

CUDOS

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

2005
Annual Report



Research Director's Introduction

Ben Eggleton



2005 was a landmark year for CUDOS. For the first time we succeeded in demonstrating optical functions (signal regeneration, buffering and channel separation) in compact configurations that will lead towards integration into a photonic integrated circuit. At the same time our programs in fundamental photonics provided valuable insights on propagation effects in photonic crystal materials. We were reviewed during the year, first by an external scientific committee and then by the Australian Research Council, with outcomes exceeding our expectations in both cases. We had another extremely successful CUDOS Workshop, this time at Macquarie University. CUDOS staff organised the highly successful Photonic Crystals: Fundamentals to Devices workshop and the Bragg Gratings, Poling and Photosensitivity (BGPP) Conference in Sydney, held in conjunction with the ACOFT meeting with 250 attendees.

Research Successes

In its third year of operation, the Centre is making great strides in its pursuit of developing a photonic integrated circuit (PIC). Our flagship projects, described in detail for the first time in this report, were established in 2004. Already they are making major progress in demonstrating some of the key functions that a PIC will need to have for successful application in next-generation optical communications systems: signal regeneration, switching, buffering and optical multiplexing. To achieve these results, we are continuing to build our science base, with more than eighty publications in refereed journals this year, as well as developing strong platforms for device development. These platforms include our computational modelling program, development of materials processing expertise with chalcogenide and polymer systems and our micro-fabrication capabilities in laser direct writing, focused ion beam and optical lithography, and two-photon photolithography.

I am delighted to note that in all measures of scientific impact and excellence – numbers of publications and impact factor, invitations to present at major international meetings – the Centre exceeded its targets by a factor of two. I would like to acknowledge the tremendous efforts by my colleagues that led to this result.

Science Review and Centre Review

All Centres of Excellence are reviewed by the Australian Research Council in their third year of operation. Our review took place in October. Prior to that, the Centre commissioned a review of its science by four experts chosen to represent different areas of CUDOS activity and representing both industry and academia: Professor MM (Marty) Fejer (Stanford), Professor Costas Soukoulis (Iowa State/Ames National Laboratory), Dr Steve Frisken (Engana Ltd, Sydney) and Dr Lothar Moeller (Lucent Technologies). The principal outcome of the review was a strong endorsement of the quality and strategic direction of the Centre's research program, with the finding that "The panel commended the integration within the CUDOS program of a wide range of research activities in materials, microfabrication technologies, fundamental nonlinear optics and photonic devices. They noted that through strong collaboration driven by a long-term strategic goal, the Research Director and Chief Investigators have built an internationally-significant centre of research excellence in photonics with a unique set of skills and capabilities."

The ARC review focused on all areas of the Centre's operation, from its research performance against performance targets to postgraduate and postdoctoral training and governance issues. As Centre Research Director I provided a comprehensive submission to the ARC in advance of the review, as did each of the five participating universities. I am delighted to report that (although we are still waiting for the formal report of the review committee) the ARC has endorsed our program and confirmed that the Centre will continue until at least the end of 2007.

BGPP/ACOFT and the Photonic Crystals: Fundamentals to Devices Workshop

CUDOS researchers organized and managed major international meetings on the topics of Photonic Crystals and microstructured materials. The Bragg Gratings, Poling and Photosensitivity (BGPP) meeting is a biennial conference that has, for over a decade, been the international focus for reporting new developments in an area that is a key aspect of CUDOS research. In 2005 the meeting was held in Sydney in combination with the Australian Conference on Optical Fibre Technology (ACOFT). I chaired the organising and program committees for the BGPP section of the meeting, while Ross McPhedran, Martijn de Sterke, Justin Blows and David Moss were members of the program committee. Over 200 delegates registered for the BGPP meeting, including 80 internationals.

The "Photonic Crystals: Fundamentals to Devices" was organised and the program schedule fully planned by CUDOS researchers. There were over 150 attendees at the workshop, which featured keynote presentations from pre-eminent researchers including Russell (Bath), Soukoulos (Iowa), Krauss (St Andrews), Busch (Karlsruhe) and Fan (Stanford) as well as CUDOS researchers. This meeting follows in the same spirit as earlier meetings organised by CUDOS researchers: Photonic Crystals Down under organised by Yuri Kivshar in Canberra in 2002; and Photonic Crystals and Holey Fibers, organized by me in Vancouver in 2003.