

# Research Training

CUDOS is strongly committed to mentoring, education and training to help our local and international postgraduate students in their current research and prepare them for future roles in academia and industry. We therefore organise research and training seminars and encourage and support students and early career researchers to attend professional training courses and take part in collaborations both with other CUDOS nodes as well as with partner investigators overseas.

## Enrolments/Completions

In 2011 completions and enrolments exceeded targets and graduate outcomes are strong. Sixty Six students were enrolled in postgraduate studies over all CUDOS nodes, in either PhD, Masters by Research, Masters by Coursework and Honours programs. Twenty three students completed their studies in 2011; we congratulate and wish them all the best in their future endeavours.

## Exchange Program CUDOS – Imperial College London

2011 saw the announcement of the CUDOS-Imperial College London Metamaterials PhD Student Exchange Program. The program is designed to enhance the collaborative links with our partners in London in the areas of metamaterials and plasmonics. It supports PhD students undertaking their studies at one of the CUDOS nodes to visit and work with our Partner Investigator, Sir John Pendry, or one of his co-workers at Imperial College for up to 6 months, with travel and living costs covered jointly by CUDOS and ICL. Following a competitive assessment process the first two recipients were selected at the end of 2011; Charan Shah from RMIT and Wei Liu from ANU will commence their exchange in 2012. Reciprocal visits from PhD students enrolled at ICL are anticipated in 2012.

**CUDOS – Imperial College London Exchange, LtoR:**  
*Dragomir Neshev (CUDOS), Charan Shah, Ortwin Hess (Imperial College), Wei Liu and Ross McPhedran (CUDOS)*



### Entrepreneurship Seminar Series

The theme of many of this year's activities was entrepreneurship and commercialisation, with the aim to introduce CUDOS students and staff to the process and the difficulties of creating a commercial product from an initial invention or "how to move an invention from the research lab into the real world".

The highlight of these activities was clearly the CUDOS Entrepreneurship Seminar Series; five seminars given by high profile speakers from industry backgrounds, speaking on various aspects of entrepreneurship. The series was conceived and facilitated by Dr. Simon Poole, from CUDOS' industry partner Finisar and CUDOS Board Member. The series was sponsored by CUDOS and the Australian Optical Society (technical sponsor). The seminars were broadly advertised and open to any interested parties.

This Series comprised a mix of talks on various background aspects of entrepreneurship and commercialisation and "war stories" of entrepreneurs speaking about their experiences of creating a product from a research innovation. Dr Poole kick started the series with "A tale of three start-ups: Indx, Finisar and WaveShaper" which was followed by talks from Karl Rodrigues (CSIRO), Dr John Haywood (Smart Digital Optics), John Dyson (Smartfish Ventures) and Dr. Harald Rosenfeldt (former Adaptif Photonics now Finisar). With the exception



**John Dyson from Starfish Ventures at the Entrepreneurship Seminar Series**

of John Dyson's talk, which was held in conjunction with the KOALA student conference in Melbourne, all seminars were presented at the University of Sydney, recorded on video and made available via the CUDOS website ([http://cudos.org.au/education/seminars\\_videos.shtml](http://cudos.org.au/education/seminars_videos.shtml)) to give students and staff from other nodes access to the seminar contents.

Attendance figures exceeded 50 at each of the seminars and staff and students availed themselves of the opportunity to initiate informal discussions with the speakers over the lunch provided. Based on its success in 2011, the Entrepreneurship Seminar Series is scheduled to continue in 2012 with an exciting line up of speakers planned.

# Research Training Continued

## Training Opportunities and Mentoring

Students are encouraged and receive support to attend training programs run by their universities. For example, Tristan Castro undertook a Graduate Certificate in Commercialisation at RMIT. This degree aims to provide those with a commercialisation dimension to their research activity with the essential knowledge and skills to fulfill their role. Alexander Solntsev at ANU completed "Tutoring and Demonstrating in Science".

