

# Education and Training: Boris Kuhlmeiy



CUDOS maintains a strong commitment to education and training activities, not only through research training of local and international postgraduate and undergraduate students, but also through encouraging collaborations with other CUDOS nodes and overseas research centres, student competitions, support for participation in outreach activities and student chapters, and emphasis on a strong collegiate experience for all students especially at the Annual Workshop.

## Student collaborations

The annual CUDOS workshop is a fantastic opportunity for students to meet students and researchers from other nodes, but also from overseas (in particular PIs and guest speakers). CUDOS actively encourages collaborations between nodes and with PIs, and many such collaborations have started through discussions

at the student poster sessions. Notable examples were Sahand Mahmoodian (UoS) who not only closely collaborated with UTS and ANU, leading to several publications, but also spent 3 months with John Sipe (U. Toronto, and PI of the renewed CUDOS).

Irina Kabakova (UoS) had a close collaboration with Dr. Stephen Mihailov's group (Communication Research Centre, Ottawa, Canada), using gratings written in bismuth-oxide highly-nonlinear fiber by femtoseconds laser radiation in Ottawa for nonlinear switching experiments, and leading to several publications, including a post-deadline publication at FiO2010. Further, Irena with Martijn de Sterke and David Halliwell – a third year student at UoS, also collaborated with Walter Margulis' group at ACREO AB in Kista, Sweden, modelling and explaining unusual experimental results in switching experiments in double-hole optical fiber Bragg grating driven by electrical signals, also leading to a publication.

Swinburne CMP student Md Muntasir Hossain performed a collaboration work with Gengyan Chen and Xue-Hua Wang, State Key Laboratory of Optoelectronic Materials and Technologies, School of Physics and Engineering Sun Yat-Sen University, China. The research topic was to optimise the dispersion induced enhanced absorption in 3D woodpile metallic photonic crystals. The research group from China worked on calculating the band diagrams of 3D silver woodpile MPCs by using Finite-Difference Time-Domain (FDTD) method, and the work was published in Optics Express in 2010.

From the 20th of February to the 13th of March 2010, Swinburne CMP student Ben Cumming travelled to the University of Oxford to participate in collaborate research on the fabrication of three-dimensional photonic crystals with an adaptive optics setup. Working in the Department of Engineering Science with Alexander Jesacher and Martin Booth, the team demonstrated significant improvement in photonic crystal quality when an adaptive optics system was used to compensate for aberration in photonic crystal fabrication.

Mark Turner (Swinburne CMP) visited Freidrich Alexander University Erlangen-Nuremburg, in September 2010 for a collaboration on fabrication and analysis of gyroid photonic crystals; this work has already led to two conference presentations.



Happy students at the 2010 CUDOS workshop.



**Nem Jovanovic receiving first prize of the Optics Visualized at the BGPP Meeting in Karlsruhe, Germany.**

Wei Liu (ANU NLPC) collaborated closely with Chris Poulton (UTS), interacting at the workshop and through mutual visits, leading to a publication in Applied Physics Letters.

### **Undergraduate and postgraduate coursework**

A number of CUDOS researchers hold teaching and research positions or do small amounts of voluntary teaching, within their respective universities. This provides a great opportunity to share our expertise, make courses more attractive by including examples of current research, and foster the next generation of photonics researchers and engineers.

At the University of Sydney, CUDOS staff has been heavily involved in the development and the teaching of the new Masters and Graduate Diploma in Photonics and Optical Science, which had its first student intake in 2010. In particular Ben Eggleton and Martijn de Sterke taught physical and non-linear optics, David Moss gave a course on light sources and detectors, Christian Grillet and Christelle Monat gave lectures on nano-photonics, Chris Walsh organized a course entitled 'Optics in the Industry,' and Boris Kuhlmeiy gave several lectures on biophotonics. The programme, coordinated by former CUDOS student Peter Domachuk, has already proven to be successful with 12 students enrolled in 2010. CUDOS research staff are looking forward to supervise some of these students for research projects in 2011 and beyond. David Moss also gave lectures on optical data storage and processing.

