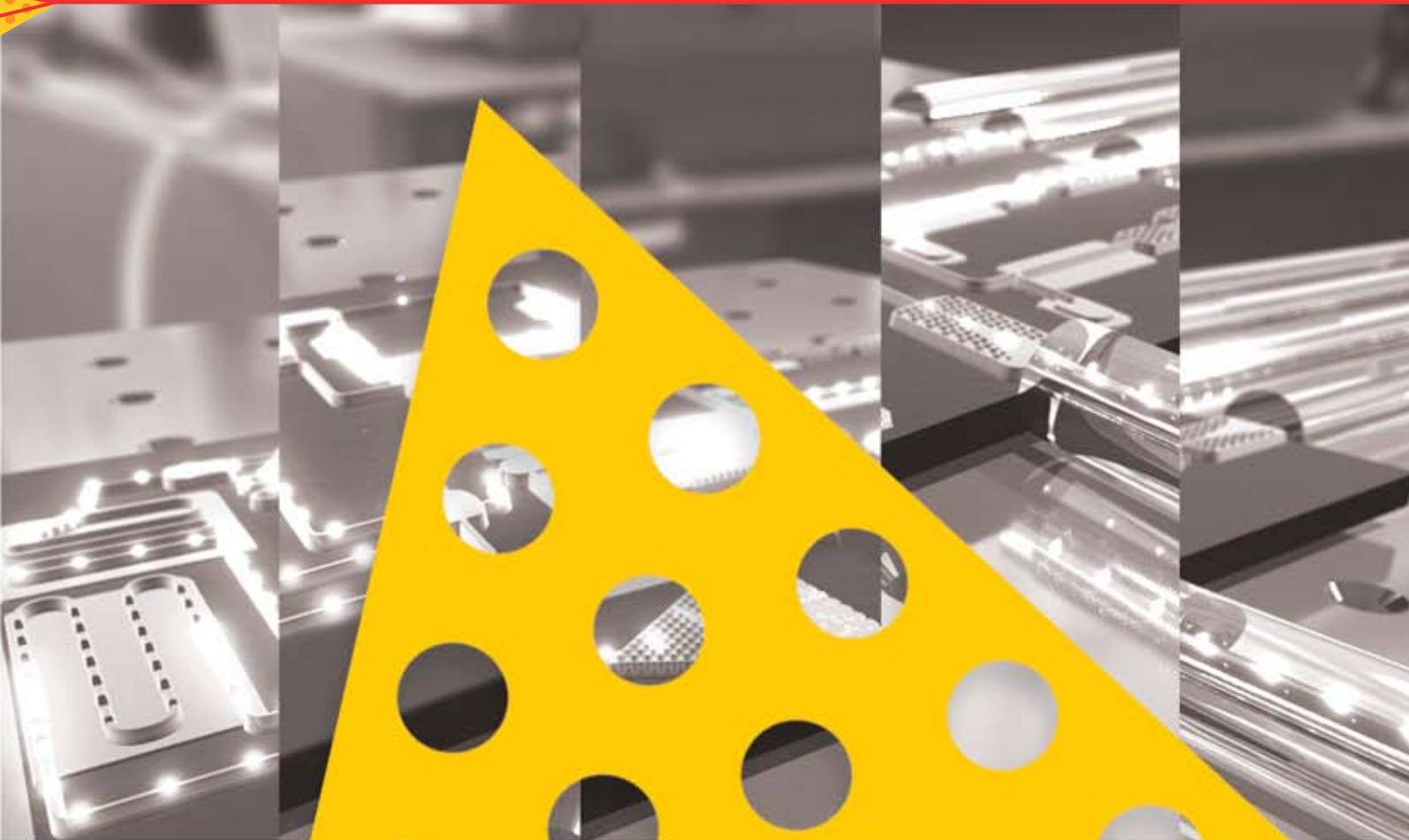




# CUDOS

The Centre for Ultrahigh bandwidth Devices for Optical Systems (CUDOS)  
An Australian Research Council Centre of Excellence



## Annual Report 2007

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Ben Eggleton, Min Gu and Yuri Kivshar at the Shine Dome following the awards ceremony of the Australian Academy of Science in Canberra.