Students are provided with many opportunities to present their work to peer groups and get feedback from mentors. The Annual CUDOS Workshop features a session where all students present a synopsis of their work in one minute, using a single slide accompanied by their poster. The posters are then judged by a panel of international experts and prizes awarded to the winners.

The Centre is also committed to providing mentoring and career development opportunities for its early career researchers. Mentoring takes place in the context of formal and informal gatherings and other activities that promote career development and enhancement. Junior researchers are encouraged and receive generous support to attend international conferences where opportunities for networking and introduction to professional colleagues are provided by senior researchers. Members of the Centre's Leadership Group assist junior staff members with preparation of grant applications. In 2011 a new position of Project Leader for each of the six Flagship projects was created and offered, where possible, to early career researchers to provide greater exposure to and experience in areas of project management.

CUDOS' strong commitment to mentoring is no more evident than in its success in the latest funding rounds for ARC Discovery Early Career Researcher Awards (DECRA), with six DECRA's being awarded across the Centre.

## Annual Student Competition

Each year CUDOS organises a student competition challenging our students to think outside the box and create displays, videos or posters in areas such as outreach or teaching. The competition is judged at the Annual CUDOS Workshop. The 2011 competition required students to design an outreach poster or activity, relevant to CUDOS research that would appeal to and engage senior high school students by connecting to fundamental science and stimulating their interest in the study of Optics. The competition was judged by high school students from Tomaree High School, and was won by Macquarie University students Yuwen Duan, Alex Arriola and Simon Gross for their "Laser telephone" which is a hands-on demonstration of light transmitting information from

a microphone to a head set. Students can observe the light reflecting off several mirrors to the detector, and can adjust the mirror angles to change the optical path and change the detected signal. The second prize winners, Thomas Meaney, Chris Miese and Jocelyn Liu, also from Macquarie, presented a poster entitled "Optical Fibre Networks."



**Winners of the 2011 Student Competition**

## Student Achievements

Our students continue to impress with their success in various competitions and recognition by peak national and international professional bodies, thus adding to the CUDOS Portfolio of Student Achievements.

**The Australian Institute of Physics Postgraduate Presentation for 2011** was awarded to **Alessandro Tuniz** from the University of Sydney for his talk on *Drawing the Invisible Fibres for Hyperlenses and Emperor's Clothes*. Also awarded was a highly commended prize to **Robert Williams** from Macquarie University for his talk on *Lasers Switched on by Light: An Optically-Driven All-Fibre Q-Switch*. Robert was also the recipient of the **Australian Optical Society Postgraduate Student Prize**.

Alessandro also received **The University of Sydney Faculty of Science Postgraduate Research Prize for Outstanding Academic Achievement**, and the **Incubic/Milton Chang Student Award** from The Optical Society, to assist with travel to CLEO for the purpose of presenting a paper.

**Thomas Meaney** from Macquarie won **Best Poster** at the IEEE International Symposium of Optomechatronic Technologies in Hong Kong and **Liang Du** from Monash was awarded the **Corning Outstanding Student Paper Award**, OFC/NFOEC 2011.