At Macquarie University, Mike Steel delivered third year course on classical optics, a series of graduate seminars on theory of guided wave optics, and also spoke at the University of Sydney's OSA Student Chapter careers night. Judith Dawes was acting degree director for BSc (Photonics) and B Optical Technology, and she also organised the annual Department of Physics and Astronomy Careers Evening, for which Nem Jovanovic (amongst others) was a guest speaker on the topics of postdoctoral research, resumes and job interviews. She was also Department Director for Higher Degree Research Students. Judith Dawes and Michael Withford co-taught the unit Physics Research Skills, incorporating project

management, budgeting, journal and thesis writing, IP, ethics, and career development for postgraduate students.

Michael Withford gave a 2nd year course on Introduction to Optical Science and Technology. This course material included examples of CUDOS photonics research and visits to CUDOS laboratories. He was also unit convenor for the Industrial Project unit linking undergraduate students with research projects in local photonics companies and institutions.

Alex Fuerbach taught two specialised 3rd-year physics units entitled "Optical and Photonic Devices and Systems I and II" and presented one 3-hour seminar about "Light" as part of the unit "The tradition of Science", aimed at a more general audience. In his lectures he utilised of CUDOS research outputs to illustrate the immense potential of modern Photonics technology. Alex is also OPTO lab director at Macquarie University.

Nem Jovanovic also delivered a guest lecture on integrated photonic circuits to the 3rd year Optical and Photonic Devices and Systems course, which discussed the research activities of the CUDOS@MQ laboratories and included a tour of the facilities afterwards.

Ben Johnston (MQ) delivered a short course on laser micro-fabrication at ICONN 2010.

At RMIT University, 4th year and masters by coursework communication engineering students benefited from many examples of CUDOS research featured by Arnan Mitchell in his course on optical fibre technology. Prof Mitchell has also run short courses on photonic signal processing and sensing at the Inter-Continental Advanced Materials and Photonics (ICAMP) summer school in Sydney in June and the 5th Asia-Pacific Conference on Transducers and Micro-Nano Technology (APCOT) in Perth in July 2010.





## Student competition:

Every year CUDOS organizes a student competition, with varying challenges ranging from developing outreach presentations to writing popular science articles. The price is awarded at the CUDOS workshop, and thanks to the immense imagination and creativity of our students the presentation of the entries has become a highlight of life at CUDOS. The challenge in 2010 was to create a short CUDOS-themed video that had the potential of becoming viral on online media. We were entertained with some tremendous entries, with University of Sydney students Felix Lawrence and Sahand Mahmoodian winning first prize by acclamation for their MC UDOS which has accumulated over 2,200 hits on youtube (<http://www.youtube.com/watch?v=faZwLEn4DZo>).

The "MC Udos" Video was later presented during a talk by Kali Madden at the Australian Science Communicators (ASC) National Conference in a session entitled "Putting science across: evaluating communication". The audience (over a hundred professional communicators from around the nation) adored the video and a senior CSIRO employee later told Kali that she would introduce a similar program in her areas - yet again CUDOS outreach and education setting benchmarks for Australia.

Also noteworthy is a former winning entry of the CUDOS student prize, Macquarie University student's outstanding "Phrame by Phrame photonics," winning – after some further developments and improvements by Nemanja Jovanovic – the "first prize of the "Optics Visualized" contest at the BGPP Meeting in Karlsruhe, Germany. Nem received US\$2,000 for the prize, which he shared with the Macquarie team who were involved in the production of this great animation (<http://www.optics-visualized.com/>).



Sahand Mahmoodian ruling the lightwaves as MC UDOS.

## Student prizes

Mr. Xin Gai (ANU LPC) was awarded one of two student oral prizes at the 2010 Conference on Optoelectronic and Microelectronic Materials and Devices (COMMAD2010), December 2010.