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

## ▶ VISION

**CUDOS is a world-leading Centre in microphotonics, with internationally pre-eminent research underpinning a strategic focus on all-optical signal processing devices.**

## ▶ MISSION

**CUDOS conducts fundamental strategic research aimed at demonstrating and developing technology for optical processing devices that will enhance Australia's communications infrastructure and our status as a technologically-advanced economy .**

## ▶ KEY FACTS

- 56 researchers, 47 students and 4 administrative staff across five nodes.
- 19 visiting researchers during the year including three visiting students
- 88 publications in refereed journals, with an average impact factor of 2.9 (3.8 for the 55 top-ranked publications)
- More than 30 invited presentations at national and international meetings
- Cash income \$4.3M in 2007 with in-kind and indirect support of \$6M. The Centre also received cash support through Research Infrastructure Block Grants, student stipends (APA and UPA) and competitive grant funds awarded by the five Universities.

CUDOS gratefully acknowledges the support of the Australian Research Council. We also acknowledge the financial and in-kind support provided by the Collaborators – the University of Sydney, the Australian National University, Macquarie University, the University of Technology Sydney and Swinburne University of Technology. Finally, we are grateful for financial support provided by the New South Wales Government through the Department of State and Regional Development.



The University of Sydney



Australian Government  
Australian Research Council



Department of State and  
Regional Development

# Research Director's Introduction



## ◀ Ben Eggleton

the subject of intense international interest. These platforms have commercial potential and to reflect that fact, CUDOS researchers over the past twelve months have filed more than half a dozen patent applications.

Domestically, CUDOS has had a significant impact on its partner Universities with more than six continuing academic positions in photonics being created including some at professorial level. Sydney has established an Institute for Photonics and Optical Science to capture the momentum that CUDOS has established and broadened it to opportunities in biology and the health sciences. Swinburne's Centre for Microphotonics is being substantially expanded with new professorial appointments and Macquarie's activities in photonics have now been recognised as one of ten CORE (Concentration of Research Excellence) areas across the University. UTS has made two new faculty appointments.

CUDOS has had an impact on research activities beyond those funded by the Centre of Excellence program. Our research capabilities - strong teams, excellent collaboration and advanced research and micro-fabrication facilities - have led to a range of related projects funded by Discovery, Linkage or other grant schemes. These include a major Linkage grant with Optium Australia which capitalises on the advanced optical test bed developed as part of the CUDOS program, collaborative research programs with other industry partners, Discovery grants on supercontinuum generation, microfluidics and nonlinear optical physics of solitons and International Science Linkage programs for collaborative research with partners in the UK, Europe and Ireland. These activities are not reported on here since they are not funded by the ARC Centre grant, but they represent a substantial leveraged outcome to the Centre of Excellence funds.

In summary, we have indeed fulfilled our original mission. What, then, about the future? During the next three years we will commercialise some of our technology in all optical signal processing while with our support, our University partners will provide increased training (eg, new Masters programs) and research opportunities in photonics. We will continue to raise the profile of photonics in the country to a level consistent with its importance as an enabling technology for a range of ICT industries. These activities will match national needs and priorities: innovation leading to wealth creation, development of national infrastructure and training to address the growing shortage of ICT professionals across a range of industries including telecommunications, defence and health sciences. We are confident that we will deliver substantial benefit to Australia both through our research outcomes and the highly trained professionals that will be in demand in Australia's ICT industries.

Most importantly we will continue to grow our strategically planned fundamental science, which has been the cornerstone of our success to date. The far-sighted research opportunities we identified in 2002 are now central themes at most major international optics meetings but new areas like meta-materials and plasmonics are beginning to emerge. The exciting thing for CUDOS is that the science and technology platforms we have developed over the past five years place us in an ideal position to develop strong programs in these areas, and we intend to do this over the coming years so that we continue to be at the forefront of modern photonics.

Our Advisory Board is playing a key role in the planning process to bring existing programs to fruition and develop new ones.

CUDOS has now completed its first five years. With the commencement of our three year extension funding period beginning in 2008, it's an appropriate time to look back on what we have achieved and to offer some guidance on our expectations for the coming three years.

In 2002 we proposed our vision for CUDOS as an international leader in nonlinear photonics, producing "innovative outcomes with major social and economic benefits to Australia". In particular, we said we would demonstrate "all-optical processing applications and devices for ultrahigh bandwidth optical telecommunications systems derived from fundamental research in nonlinear optical materials, photonic crystals, micro-structured optical fibres and micro-photonics".

