunity to get involved in optical research in a state of the art facility and to network and learn from the world experts in my particular area of research was invaluable."

Optics + Photonics 2008, San Diego conference (August). Attended by Dave (poster), Jen (2 talks), Karen (talk), John (talk). Preceded by chapter officer leadership workshop.



At one of the poster sessions. The South Africans (left) got on tremendously with the Irish (right, a combined group from the UCD chapter and Trinity College, traditional rivalries on hold!).



Conferences like Optics and Photonics offer tremendous opportunities to graduate students to meet interesting and influential people. Here John Healy chats with SPIE CEO Eugene Arthurs over lunch.

August was a busy month for us, with San Diego followed by **Optoinformatics'08**. At this informal Summer School organised by the Irish Optics and Photonics Network, we were honoured to attend extended tutorial-style talks by five leading researchers. Professor Ari Friberg spoke on characterising polarization in random electromagnetic fields. Dr Steen Hanson discussed applications of dynamic speckle. Professor Andrew Harvey's talk was on computational imaging. Professor Jürgen Jahns spoke about microoptics for interconnection and processing, and Professor Wolfgang Osten gave a lecture on digital holographic metrology. In addition, a few select postgrads and postdocs, including Jennifer Ward, gave shorter talks. Five chapter members presented posters. Enormous credit must be granted Karen Molony, who had a big organisational role in the school. The venue, NUI Maynooth, was pleasant and free of distractions.

The following week, James Ryle, John Healy and Karen Molony attended the **Biophotonics and Imaging Graduate Summer School '08**. Organised by Dr Martin Leahy of the University of Limerick, this summer school focused on medical imaging, and included lengthy talks by some of the top experts in a number of fields. Valery Tuchin spoke about optical clearing of tissues, a fascinating look at techniques to make tissue more transparent, permitting improved access for both diagnostic imaging and laser surgical tools. Peter So of MIT presented an overview of the field of fluorescence imaging.



BIGSS'08 – visiting the Cliffs of Moher. Pictured are (r to l) Dr Bryan Hennelly, John Healy, Karen Molony, Craig McDougal, Dr Damien Kelly and James Ryle.

The BIGSS'08 was a tremendous success academically and socially. One afternoon was reserved for some group sightseeing. We visited a dolmen in the Burren. A dolmen is a Celtic structure made from two standing stones and a capstone which marked a burial site. The Burren is a unique karst-landscape region composed of limestone

pavements with crisscrossing cracks. The region supports Arctic, Mediterranean and Alpine plants side-by-side, due to the unusual environment. Following a quick visit to the Burren Perfumery, we visited the spectacular Cliffs of Moher (see photo above), which afford a beautiful view out across the Atlantic, though visibility was just a little short of letting us see the Aran Islands. We finished the evening with a medieval banquet in Bunratty Castle. The diverse group of students, drawn from all over Europe, got on tremendously.

Returning (perhaps a little reluctantly!) to the talks, Gert Nilsson spoke about a number of his own research projects through his career in biophotonics, including laser Doppler techniques for measuring blood flow. Dr Nilsson also gave a fascinating talk on the challenges involved in commercialising these sorts of medical devices, drawing on his experience from the set up of a number of such companies. He also emphasised the coming importance of portable medical devices for treatment in the home. Lihong Wang discussed photoacoustic tomography, a really exciting technique which uses ultrasound transducers to detect reflected pressure waves created by laser illumination of the skin, which has shown capability to detect structures at significantly greater depths than pure optical techniques. Jannick Rolland gave a wonderful introduction to an exciting field undergoing substantial study at the moment: optical coherence tomography. Thomas Naughton spoke about a topic of immediate interest to much of the student chapter. Many of us work in or near the field digital holography, and while that material was relatively familiar to us, it was fascinating to see digital holographic microscopy in the context of the other imaging techniques discussed in the school. The final talk was by Rasmus Larsen, and it was a real change of pace. His topic was “Hyperspectral Image Analysis - methods for regression and classification in hyperdimensional spaces”, a very interesting field which attempts to develop automatic tools which apply statistical measures to medical imaging to produce metrics useful in diagnosis. An example given was of a particular kind of inflammation, the severity of which is currently rated subjectively by doctors. By examining the correlation between a large space of statistics generated from an image of an inflamed area and doctor’s rating of the severity of the inflammation, statistics which appear to indicate the severity automatically were found. Of course, it is then necessary to perform larger studies to confirm this result, but this sort of work is very interesting.