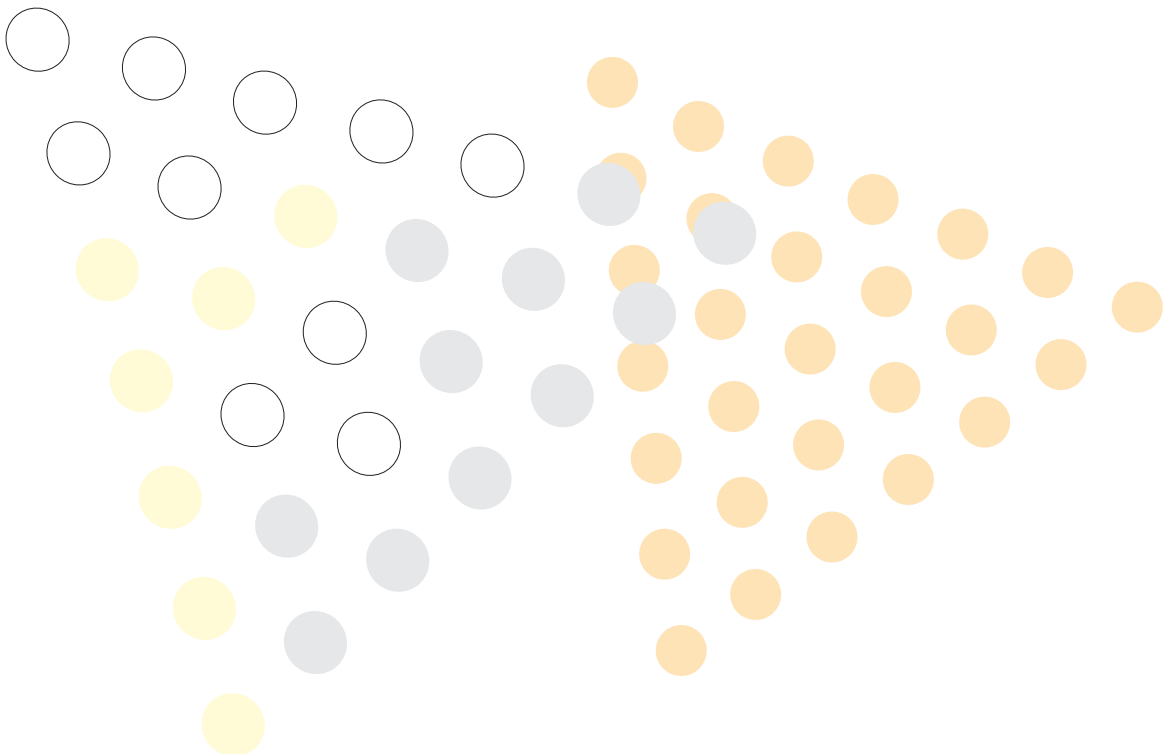
Mark Turner and Md Muntasir Hossain (both Swinburne CMP) won the 2010 CMP Student of the Year and Student Innovation prize respectively. In addition, Mark Turner was awarded the OSA student prize for best student presentation at the AIP/ACOFT conference held in Melbourne, December 2010.

Alessandro Tuniz (UoS) received second place for Best Oral Contribution, PECS IX, Granada, and the Wanda Henry Prize for Best Student Presentation at ACOFT 2010 in Melbourne.

Irina Kabakova (UoS) received the SPIE price for the best student talk at AIP'10 in Melbourne;

Nem Jovanovic (MQ) was one of two NSW finalists for the Bragg award for best physics PhD in 2010, and also received first prize at "Optics Visualized" contest (see Student competition for details).

Finally, Sahand Mahmoodian (UoS) was the recipient of the student poster prize at the CUDOS workshop.



