

SPIE



Student Chapter

University College Dublin

SPIE Student Chapter

Annual report

Report submitted: 1 June 2008

Period reported on: January 2007 – December 2007



Elected Officers 2008

Title	Name	email addresses	Member #
President	Mr John Healy	jhealy@ee.ucd.ie	3049735
Vice-President	Ms Jennifer Ward	jward@ee.ucd.ie	3011680
Secretary	Mr David Monaghan	david.monaghan@ucd.ie	906452
Treasurer	Ms Ciara Close	ciara.close@ee.ucd.ie	867917
Women's Officer	Ms Karen Molony	karen.molony@gmail.com	
Education Officer	Mr Dusan Sabol	dsabol@centrum.sk	
Advisor	Dr. John Sheridan	john.sheridan@ucd.ie	

Current Student Chapter Members.

James Egan
John Healy
Shui Liu
Conor McElhinney
Karen Molony
David Monaghan
James Ryle
Dusan Sabol
Nektarios Valous
Jennifer Ward

Chapter activities

Last December, the chapter was given **25 free books**, by the SPIE. These have proven very useful in our continuing studies.

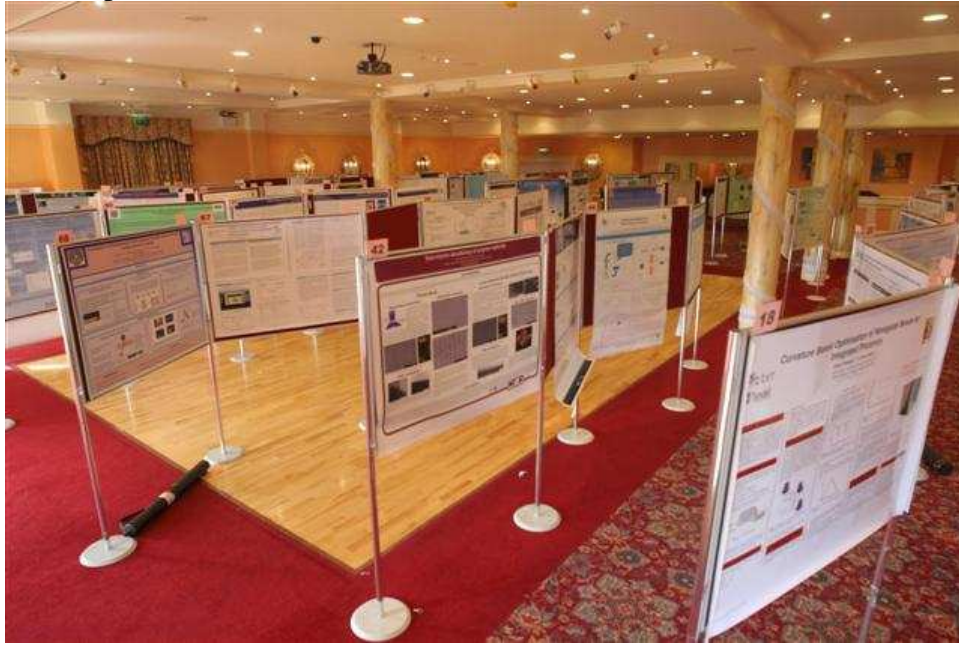
Ms Jennifer Ward worked with Dr Bill Glenn and Prof. William Rhodes at the **Imaging Technology Centre in Florida Atlantic University** from October 2007 until May 2008. She worked on a number of areas, primary imaging through the turbulent atmosphere using lucky imaging and aperture synthesis. Her work 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."

Photonics Ireland 2007 was held from September 24th to 26th, in the Galway Bay Hotel, Galway, Ireland. It was attended by five postgraduates from the UCD group: John Healy, David Monaghan, James Ryle, Dusan Sabol and Jennifer Ward, and three from Maynooth: Conor McElhinney, Jonathan Maycock and Karen Molony. We were accompanied by the group postdoctoral researcher, Dr Guohai Situ. Photonics Ireland 2007 was the first conference organized by the Irish Optics and Photonics Network, an informally organized network which brings together research students, post-docs, senior researchers and industry in the photonics sector in Ireland. This all-Ireland conference had ten scientific sessions covering most aspects of photonics research in Irish academia, and included a special Photonics Industry Session.