Early in September, a **joint SPIE/OSA student chapter event** was held. We were privileged to receive two talks from the eminent Prof. Tony Siegman, who spoke about Fresnel reflection and the origins of the laser. Dr Andrew Ellis of UCC also spoke on optical signal processing challenges in fibre communication, while Dr Damien Kelly of NUIM gave the first of his series of lectures, this one on simulation of ultrashort pulses through an aperture.

In October, three of our members, James Ryle, David Monaghan and Ciara Close, attended the **Frontiers in Optics (FiO) 2009/Laser Science (LS) XXV conference** in Rochester, New York.

John Healy worked with Prof. William Rhodes at the **Imaging Technology Centre in Florida Atlantic University** from November 2008 until April 2008. He worked on characterizing the errors introduced into Fourier optics based numerical simulations of light-wave propagation achieved by digitizing the scalar wave field and propagation equation. His work there was supported by a bursary from FÁS, Ireland’s

National Training and Employment Authority. Prof Rhodes has maintained a close collaboration with the group at UCD for the past number of years. While in the US, John gave a talk to the FAU optics seminar group, visited the **Georgia Tech Research Institute** and attended a conference in Vancouver, BC, the **OSA Topical Meeting and Tabletop Exhibit on Digital Holography and Three-Dimensional Imaging**.

In December, the Applied Optics Group in Galway, lead by Prof. Chris Dainty, hosted an **NUIG-UCD Seminar Day**. David Monaghan, Michael Gleeson, Jennifer Ward and James Ryle all gave talks on their work, as did a number of students from NUI Galway.

Additional talks attended by chapter members (held in UCD unless otherwise noted). Prof. Seamus Curran, Physics Dept., University of Houston, Texas, USA gave a seminar on December 10 on "Nanocomposites - focus from discovery to applied technology". On October 24th, "The Patenting Process in Europe: A view from the European Patent Office" by Dr Eddie Cooke of the European Patent Office. On February 11th, Dr Paul O'Grady gave a talk on, "Sparse Solutions of Non-Negative Under-Determined Systems of Equations".

In 2008, Sean O'Duill and Michael Gleeson graduated with PhDs. The SPIE Student Chapter wishes them every success in their careers.

Membership

Membership has fallen with a number of graduations. However, several lapsed members have promised to renew their membership soon, and new students have already been presented with the benefits of SPIE membership, so we anticipate our numbers climbing again in the near future.

Publications

The chapter members have again been very active in publications this year. Current or former chapter members are highlighted in bold.

Journal papers

- K. Drakakis, **J. Healy** and S. Rickard, "A stochastic analysis approach in the search for Costas arrays," *International Journal of Applied Mathematics and Engineering Sciences*, 2(1), (Jan.-June 2008) 73-88.
- **J. J. Healy**, B. M. Hennelly and J. T. Sheridan, "An Additional Sampling Criterion for the Linear Canonical Transform," *Opt. Lett.* 33(22), 2599-2601 (2008).
- **J. J. Healy** and J. T. Sheridan, "Cases where the linear canonical transform of a signal has compact support or is band-limited," *Opt. Lett.* 33(3), 228-230 (2008).
- **M. R. Gleeson, D. Sabol, S. Liu, C. E. Close, J. V. Kelly, J. T. Sheridan,** "Improvement of the spatial frequency response of photopolymer materials by modifying polymer chain length," *J. Opt. Soc. Am. B* 25(3), 396-406, (2008).
- **M. R. Gleeson, S. Liu, S. O'Duill, J. T. Sheridan,** "Examination of the photoinitiation processes in photopolymer materials," *J. Appl. Phys* 104, 064917, pp. 1-8, (2008).

- **J. P. Ryle**, M. Al-Kalbani, N. Collins, U. Gopinathan, G. Boyle, D. Coakley, and J. T. Sheridan, "Compact portable ocular microtremor sensor: design, development and calibration," *J. Biomed. Opt.* 14, 014021 (2009), DOI:10.1117/1.3083435
- G. Situ, **J. P. Ryle**, U. Gopinathan, and J. T. Sheridan, "Generalized in-line digital holographic technique based on intensity measurements at two different planes," *Appl. Opt.* 47, 711-717 (2008)
- J. V. Kelly, **M. R. Gleeson**, **C. E. Close**, J. T. Sheridan, "Optimised scheduling for holographic data storage," *J. Opt. A: Pure Appl. Opt.* 10, 115203, (2008).
- **D. S. Monaghan**, G. Situ, U. Gopinathan, T. J. Naughton, J. T. Sheridan, "Role of phase key in the double random phase encoding technique: an error analysis," *Appl. Opt.*, Vol. 47, pp. 3808-3816, 2008.
- U. Gopinathan, **D. S. Monaghan**, B. M. Hennelly, C. P. Mc Elhinney, D. P. Kelly, J. B. McDonald, T. J. Naughton, and J. T. Sheridan, "A projection system for real world three dimensional objects using spatial light modulators," *Journal of Display Technology*, Vol. 4, pp. 254-261, 2008.
- Guohai Situ, **David S. Monaghan**, Thomas J. Naughton, John T. Sheridan, Giancarlo Pedrini and Wolfgang Osten, "Collision in double random phase encoding," *Opt. Comm.*, Vol 281, Issue 20, pp. 5122-5125, 2008.