# List of Students

Name	University	Type	Supervisor	Title	Completion date (approx. month/year)
Continuing postgrads (including completing in 2010)					
Alex Minovich	ANU (NLPC)	PhD	Neshev	From Extraordinary Optical Transmission to Left-Handed Fishnet Metamaterials	2010
Arthur Davoyan	ANU (NLPC)	PhD	Shadrivov, Sukhorukov, Kivshar	Nonlinear plasmonics and metamaterials	2011
Francis Bennet	ANU (NLPC)	PhD	Neshev, Krolikowski	Tunable microphotronics based on infiltrated photonic crystal fibres.	2011
Sangwoo Ha	ANU (NLPC)	PhD	Sukhorukov	Slow light in periodic photonic structures	2011
Alexander S. Solntsev	ANU (NLPC)	PhD	Sukhorukov, Neshev, Kivshar	Optical interactions in nonlinear photonic nanostructures	2012
Alex Minovich	ANU (NLPC)	PhD	Neshev	From Extraordinary Optical Transmission to Left-Handed Fishnet Metamaterials	2010
Wei Liu	ANU (NLPC)	PhD	Neshev, Miroshnichenko, Shadrivov, Sukhorukov	Resonant Phenomena in Plasmonic Nanostructures	2012
Khu Vu	ANU Laser Physics Centre	PhD	Madden, Luther-Davies	Tellurite waveguides	2011
Ting Han	ANU Laser Physics Centre	PhD	Madden, Luther-Davies	High Performance waveguides produced by nanoimprinting and hot embossing	2011
Xin Gai	ANU Laser Physics Centre	PhD	Luther-Davies, Madden, Choi	Nanophotonic nonlinear devices produced by e-beam lithography	2011-2012
Ksawery Kalinowski	ANU (Laser Physics Centre/Nonlinear Physics Centre, ANU)	PhD	Krolikowski	Parametric wave mixing in randomized nonlinear structures	2012
Amrita Prasad	ANU Laser Physics Centre	PhD	Luther-Davies	Ge-As-Se glasses for all optical processing	2010
Robert Williams	Macq	PhD	Withford, Marshall	Tunable fibre laser sources	2012
Christopher Miese	Macq	PhD	Fuerbach, Withford	Generation and application of high-energy femtosecond laser pulses with MHz repetition rates	2011
Simon Gross	Macq	PhD	Fuerbach, Withford	Photonics Device Fabrication	2012
Nick Cvetojevic	Macq	PhD	Withford, Lawrence (AAO), Jovanovic	Development and the integrated photonic spectrograph for astronomy	2012
Dionne Haynes	Macq	MPhil	Withford, Dawes	Relative contributions of scattering, diffraction and modal diffusion to Focal ratio degradation in optical fibres	2011
Geraldine Marien	Macq	PhD	Withford, Lawrence (AAO), Jovanovic	Time series astronomy using fibre Bragg gratings	2012
Christopher Miese	Macq	PhD	Fuerbach, Withford	High-energy fs laser pulses with MHz repetition rates	2011