The attendees at Photonics Ireland 2007

The Conference was a major success for all involved, with 180 participants representing the Photonics Research Community in Ireland. 30 scientific papers were presented, 6 of which were delivered by invited international speakers. The Conference was formally opened by Prof. Fionn Murtagh, Director of ICT Directorate at SFI (Science Foundation Ireland). An impressive poster session boasting 140 posters was also held, in which each of the students presented their work.



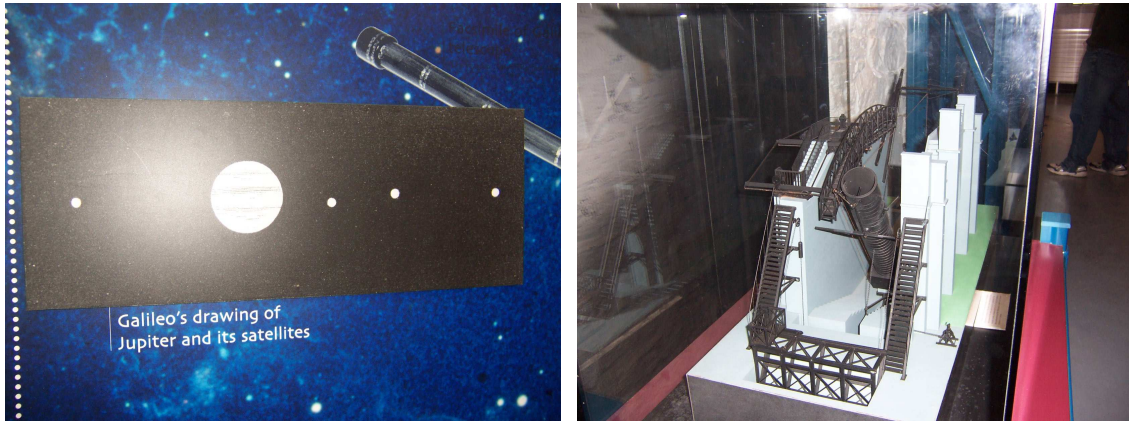
140 posters on display at Photonics Ireland 2007

The conference was an excellent opportunity to view the photonics research going on in Ireland, and to make useful contacts in industry and academia.

In August, a number of members, including Dave Monaghan, attended **Optics and Photonics 2007**, in San Diego, CA.

On 29th May 2007, a group of us **visited the observatory and museum in the Birr Castle Demesne**. Birr Castle is located in County Offaly, in the centre of Ireland, about two hours from Dublin. During the 1840's and starting from virtually first principles, the third Earl of Rosse designed and had built a 72 inch reflecting telescope which was the largest in the world and remained so for three quarters of a century. He used this instrument, now known as Rosse's Leviathon, to study and record details of immensely distant stellar objects and to provide evidence that many of these mysterious nebulae were actually galaxies.

Two students drove the rest of us down, and we met at the visitor centre where we drank tea and coffee. We explored the extensive displays in the visitor centre, which began with some introductory material to astronomy, including reproductions from Galileo's notes. Pictured below you can see one of these – Galileo's drawing of Jupiter and its satellites. The displays then turned to the astronomy done by the Parsons family at the site, with particular focus on the Earl of Rosse's Leviathon – the 72 inch telescope. Scale models, diagrams and photographs told the story of this incredible piece of craftsmanship.



*(left) Galileo's drawing of Jupiter and its satellites.
(right) A scale model of Rosse's Leviathan*

The displays turned to other work of the Parsons family, including the steam turbine, which Charles Parsons patented in April 1884 and used to drive an electrical generator, which he also designed.



(l to r) Dave Monaghan, John Healy, Jennifer Ward, Dr Unnikrishnan Goptinathan, Dr Guohai Situ and James Ryle. In the background is Birr castle.

We then turned our attentions outdoors. It's not possible to visit the castle itself, as this is still occupied, but we explored the grounds and found Rosse's Leviathan.



The Leviathan of Parsonstown – the Earl of Rosse's 72 inch telescope.

We then visited the gardens, before rounding off the trip with a meal. The trip offered a fascinating glimpse of a piece of astronomy history, and the experience of visiting a genuinely historic artefact of natural philosophy in Ireland.