# Research Students

## 2011 Student Members of CUDOS

	NAME	ARC CENTRE SUPERVISOR(S)	THESIS TOPIC
Macquarie University	PHD		
	Alex Arriola	Fuerbach, Withford	Nanophotonic sensor fabricated with ultrafast and high energy pulsed lasers
	Nick Cvetojevic	Withford, Steel, Jovanovic	Development of the Integrated Photonic Spectrograph for Astronomy
	Yuwen Duan	Withford, Marshall	Development of multiple wavelength waveguide lasers
	Simon Gross	Fuerbach, Withford	Photonics Device Fabrication
	Geraldine Marien	Withford, Jovanovic	High Temporal and spectral resolution astronomy with Fibre Bragg Gratings
	Thomas Meany	Withford, Marshall	Quantum photonic devices
	Christopher Miese	Fuerbach, Withford	Micro structuring of transparent dielectrics with Femtosecond pulses in the high repetition rate regime
	Liu Qiang	Steel, Withford	One way laser writer waveguides in nonlinear soft glasses
	Izabela Spaleniak	Withford, Lawrence, Ireland	Photonic lanterns in astronomy
	Robert Williams	Withford, Marshall, Steel, Jovanovic	Advanced point-by-point fibre Bragg gratings and applications in fibre lasers
MASTERS (MPhil)			
Dionne Haynes	Withford, Dawes	Relative contributions of scattering, diffraction and modal diffusion to Focal ratio degradation in optical fibres	
Monash University	PHD		
	Liang Du	Lowery	Fibre nonlinearity mitigation techniques in optical communication systems
	Mohammad Morshed	Lowery	Nonlinear Processing for Optical OFDM System
	MASTERS (MEng)		
Martin Firus	Lowery	Optical analogue to digital conversion for ultra high speed communications systems	
Swinburne	PHD		
	Ben Cumming	Gu, Zhou	Aberration compensation in high refractive index materials
	Zongsong Gan	Gu, Jia	Radiation dynamics in nanophotonic systems
	John He	Jia, Gu	Active hybrid photonic nanostructures
	Han Lin	Gu, Jia	Parallel laser writing of nanophotonics devices
	Hossain Md. Muntasir	Gu, Jia	Metallic and hybrid plasmonic nanostructures
	Elisa Nicoletti	Gu	Engineering and characterisation of chalcogenide-based photonic microstructures
Mark Turner	Gu, Davis	Plasmonic chiral structures	

# Research Students Continued

	NAME	ARC CENTRE SUPERVISOR(S)	THESIS TOPIC
ANU-NLPC	PHD		
	Xin Gai	Luther-Davies, Madden	Nanophotonic nonlinear devices produced by e-beam lithography
	Ting Han	Wang, Luther-Davies	Nano-Moulding of Integrated Optical Devices
	Khu Tri Vu	Madden, Luther-Davies	Tellurite waveguides
	Ting Wang	Luther-Davies, Wang	Understanding and optimising the microstructure of Ge-As-Se glasses for optimal device performance
	Jin Zhe	Luther-Davies, Madden, Choi	Hybrid photonic waveguides
ANU-NLPC	PHD		
	Francis Bennet	Neshev, Krolikowski	Light propagation in tuneable nonlinear periodic photonic structures
	Artur Davoyan	Shadrivov, Sukhorukov, Kivshar	Nonlinear Plasmonics and Metamaterials
	Kirsty Hannam	Powell, Shadrivov, Kivshar	Tuning and coupling in metamaterials
	Sergey Kruk	Neshev, Kivshar	Compensation of Losses in Fishnet Multilayer Metamaterials
	Mingkai Liu	Powell, Shadrivov, Kivshar	Complex chiral metamaterials
	Alexander Solntsev	Sukhorukov, Neshev, Kivshar	Optical interactions in nonlinear photonic nanostructures
	Yue Sun	Sukhorukov, White, Choi, Kivshar	Nonlinear and optomechanical interaction in photonic devices
Wei Liu	Neshev, Miroshnichenko, Sukhorukov	Resonant Phenomena in Plasmonic Nanostructures	
RMIT	PHD		
	Iryna Khodasevych	Mitchell, Rowe	Tunable Metamaterials at Millimetre-wave Frequencies
	Charan Manish Shah	Mitchell, Sriram, Bhaskaran	Realisation of tunable metamaterials at millimetre-wave frequencies
	Tristan Crasto	Mitchell, Steigerwald	PPLN waveguides for Ultrahigh Bandwidth Signal Processing
	Naser Dalvand	Mitchell, Nguyen	Numerical Simulation of Silicon Photonic Devices Employing Lateral Leakage
	Geethaka Devendra	Mitchell, Nguyen	Slot enhanced coupling
	Tim Lunn	Bui, Mitchell	Investigation of non-linear polarisation phenomena in Lithium Niobate Waveguides
	Kiplimo Yego	Mitchell, Nguyen	Silicon Photonics Biosensors Employing Lateral Leakage
	Eike Zeller	Mitchell, Nguyen	Planar fluid-infiltrated waveguide platforms
	Mahmud Tanveer	Bui, Mitchell	Doped Polymer Waveguides for Optofluidic Sensors
HONOURS			
	Anthony Hope	Mitchell, Nguyen	Silicon Photonic and Plasmonic Waveguide Sensors
UTS	PHD		
	Dougal Kan	Botten, Poulton	Semi-analytic modelling of Photonic Crystal Woodpiles



