

CUDOS

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



2005 Annual Report



Senior Centre Members



Research Director:
Ben Eggleton (Sydney)

Ben Eggleton is currently an ARC Federation Fellow and Professor of Physics at the University of Sydney and the Research Director of CUDOS. In 1996, he joined Bell Laboratories, Lucent Technologies as a Postdoctoral Member of staff then transferred to the Optical Fiber Research Department. In 2000 he was promoted to Research Director within the Specialty Fiber Business Division where he was responsible for forward-looking research supporting Lucent Technologies business in optical fiber devices. Prof. Eggleton has co-authored over 140 journal publications and numerous conference papers. He was the recipient of the 2004 Prime Minister's Malcolm McIntosh Science Prize for Physical Scientist of the year, the 2003 ICO prize from the International Commission on Optics, the 1998 Adolph Lomb Medal from the OSA the distinguished lecturer award from the IEEE/LEOS, is an OSA Fellow and recipient of an R&D100 award. Professor Eggleton's interests include nonlinear optics and optical solitons, optical gratings and photonic crystals, optical communications, photonic crystal fibres, optical-fluidics, supercontinuum generation and integrated optics. Within CUDOS Professor Eggleton is the Research Director and heads the University of Sydney experimental program.

In 2005 Professor Eggleton presented numerous invited presentations at international meetings, including the OSA sponsored topical meeting on Nanophotonics and a plenary presentation at the ICO tri-annual meeting in Changchun, China. Professor Eggleton was the general chair for the Photonic crystals, Fundamentals to Devices workshop held in Sydney Australia and the Program chair for Bragg gratings, Photosensitivity and Poling Topical Meeting, also held in Sydney Australia; was a Subcommittee chair for the Conference on Lasers and Electro-Optics; was the Co-organizer of the symposium on confinement and control in microphotonic structures at the Lasers and Electro-optics Society Annual meeting. Professor Eggleton is an Associate editor for IEEE Photonic Technology Letters, is on the advisory Editorial Board for Optics Communications and Chinese Optoelectronics Letters and regularly reviews papers for Optics Letters, Optics Express, Optics Communications, Nature Physics, Journal of Lightwave Technology, Optical Fiber Technology. He is a Council member of the Australian Optical Society.



▲ Ben: Ben Eggleton with Charles Townes (Nobel Prizewinner and co-inventor of the laser) at the ICO Plenary session in China.

Deputy Director:
Yuri Kivshar (ANU)



Yuri Kivshar, a Federation Fellow and Professor at ANU, is the Deputy Director of CUDOS. He has been working on various problems of nonlinear guided-wave optics, including the study of solitary waves, optical self-trapping effects, soliton interaction, photonic crystals, and nonlinear all-optical switching. More recent research interests of Prof. Kivshar have shifted towards the physics of photonic crystals and their unique properties such as negative refraction. He is responsible for two research projects of the CUDOS Microphotonics Program on nonlinear photonic crystals: nonlinear switching and nonlinear localized modes.

Yuri is an Advisory Board member for the professional journals Optics Communications and Chaos, and also a member of International Advisory Committees for a number of 2005-2006 meetings, including the International Conference on Micro-and Nano-Photonics ROMOPTO (Romania, 2006) and Photon'06 (UK, 2006).

In 2005, Yuri Kivshar presented invited and keynote talks on the topic of the research projects of CUDOS at the following meetings: the 16th Biennial Congress of the Australian Institute of Physics (Canberra, Australia), DFG'2005 Annual Meeting of the German Physical Society (Berlin, Germany), The Annual Conference of the Centre for Nonlinear Studies, Los Alamos National Laboratory (Santa Fe, USA), PECS'VI International Conference on Photonic and Electromagnetic Crystals (Crete, Greece), International Conference FPU+50: Nonlinear Waves 50 years after Fermi-Pasta-Ulam (Rouen, France); SPIE International Congress on Optics and Optoelectronics (Warsaw, Poland); LEOS'2005 The Annual Meeting of the IEEE Laser & Electro-Optics Society (Sydney, Australia); International Workshop on Noise, Chaos, and Complexity in Lasers and Nonlinear Optics (Colonia del Sacramento, Uruguay).