Han Lin	Swinb	PhD	Gu, Jia	Parallel laser writing of nanophotonic devices	2012
Mark Turner	Swinb	PhD	Gu, Davis	Plasmonic chiral structures	2012
Zongsong Gan	Swinb	PhD	Gu, Jia	Radiation dynamics in nanophotonic systems	2012
Ben Cumming	Swinb	PhD	Gu	Aberration compensation in high refractive index materials	2012
Elisa Nicoletti	Swinb	PhD	Gu, Zhou, Jia	Development of new non linear materials for photonic crystal applications	2011
Md Muntahir Hossain	Swinb	PhD	Gu, Jia	Metallic and hybrid plasmonic nanostructures	2011
Parry Chen	UoS	PhD	McPhedran, Botten, Asatryan, Steel	Photonic crystals with positive and negative refractive index inclusions	
Sahand Mahmoodian	UoS	PhD	de Sterke, McPhedran, Botten, Poulton, Dossou	Defect Modes in Photonic Crystals	2011
Stephen Dekker	UoS	PhD	Eggleton, de Sterke	Nonlinear optical processes in tapered chalcogenide nanowires	2011
Trung Vo	UoS	PhD	Eggleton, Schroder, Pelusi	Nonlinear signal processing in Chalcogenide waveguides	2011
Casey Handmer	UoS	MSc	de Sterke, McPhedran	Sub-Rayleigh Microscopy: A practical application of blazed evanescent orders	2011
Alvaro Casas Bedoya	UoS	PhD	Eggleton, Domachuk	Optofluidics	July 2012
Alessandro Tuniz	UoS	PhD	Kuhlmeiy, Fleming	drawn metamaterials	March 2012
Darran Wu	UoS	MSc	Kuhlmeiy, Eggleton	Photonic crystal fibre directional coupler: ultrasensitive refractive index sensing	Nov-10
Bill Corcoran	UoS	PhD	Eggleton, Monat	Non-linear Signal Processes in Silicon Waveguides	2011
Felix Lawrence	UoS	PhD	de Sterke, Botten, McPhedran	Photonic Crystals and Impedance	2011
Irina Kabakova	UoS	PhD	de Sterke, Eggleton	Nonlinear pulse propagation effects in complex Bragg gratings	2011
Michael Lee	UoS	PhD	Grillet, Eggleton	Optical cavities through photosensitivity in chalcogenide photonic crystals	2011
Dougal Kan	UTS	PhD	Botten, Poulton	Semi-analytic modeling of Photonic Crystal Woodpiles	2011
Michael Byrne	UTS	PhD	Botten	Modal formulations for photonic crystal devices	withdrawn
Eike Zeller	RMIT	PhD	Mitchell, Nguyen	Air Structured Polymer Waveguides: A Platform for Nonlinear Optics	March 2012
Tristan Crasto	RMIT	PhD	Mitchell, Nguyen	Lateral Second Harmonic Generation in Lithium Niobate Integrated Optics for Photonic Signal Processing	March 2012
Geethaka Devendra	RMIT	PhD	Mitchell, Nguyen	Impact of Slot Enhancement on Coupling Phenomena in Silicon Photonics	March 2012
Kushan Dayaratne	RMIT	PhD	Mitchell, Bui	Time Sampled Analogue Photonic Signal Processing	Aug-11