NAME	ARC CENTRE SUPERVISOR(S)	THESIS TOPIC
<b>PHD</b>		
John Scott Brownless	de Sterke, Steel, Judge	Optics in Metamaterials
Alvaro Casas Bedoya	Eggleton, Domachuk	Optofluidics dispersion engineering of photonics crystal waveguides
Parry Chen	McPhedran, de Sterke	Modal simulation methods and anomalous wave propagation in periodic structured plasmonic and metamaterial systems
Matthew Collins	Eggleton, Xiong	Nonlinear Photonic Devices for Quantum Information Processing
William Corcoran	Eggleton, Monat	Enhanced optical nonlinearity in silicon waveguides for ultrafast all-optical devices
Stephen Dekker	Eggleton, de Sterke	Supercontinuum Generation in Dispersion Engineered Arsenic Sulphide Waveguides and Tapers
Tomonori Hu	Jackson, Hudson, Eggleton	Creating highly efficient mid-infrared fiber lasers capable of high power, high repetition rate, pulsed emission
Irina Kabakova	de Sterke, Eggleton	Control of light in Bragg gratings by nonlinear switching and rapid frequency tuning
Felix Lawrence	de Sterke, McPhedran, Botten, Dossou	Photonic crystal antireflection coatings, surface modes, and impedances
Michael Lee	Eggleton, Grillet	Nonlinearity and Photosensitivity in Chalcogenide Glass Photonic Crystals
Sahand Mahmoodian	de Sterke, McPhedran, Poulton	Theoretical methods for localised photonic crystal modes
Yvan Paquot	Eggleton, Schröder	Integrated all optical information processing at ultrahigh bit rate
Alessandro Tuniz	Fleming, Kuhlmeiy	Fiber Metamaterials
Trung Vo	Eggleton, Pelusi, Schröder	All-optical and non-linear signal processing
<b>MASTERS BY RESEARCH (MSc)</b>		
Björn Sturmborg	de Sterke, McPhedran	Photonic Crystal Photovoltaics: More Absorption with Less Silicon
<b>MASTERS BY COURSEWORK (MPhotOptSci)</b>		
Pat Blown	de Sterke, Gutman	Characterisation of Slow Light Photonic Crystals Waveguides Through Reflection Properties
Tomonori Hu	Eggleton, Schröder	Complex filtering in dissipative solitons lasers
Rong Li	Jackson	Exciting Ho-doped silicate glass fiber lasers using high power diode lasers operating at 1.95 um
Matthew Stuart	Eggleton, Husko	Dispersion Measurement of Slow Light in Photonic Crystal Waveguides
<b>HONOURS</b>		
Owen Brasier	Eggleton, Schröder	Noise Monitoring in optical Networks
John Scott Brownless	de Sterke	Hexagonal Lattice Photonic Crystal Waveguide Arrays: from Slow Light to Supermodes
Adam Byrnes	Eggleton	Stimulated Brillouin Scattering Induced Slow and Fast Light on a Photonic Chip
Rebecca Lodin	Kuhlmeiy, Domachuk	Silk Biophotonic Sensing

The University of Sydney