In 2007, **SPIE Educational Scholarships in Optical Science and Engineering** were awarded to both Mr Michael Gleeson and Mr John Healy.

Publications

There is a strong publishing ethic within the chapter. This is reflected in our recent publication record. Papers prefixed with an asterix were invited papers.

Book Chapters

- **C. P. Mc Elhinney**, B. M. Hennelly, T. J. Naughton, and B. Javidi "Extraction of three-dimensional information from reconstructions of in-line digital holograms", *Three-dimensional Imaging, Visualization and Display*, Springer September 2008.

Journal

- 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, accepted for publication (2008).

- **C. P. Mc Elhinney**, B.M. Hennelly, and T.J. Naughton. “Extended focused imaging for digital holograms of macroscopic three-dimensional objects”, *Applied Optics* 47, pp.D71-D79 (2008).
- K. Drakakis, **J. Healy** and S. Rickard, “A stochastic analysis approach in the search for Costas arrays,” accepted for publication, *International Journal of Applied Mathematics and Engineering Sciences* (2008).
- 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).
- M. R. Gleeson, **D. Sabol**, **S. Liu**, C. E. Close, J. V. Kelly, J. T. Sheridan, “Improvement of the spatial frequency response of photopolymer material by modifying polymer chain length,” *J. Opt. Soc. Am. B*, **25**, No. 3, pp.396-406 (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**, 228-230 (2008).
- **D. S. Monaghan**, U. Gopinathan, T. J. Naughton, J. T. Sheridan, “Key-space analysis of double random phase encryption technique”, *Appl. Opt.*, Vol. 46, Issue 26, pp. 6641-6647 (2007).
- Guohai Situ, U. Gopinathan, **D. S. Monaghan**, J. T. Sheridan, “Cryptanalysis of optical security systems with significant output images ”, *Appl. Opt.*, Vol. 46, Issue 22, pp. 5257-5262, (2007).
- **C. P. Mc Elhinney**, A. Castro, Y. Frauel, J. B. Mc Donald, B. Javidi, and T. J. Naughton. “Depth-independent segmentation of macroscopic three-dimensional objects encoded in single perspectives of digital holograms”, *Optics Letters*, 32, pp.1229-1231 (2007).
- M. R. Gleeson, J. V. Kelly, **D. Sabol**, C. E. Close, **S. Liu**, J. T. Sheridan, “Modelling the photochemical effects present during holographic grating formation in photopolymer materials,” *J. Appl. Phys.* **102**, 023108, pp. 1-9 (2007).
- D. P. Kelly, **J. E. Ward**, U. Gopinathan, J. T. Sheridan “Controlling speckle using lenses and free space”, *Opt. Lett.*, **32**, pp. 3394-3396 (2007)

Conferences

In addition to the below, a number of members have papers accepted for Optics and Photonics 2008.

Euro American Workshop on Information Optics

- * **C.P. McElhinney**, B.M. Hennelly, L. Ahrenberg, J. Maycock, T. Kreis, J. McDonald, and T.J. Naughton “Automated twin-image removal from in-line digital holograms”, Euro American Workshop on Information Optics, Annecy, France, 1st - 5th June, 2008.

Photonics Europe 2008

- **J. J. Healy** and J. T. Sheridan, “Analytical and numerical analysis of ABCD systems” Proc SPIE 6994, Strasbourg, France (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 (2008).
- **C. P. McElhinney**, B. M. Hennelly, J. B. McDonald, and T. J. Naughton, “Segmentation of macroscopic object digital holographic reconstructions using extracted depth information” Proc. SPIE Vol. 7000, 700003 (2008).
- **C. P. McElhinney**, B. M. Hennelly, and T. J. Naughton. “Focused Image creation approaches for macroscopic objects encoded in digital holograms”, Photonics Europe Conference, Strasbourg, France (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 Vol. 6994, 69940P (2008).
- **D. Sabol** and J. T. Sheridan, “Approximate analytic analysis of scatter from slanted gratings” Proc. SPIE Vol. 6994, 699408 (2008).
- **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 Vol. 6994, 69940S (2008).
- **S. Liu**, M. R. Gleeson, S. O’Duill, and J. T. Sheridan, “Examination of the photoinitiation processes in photopolymer materials” Proc. SPIE Vol. 6994, 69940O (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).