Conference papers

- **J.J. Healy** and J.T. Sheridan, "Simulating paraxial optical systems using the linear canonical transform: properties, issues and applications", *Proc SPIE 7072*, San Diego, USA, (10-14 August 2008).
- **J.J. Healy** and J.T. Sheridan, "Analytical and numerical analysis of ABCD systems", *Proc SPIE 6994*, Strasbourg, France, (7-10 April 2008).
- **J.J. Healy** and J.T. Sheridan, "Bandwidth, compact support, apertures and the linear canonical transform in ABCD systems", *Proc SPIE 6994*, Strasbourg, France, (7-10 April 2008).
- M. W. Grabowski, K. M. Vogelhuber, **D. Sabol**, J. H. Chen, R. R. McLeod, and J. T. Sheridan, "Absorption and bleaching dynamics of initiator in thick photopolymer exposed to Gaussian illumination," *Proc. of SPIE Vol. 7053*, 70530D, (2008).
- **M. R. Gleeson**, **S. Liu**, **C. E. Close**, **D. Sabol**, and J. T. Sheridan, "Improvement of photopolymer materials for holographic data storage," *Proc. SPIE 6994*, 69940P (2008).
- **D. Sabol** and J. T. Sheridan, "Approximate analytic analysis of scatter from slanted gratings," *Proc. SPIE 6994*, 699408 (2008).
- **S. Liu**, **M. R. Gleeson**, **S. O'Duill**, **J. T. Sheridan**, "Examination of the photoinitiation processes in photopolymer materials," *Proc. SPIE*, 6994, 001-0012, SPIE Photon Management, presented by Shui Liu, Chair John T. Sheridan and Frank Wyrowski, Strasbourg, France (2008).
- **J. P. Ryle**, M. Al-Kalbani, N. Collins, U. Gopinathan, G. Boyle, D. Coakley, and J. T. Sheridan, "Speckle interferometric system to measure ocular microtremor," *Proc. SPIE 6991*, 69910H (2008), DOI:10.1117/12.782260

- **J. P. Ryle**, M. Al-Kalbani, U. Gopinathan, G. Boyle, D. Coakley, and J. T. Sheridan, "A compact speckle interferometer for measuring low-amplitude low frequency motion," Proc. SPIE 6994, 69940S (2008), DOI:10.1117/12.781852
- **J. P. Ryle**, M. Al-Kalbani, N. Collins, U. Gopinathan, G. Boyle, D. Coakley, and J. T. Sheridan, "Speckle Interferometric System for Measuring Ocular Microtremor," in Frontiers in Optics, OSA Technical Digest (CD) (Optical Society of America, 2008), paper FThM11.
- **S. P. Ó Raghail** (Irish version of the name James P. Ryle), "Bíonn na súile scéalach: ar thóir chóras neamhtheangmháiligh iniompartha chun mioncreath na súile (MCS) a thomhais," Comórtas A19 – Aiste ar théama innealltóireachta, Comórtas liteartha Oireachtas na Gaeilge 2008. IN IRISH
- **M. R. Gleeson, S. Liu**, J. T. Sheridan, "Non-local photo-polymerization kinetics with multiple termination mechanisms and post-exposure effects," SPIE Proc. 7053, Organic 3D Photonics Materials and Devices II, Paper No. 7053-17, (2008).
- **D. S. Monaghan**, U. Gopinathan, G. Situ, T. J. Naughton, J. T. Sheridan, "Cost function statistical analysis in double random phase encoding," SPIE Optics & Photonics 2008, Proc. SPIE, Vol. 7072, pp. 7072Z, 2008.

Financial information

The SPIE did not have any expenditure during 2008. Planned expenditure for 2009 includes hosting a series of talks on optical propagation and digital holography by Dr Kelly (for which the SPIE grant was specifically applied), and support of the Parson Lectures, a series of seminars hosted in conjunction with the OSA student chapter.

	CR €	DR €
Opening balance (Jan 2008)		504.44
SPIE grants	334.43	
Ending balance (Mar 2009)	838.87	