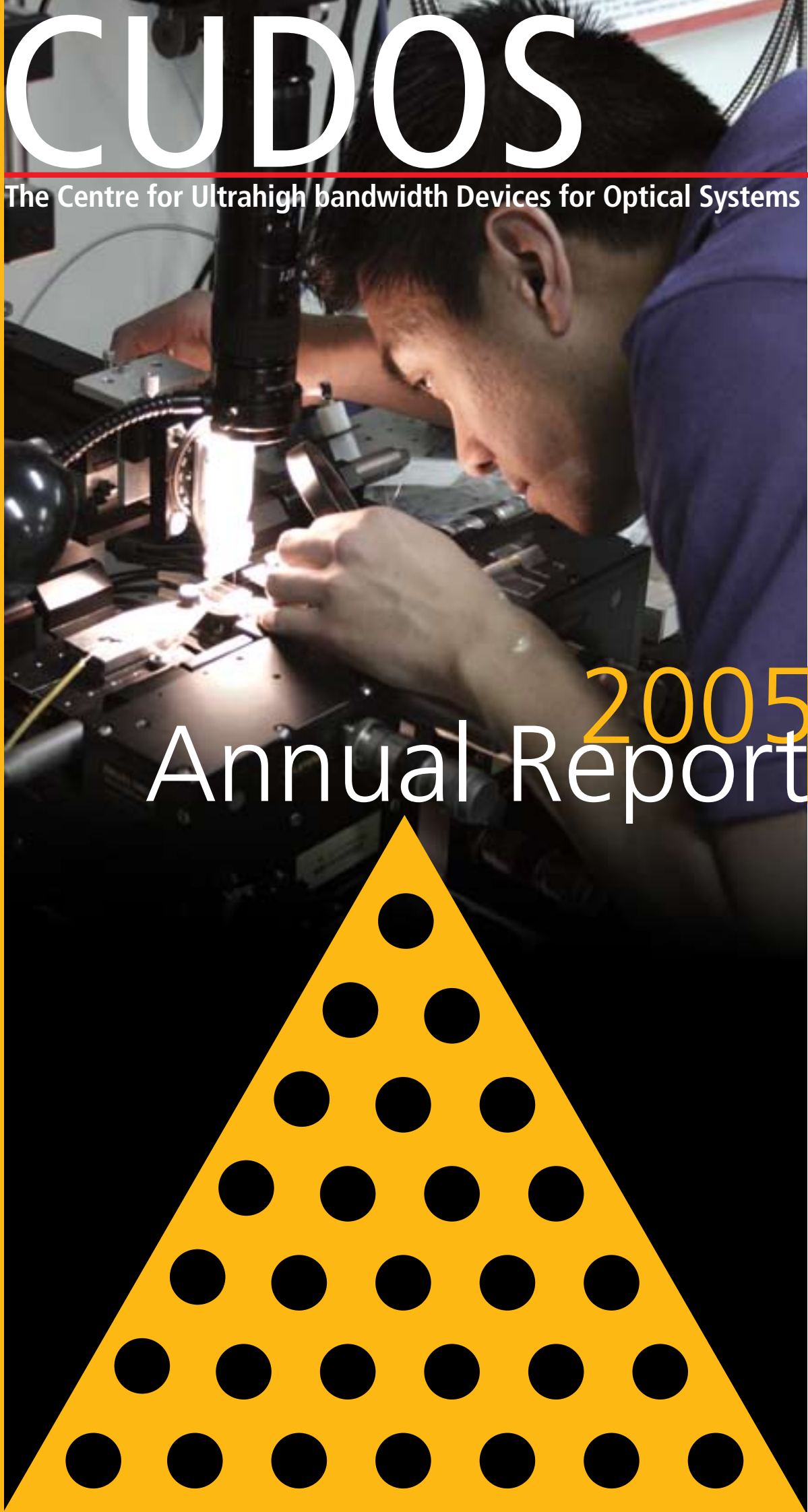


# CUDOS

The Centre for Ultrahigh bandwidth Devices for Optical Systems (CUDOS)

2005  
Annual Report



# Education and Training Report



I never cease to be amazed by the quality of our students and their work. It is particularly pleasing that during 2005 our students have again received numerous prestigious Prizes & Awards. This was also the first year in which a large number of our postgraduate students finished their studies, and continued their career elsewhere. A final highlight is that 2005 was also the year in which our student competition kicked off, with the winners

announced during our workshop in September. I will now look at these three in turn.