What have we achieved against that five year goal? On the basis of peer assessment, number and quality of journal publications and invited presentations at national and international conferences, we have been spectacularly successful. Through our research achievements, we are a leading international research centre. Everyone wants to work with us, with CUDOS now a partner in major European programs and attracting large numbers of international students. Our science has led to the development of technology platforms - chalcogenide optical processors and direct-written compact waveguide oscillators for example - that are

The composition of this Board has changed significantly during the year. Our foundation Chairman, Dr Simon Poole, has advised that his role as CEO of Optium Australia has increased to the extent that he is unable to continue in the Chairman's role. I compliment Simon on the success of his company (over 120 employees and growing rapidly) and thank him for his advice and support during the past five years. I am delighted that Dr Bob Watts FAA, ex-Chief Scientist for BHP Billiton has accepted my invitation to chair the Advisory Board. Bob chaired his first meeting in November 2007 and I look forward to a fruitful and enjoyable relationship with him. I also welcome Dr David Skellern (CEO, NICTA), Dr Steve Frisken (CTO, Optium) and Mr Laurie Bode (Program Director, Defence Material Organisation) to the Board and thank Dr Scott Rashleigh, Professor Rod Tucker and Dr Steve Duvall for their assistance over the past five years.

Finally, I acknowledge the efforts of all my CUDOS colleagues, both staff and students, for their effort and inspiration during

the first five years of CUDOS. I congratulate Professor Min Gu, who was admitted as a Fellow of the Academy of Science, and Professor Yuri Kivshar, awarded the Lyle Medal of the Academy. At the same ceremony, I was honoured with the presentation of the Academy's Pawsey Medal. While such awards are individual honours, they reflect on our colleagues and indeed on CUDOS as a whole. We are where we are because of a superbly motivated group of people, and I am really looking forward to seeing how far we can go by 2010!



Research Director, CUDOS  
ARC Federation Fellow

## Chairman's Introduction

### Bob Watts

I'm delighted to have the opportunity to chair the CUDOS Advisory Board following Simon Poole's decision to stand down. During the previous three years I chaired two ARC panels evaluating applications for Centres of Excellence and this new role gives me the opportunity to see how things work from the other side of the table.

My experience on the evaluation panels was instructive. Centres must be first and foremost powerhouses of strategically-directed fundamental research, but there are many high quality groups in Australia whose research, and the quality of the people, fit this criterion. How then does the ARC decide on who gets funded? My take away from the ARC experience is that there are three key measures.

The first is the value that Centres add to their research outcomes through commercialisation, technology transfer and end user interaction. These benefits often take years to be realised so indicative factors of future success like matching funds, direct involvement of external collaborators, and properly bench-marked flexible research programs are key factors.

The second relates to people - in particular, the next generation of researchers and professionals whose experience in a Centre of Excellence develops not only their research skills, but their meta-skills as well - networking, project planning, collaborative research skills and so on, all of which develop their capability to make a significant impact in their profession. Centres of Excellence should produce leaders in their chosen professions.

The third area of importance is the strength of the interactions across Universities and other associated research facilities. Centres of Excellence must clearly demonstrate value-add. Research programs should cross two or more institutions, research students and postdoctoral researchers should be aware of the full Centre program, and they should spend significant periods working in laboratories other than their home base.

CUDOS is doing well in all three areas. The market for the advanced devices originating from the Centre's research is at an early stage, but the Centre has been active in building relationships with both financiers and key industry players. The Centre is doing a fine job in building Australia's human capacity in the area of photonic science by attracting, from within Australia and abroad, researchers of high international standing and highly talented research students.

What, then, can I and the Advisory Board do to assist Ben and his team? The Board has entrepreneurs, senior figures from industry and academia and others with many years successful experience in managing research teams. We represent a wealth of experience and invaluable advice in many of the areas that are crucial for the Centre's success, and to my pleasure, Ben and his team are eager for this advice. We do not wish to advise on the research program developed by Ben and his team. Twice in the last three years Ben has convened scientific review committees chosen from international peers to comment on these matters. The Advisory Board is focused on assisting CUDOS to address those value-added aspects necessary for the Centre's success, and to help position the Centre to continue its research for the benefit of Australia well after its extension funding expires in 2010.

Dr Bob Watts  
FAA, FTSE, FRACI  
Chair, Advisory Board