In 2005, Prof. Kivshar was awarded the Walter Boas Medal of the Australian Institute of Physics, recognising excellence in research in Physics in Australia.

Associate Director: Martijn de Sterke (Sydney)



Martijn de Sterke received his PhD from the University of Rochester in 1987 and after this held a postdoctoral position at the University of Toronto. Since 1991 he has been in the School of Physics at the University of Sydney, where he is now a Professor. He has worked in areas such as fibre optics and fibre gratings, nonlinear optics, photonic crystals, and solid state physics. Within

CUDOS he leads the Slow Light Flagship Project and involved in the Photonic Crystal Modeling, Radiation Dynamics, and Fibre-based Devices projects. He is the CUDOS Education & Training Coordinator and the Associate Director.

During 2005 he was Member of the Program Committee of the 11th MicroOptics Conference (MOC'05), held in Sabo Kaikan, Japan, a member of the Program Committee of the 2005 Photonic Crystal Fibre conference, part of the Optics and Opto-electronics Congress, held in Warsaw (Poland), and Co-chair, Program Committee of the Special Symposium on Confinement & Control in Microphotonic Structures, of the 2005 IEEE LEOS Annual Meeting Conference, held in Sydney. He is an Associate Editor of Optics Express, a council member of the Australian Optical Society, and a member of the Peer Review College of the EPSRC in the UK. He is Associate Dean for Research in the Faculty of Science at the University of Sydney.

Chief Investigator: Min Gu (Swinburne)



Min Gu is the Director of the Centre for Micro Photonics at Swinburne University. Within CUDOS, he is a member of the Executive, a coordinator of the flagship project for 3D Photonic Crystals and the leader of the

three-dimensional photonic crystals project. His research interests span nanophotonics, biophotonics and multiphoton-induced devices, with internationally renowned expertise in laser scanning microscopy, nonlinear optical microscopy, and three-dimensional optical imaging theory.

During 2005 Professor Gu was a Bureau member and Vice President of the International Commission for Optics, and a Bureau member and Past President of the International Society of Optics within Life Sciences. He presented eighteen invited talks at international meetings during 2005. During 2005 he was awarded a Foreign Visiting Professorship Award, Ministry for Education (April), P. R. China, an OSA Fellow Travel Award, and an EPSRC Visiting Professorship Award (UK). He was on the international conference committee for fourteen different meetings during the year, is on the Editorial Board of eight optics journals, and acted as a referee for eighteen different journals during the year.

Chief Investigator: Michael Withford (Macquarie)



Michael Withford was awarded a PhD from Macquarie University in 1995 for his investigations of the effects of gas additives on copper vapour laser performance. His continuing work in this field led to the development of a new sub-class of metal vapour, termed kinetically enhanced copper laser, patented in the US, Europe, Canada and Australia. His current

research focus covers laser micromachining and fabrication a range of photonic devices such as fibre Bragg gratings, periodically poled ferroelectric materials, compact amplifiers and lightwave circuits. Dr. Withford leads both the Macquarie University node of CUDOS and commercial venture Laser Micromachining Solutions. He is currently an ARC Research Fellowship, Associate Director of the Centre for Lasers and Applications, and Deputy Chair of the Macquarie University Research Grant Committee.

He serves as a reviewer for Photonics Technology Letters, Optics Express, Applied Optics, Journal for Quantum Electronics, Optics Letters and Journal of the Optical Society of America A.