Digital Holography and Three-Dimensional Imaging 2008

- **C. P. McElhinney**, B. M. Hennelly, and T. J. Naughton. “Focused image creation algorithms for digital holograms of macroscopic three-dimensional objects”, Digital Holography and Three-Dimensional Imaging, Tampa Bay, Florida, USA (2008).

Photonics Ireland 2007

- **D. S. Monaghan**, G. Situ, T. J. Naughton, J. T. Sheridan, “Security analysis of phase-encoded input images in Optical Encryption”, Photonics Ireland, Galway, Ireland (2007).
- **D. Sabol**, C. E. Close, M. R. Gleeson and J. T. Sheridan, “Photochemical processes in dry photopolymer”, Photonics Ireland, Galway, Ireland (2007).
- **J. P. Ryle**, G. Situ, U. Gopinathan, **D. S. Monaghan**, S. McDonnell, T. J. Naughton and J. T. Sheridan, “Digital holographic techniques imaging biological specimens”, Photonics Ireland, Galway, Ireland (2007).
- **J. Ward** and J. Sheridan, “The measurement of localised deformations using in-plane speckle photography and mixed domain linear canonical transforms”, Photonics Ireland, Galway, Ireland (2007).
- **J. J. Healy**, B. M. Hennelly, J. T. Sheridan and D. Kelly, “Simulation of Linear Paraxial Optical Systems Using Linear Canonical Transforms”, Photonics Ireland, Galway, Ireland (2007).

- **C.P. McElhinney**, B.M. Hennelly, J.B. Mc Donald, and T.J. Naughton. “Segmentation of macroscopic objects from digital holograms using focus and shape information”, Photonics Ireland Conference, Galway, Ireland (2007).

Irish Machine Vision and Image Processing Conference 2007

- **C. P. McElhinney**, A. Castro, Y. Frauel, J.B. Mc Donald, B. Javidi, and T.J. Naughton. “Segmentation of three-dimensional objects from background in digital holograms”, Irish Machine Vision and Image Processing Conference, Maynooth, Ireland, 5th – 7th September 2007.

Advanced Laser Technologies 2007

- * **C.P. McElhinney**, B.M. Hennelly, and T.J. Naughton, “Image processing of real-world three-dimensional objects sensed with digital holography,” Advanced Laser Technologies - ALT’07, Levi, Finland, 3rd - 7th September, 2007.

Optics and Photonics 2007

- * **D.S. Monaghan**, G. Situ, **J. Ryle**, U. Gopinathan, T. J. Naughton, J. T. Sheridan, “Key-space analysis of double random phase encryption”, Optics & Photonics 2007, San Diego, CA, USA (2007).
- **D. Sabol**, M. Gleeson, C. Close, **S. Liu**, and J. Sheridan, "Photopolymer material used in the recording of slanted gratings", Proc. SPIE Vol. 6698, San Diego, (2007).

Planned activities

April 2008 will see a **collage poster session** organised by the UCD Graduate School for postgraduate students in the UCD College of Engineering, Mathematical & Physical Sciences. A number of our members will attend **Photonics Europe 2008** in Strasbourg, France. More will attend **Optics and Photonics 2008** in August. Mr Michael Gleeson, who is shortly to be examined for his PhD, will give a talk on his thesis in June. Almost half of the UCD group work on **holography**, and for them, this talk will be particularly interesting. Ms Jennifer Ward will present a short talk on her work on **lucky imaging and synthetic apertures** undertaken in Florida Atlantic University. In August, an informal **Summer School** is intended for PhD students and post-docs working in the general area of physical optics and information processing. At the end of August, two members plan to attend **Biophotonics and Imaging Graduate Summer School 2008**.

Financial information

As the SPIE student chapter was inactive recently, there is relatively little movement in our accounts. Due to changes in personnel, some information was not available at the deadline for this report. Additional information has been requested from our bank.

	DR€	CR€
Beginning balance		?
Funds raised and expended		
Trip to Birr Observatory	253.91	
Details of SPIE funding received		
Activity grant	?	
Travel grant	?	?
Other sources	0	
<u>Ending balance (January 2008)</u>		<u>504.44</u>