**Student Competition:** In this competition the students were challenged to describe an application of Centre research to an area outside telecommunications. Submissions needed to be in the form of a short research proposal, thereby aiming to develop the professional skills of our new generation of scientists. The entries were judged by Ben Eggleton, Yuri Kivshar and by me. Four students received recognition for their submissions: the first prize was shared between Neil Baker from the University of Sydney, for his submission "Soliton Oscillator," and Steve Morrison from the ANU for "Optical Analysis of Breath for Medical Diagnosis." Each student received a certificate and a \$500 cash prize. Honourable Mentions were awarded to Aaron Matthews from the ANU for "Power generation using enhancement of the photovoltaic effect with photonic crystals," and to Jiafang Li from Swinburne, for "Photonic chip based on 3D photonic crystal." Aaron and Jiafang both received a certificate and two books each.

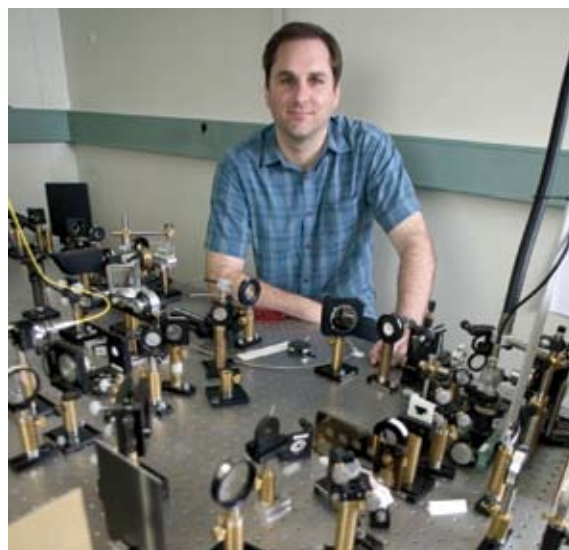
**Postgraduate completions:** During 2005 a large number of our postgraduate students finished their studies and went elsewhere, many to world-leading groups and institutions in Australia and overseas. This was in fact the first cohort of students whose projects were carried out mostly within CUDOS. For example, Yinlan Ruan finished her PhD on chalcogenide waveguide devices at the ANU and joined the DSTO-sponsored Centre of Expertise at the University of Adelaide as a postdoc. David Fussell finished his work on radiation dynamics and is now similarly a postdoc at Queen's University in Canada, while Tom White, after finishing his work on photonic crystal devices, has taken up a prestigious short-term University of Sydney Fellowship. Trina Ng finished her MSc degree at the University of Sydney and is now pursuing a PhD at the world-leading Optoelectronic Research Centre at the University of Southampton in the UK. Mehrdad Shokooh Saremi completed his PhD from Ferdowsi University in Iran as part of a co-tutelle with the University of Sydney. Ilya Shadrivov has taken up a postdoctoral position at the ANU.

**Student Prizes and Awards:** Our students again scooped the pool at Australian conferences. Michael Ventura from Swinburne won the 1st prize for the best presented results at the Australian Conference on Optics Lasers and Spectroscopy. Trina Ng was awarded the Wanda Henry prize for the best student presentation at the ACOFT conference. Steve Morrison won the Director's Prize in the Annual Graduate Program in the Physical Sciences at the ANU and the Robert and Helen Crompton Travel Scholarship (\$4,000) to make an oral presentation of his work at a conference of his choice. Peter Domachuk won the Australian Optical Society's 2005 Postgraduate Student



▲ Neil Baker (co-winner) is awarded his CUDOS student prize by Martijn de Sterke.

Prize. Tom White from the University of Sydney was selected as one of only 7 finalists of the New Focus/Bookham, competing with a large number of applicants from all over the world. Dane Austin received the Shiroki prize for the best physics honours thesis at the University of Sydney.



▲ Steven Morrison, winner of the Director's prize and the Robert and Helen Crompton Travel Scholarship at the ANU, and co-winner of the CUDOS student competition.

Even with many students finishing and leaving, we still have 22 PhD students, the same as in 2004, 3 MSc students (3 in 2004), and 6 honours students (7 in 2004). Many of the students greatly benefit from being in a Centre. For example, Peter Domachuk worked closely with Prof. Mark Cronin-Golomb, a sabbatical visitor from Tuft's University in the US. He also spent three months at OFS in New Jersey working on silica nanowires. David Fussell worked very closely with A/Prof. Marc Dignam from Queen's University in Canada. In fact, this collaboration worked so well that David has now joined Marc's group. Many of the University of Sydney students, such as Vahid Ta'eed, Mike Lamont, Neil Baker and Hong Nguyen benefit greatly from the fabrication facilities developed at the ANU. Sam Myers an MSc student from Macquarie performed part of his experiments at the University of Sydney labs with Eric Mägi, and collaborated with David Fussell, Ross McPhedran

and Martijn de Sterke on the underlying theory. Finally, Sam Campbell and Robert Hansen, a PhD and honours student at the University of Sydney, respectively, were co-supervised by Lindsay Botten at UTS. As always, CUDOS hosted a large number of international students for periods ranging from about as month to a year, indicating the attractiveness and excellent

research climate in the Centre. During 2005, the students were from the USA, Canada, Mexico, Germany, Iran, Finland, and France. We also hosted 10 lower-year undergraduate students for short projects, showing them how research is conducted and getting them excited about CUDOS's research and about science in general.