Name	University	Type	Supervisor	Title	Completion date (approx. month/year)
<b>Continuing postgrads (including completing in 2010)</b>					
Mahmud Tanveer	RMIT	PhD	Mitchell, Kostovski	Hybrid Photo- and Imprint-Lithography Polymer Waveguides and Microfluidic Channels for Biosensing	Aug-11
Tim Lunn	RMIT	PhD	Mitchell, Bui, Nguyen	Investigation of non-linear polarisation phenomena in Lithium Niobate Waveguides	Mar-12
Vikrant Kundra	RMIT	PhD	Bui, Mitchell	Time Sampled Analogue Photonic Signal Processing	Withdrawn
Vijay Sivan	RMIT	PhD	Mitchell, Bui, Nguyen	Surface Machining Lithium Niobate using Ti in-diffusion Technique	Mar-11
<b>Completions 2010</b>					
Alex Minovich	ANU (NLPC)	PhD	Neshev	From Extraordinary Optical Transmission to Left-Handed Fishnet Metamaterials	2010
Amrita Prasad	ANU Laser Physics Centre	PhD	Luther-Davies	Ge-As-Se glasses for all optical processing	2010
Darran Wu	UoS	MSc	Kuhlmeiy, Eggleton	Photonic crystal fibre directional coupler: ultrasensitive refractive index sensing	Nov-10
Vijay Sivan	RMIT	PhD	Mitchell, Bui, Nguyen	Surface Machining Lithium Niobate using Ti in-diffusion Technique	Mar-11
<b>New postgrads having started in 2010</b>					
Ting Wang	ANU (Laser Physics Centre/Nonlinear Physics Centre, ANU)	PhD	Luther-Davies, Wang	Understanding and Optimising the Microstructure of Ge-As-Se glasses for optimal device performance	2013
Zhe Jin	ANU (Laser Physics Centre/Nonlinear Physics Centre, ANU)	PhD	Luther-Davies, Madden, Choi	Hybrid photonic waveguides	2013
Sun Yue	ANU (Laser Physics Centre/Nonlinear Physics Centre, ANU)	PhD	Sukhorukov, White, Choi, Kivshar	Nonlinear and optomechanical interaction in photonic nanocavities	2013
Alex Arriola	Macq	PhD	Fuerbach, Withford	Nanophotonic sensors fabricated with ultrashort pulsed lasers	2013
Thomas Meany	Macq	PhD	Withford, Marshall	Quantum Photonic Devices	2013
Qiang (Jocelyn) Liu	Macq	PhD	Steel, Withford	One Way Laser Writer Waveguides in Nonlinear Soft Glasses	2013
Yuwen Duan	Macq	PhD	Withford, Marshall, Ams	development of multiple wavelength waveguide lasers	2013
John He	Swinb	Master	Jia, Gu	Active hybrid photonic nanostructures	2012
Yvan Paquot	UoS	PhD	Eggleton	Photonic chip based optical processing of high bit rate signals	2013
Björn Stumberg	UoS	MSc	McPhedran, de Sterke	Photonic Crystal Photovoltaics	Nov-11
Kiplimo Yego	RMIT	PhD	Mitchell, Nguyen	Silicon Photonics Biosensors Employing Lateral Leakage	2013
Naser Dalvand	RMIT	PhD	Mitchell, Nguyen	Novel Silicon Photonic Devices and Structures Exploiting Lateral Leakage	2013
<b>Honours students 2010</b>					
James Farnell	ANU/NL	Honours	Neshev	Nonlinear and tunable fishnet metamaterials	Nov-10
Kevin Ng	UoS	Engineering Honours	Eggleton, Schröder, Xiong	tunable passive mode-locked L-band laser	June 2010
Bjorn Sturmberg	UoS	Honours	McPhedran, de Sterke	Photonic Crystal Photovoltaics	Nov-10
Owen Brasier	UoS	Engineering Honours	Eggleton, Schröder	OSNR monitoring using a wavelength selective switch	Nov-10
Hannah McFarlane	UoS	Honours	Eggleton, Pant, Poulton	Stimulated Brillouin scattering in planar nonlinear waveguides	Nov-10
<b>Visiting students 2010</b>					
				<b>home institution</b>	<b>length of stay</b>
Wenjie Wang	ANU	PhD	Krolikowski	Nankai University	19/9/08 – 19/9/10
Kunlun Yan	ANU (Laser Physics Centre/Nonlinear Physics Centre, ANU)	PhD	Luther-Davies, Wang	Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences	12 months
Markus Pasch	Macq		Dawes	University of Applied Science in Ulm, Germany	6 months
Philipp Stark	Macq		Dawes	University of Applied Science in Ulm, Germany	6 months
Michaela Micko	Macq		Dawes	University of Applied Science in Ulm, Germany	6 months
Matthias Brendle	Macq		Dawes	University of Applied Science in Ulm, Germany	6 months
Clementine Niel	Macq		Jovanovic	Institut d'Optique Graduate School, France	6 months
Christian Voigtlander	Macq		Withford	Friedrich Schiller University	3 months
Michael Smith	UoS	PhD	McPhedran, Poulton	University of Auckland	6 months
Najmeh Nozhat	UoS	PhD	McPhedran, de Sterke	K. N. Toosi University of Technology, Tehran, Iran	9 months
Yvan Paquot	UoS	Masters	Eggleton, Schroder	Universite Libre de Bruxelles, Belgium	3 months
Tristan Geiller	UoS	Masters	Kuhlmeiy	Universite de Technologie de Troies, France	6 months
Camille Paoletti	UoS	Masters	Grillet	Ecole Normale Supérieure de Lyon	3 months
Tuhti Malinowski	UoS	Masters	Grillet	Ecole Normale Supérieure de Lyon	3 months
Yanbin Wang	UoS	PhD	Xiong, Eggleton	National University of Defense Technology, China.	Sep. 2009 to Sep. 2010.
Sebastien Habenicht	RMIT	Masters	Mitchell	Hochschule Bremen, University of Applied Sciences, Bremen, Germany	6 months
Sebastian Kroesen	ANU	PhD	Sukhorukov	University of Munster, Germany	one year