### List of students enrolled for higher degrees working on CUDOS projects

PhD students	Began	University	Supervisors	Thesis Title
Sam Campbell	2004	UoS	RMcP, MdS, LB	Radiation losses in photonic crystals
Ross McKerracher	2002	UoS	JB,MdS	Frequency conversion using four-wave mixing
Peter Domachuk	2003	UoS	BJE	Microfluidic optical devices
Paul Steinvurzel	2003	UoS	BJE,MdS,MJS	Arrow photonic crystal fibres
Hong Nguyen	2004	UoS	BJE	Tapered photonic crystal fibres:fundamental and applications
Vahid Ta'eed	2003	UoS	BJE, DM	Bragg gratings in highly nonlinear planar waveguides
Joe Mok	2003	UoS	BJE, MdS	Nonlinear pulse propagation in Bragg gratings
Neil Baker	2005	UoS	BJE & MdS	Slow light in chalcogenide grating structures
Mike Lamont	2005	UoS	BJE, DM	Integrated all-optical devices in chalcogenide waveguides
Ivan Garanovich	2005	ANU	AS, YK	All-optical switching in nonlinear modulated lattices
Aaron Mathews	2004	ANU	YK,MG	Bandgap engineering in nonlinear photonic crystals
Steve Morrison	2004	ANU	YK	Electromagnetic waves and scattering in nonlinear photonic lattices
Christian Rosberg	2004	ANU	YK,DN,WK	Bragg scattering in nonlinear photonic lattices
Darren Freeman	2004	ANU	BLD	Nanopatterning of photonic devices using a focused ion beam mill
Amrita Prasad	2005	ANU	BLD	Photonic devices in novel chalcogenide glasses
Michael Ventura	2003	Swin	MG,MS	Fabrication and characterization of photonic crystal devices
Jiafang Li	2005	Swin	MG,JS	Radiation dynamics of three-dimensional photonic crystals fabricated by two-photon polymerization
Michael Byrne	2003	UTS	LB	Modal formulations for photonic crystal devices
Martin Ams	2002	Macq	MW,JD,JP	Laser-written waveguides and amplifiers
Andrew Lee	2001	Macq	MW,JD	Laser fabrication of microstructures
Ben Johnston	2004	Macq	MW,PD	Periodically poled devices
Luke Stewart	2005	Macq	MW,GM,JD	Self-assembly of photonic crystal structures
Doug Little	2005	Macq	MW,GM	Near-field optical microscopy
<b>Finished during 2005</b>				
Yinlan Ruan	2001	ANU	BLD	Chalcogenide planar waveguide devices for all optical processing
Tom White	2002	UoS	RMcP, MdS, LB	Novel photonic crystal devices
David Fussell	2002	UoS	MdS,RMcP	Radiation dynamics in photonic crystals
Audrey Lobo	2001	UoS	MdS	Novel Fibre gratings
Ilya Shavidrov	2002	ANU	YK,RMcP	Left-handed materials and negative refraction
Mehrdad Shokooh-Saremi	2005	UoS	BJE	Nonlinear effects in chalcogenide Bragg gratings
<b>Masters students</b>				
Sam Myers	2003	Macq	JD, RMcP, BJE	Radiation dynamics in tapered photonic crystal fibres
Cameron Smith	2004	UoS	BJE	Coupling into photonic crystal waveguides using tapered nanowires
<b>Finished during 2005</b>				
Brendan Hanna	2003	ANU	WK,DN,YK	Light interconnection and its application in periodic medium
Trina Ng	2004	UoS	BJE,JB	Optical performance monitoring using four-wave mixing
<b>Honours students</b>				
Dane Austin	2005	UoS	BJE	Supercontinuum generation in optical fibers
Robert Hansen	2005	UoS	MdS & LB	Modes in coupled photonic crystal waveguides
Nem Jovanovic	2005	Macq	MW,AF	Development of a visible fibre laser
Michael Chen	2005	ANU	WK, YK	Light interconnection and its application in periodic medium
Anna Elizabeth Webster	2005	ANU	DN	Worked on: Nonlinear beam propagation in defocusing waveguide arrays project (did not compete)
Eric Yuihong Lo	2005	UoS (EE)	JB, BJE	Measurement of high repetition rate pulse train by homodyne detection
Mohit Patil	2005	UoS (EE)	IL, BJE	Grating apodization in chalcogenide glasses