Chief Investigator: Lindsay Botten (UTS)



During his career, Lindsay Botten, who is Professor of Applied Mathematics at UTS, has made leading contributions in electromagnetic optics in the physical and mathematical understanding of periodic structures, particularly in the optical and electromagnetic properties of diffraction gratings and photonic crystals. He has in excess of 140 refereed publications

and is a Fellow of the Optical Society of America (conferred 2005), the Australian Institute of Physics and the Australian Mathematical Society. He also has substantial interests in computational mathematics and physics and plays a major role in NSW and nationally in the development of advanced computing through his positions as University Services Director of ac3 (Australian Centre for Advanced Computing and Communications) and as a Director of APAC (Australian Partnership for Advanced Computing). Within CUDOS, he leads the Computational Modelling program, the aims of which are to advance modelling expertise within CUDOS, ensuring that various research programs have strong theoretical and computational support. The group specialises in, and is known internationally for the development and application of semi-analytic methods which are physically intuitive, analytically elegant and tractable, computationally efficient, and which capture essential physical principles and cast these in a form which generalises simple and well understood concepts.

During 2005 Professor Botten acted as a referee for eight different journals, was a member of the PIERS 2006 technical program committee (Boston) and the ETOPIM 7 Organising Committee (Sydney).

Chief investigator: Judith Dawes
(Macquarie)



Judith Dawes has 20 years experience in working with lasers and their applications in fields including communications, sensing and medicine. She graduated with a Ph.D. from the University of Sydney, and gained research experience at the University of Rochester and the University of Toronto. At Macquarie, she teaches

Physics and Optoelectronics, and is Director of the B.Tech (Optoelectronics) program and of the Physics Postgraduate program. Her research interests at Macquarie include the development of novel solid-state lasers and optical materials and the study of micro-structured optical materials such as photonic crystals. Within CUDOS she leads the Radiation Dynamics project. She reviews for Optics Letters, Optics Express, Physical Reviews, Applied Optics, Optics Communications, IEEE J. Quantum Electronics, and J. Luminescence.

Chief Investigator: Barry Luther-Davies
(ANU)



Barry Luther-Davies is a Professor of Physics, The Australian National University and a Federation Fellow. He has 35 years research experience in the diverse areas such as lasers, laser-matter interaction physics, photonics, optical materials and nonlinear optics. He oversees the Centre's work at ANU fabricating planar optical waveguide devices

and photonic crystals in chalcogenide glasses and is also leader of the CUDOS flagship project to develop a Compact Optical Switch in a 2-D Photonic Crystal. This combines the skills of researchers at ANU, The University of Sydney and the University of Technology Sydney. His broad experience in many aspects of laser physics and photonics allows him to contribute to all aspects of the CUDOS projects spanning materials science, film deposition and patterning, optical characterization and device design.

Barry is a Fellow of the Australian Institute of Physics, a Fellow of the Optical Society of America and the Australian Academy for Technological Sciences and Engineering – the last two Fellowships being awarded in 2005. He is currently a topical editor for the Journal of the Optical Society of America-B, and a regular reviewer for the Optical Society of America, Institute of Physics, IEEE, Optics Communications, and Thin Solid Films.

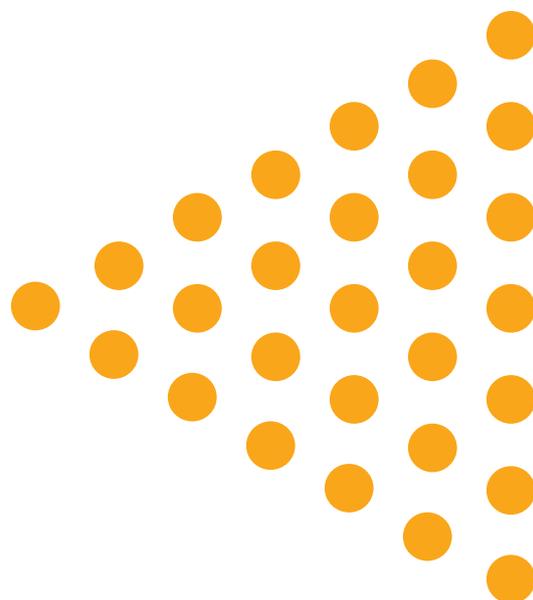
Chief Investigator: Ross McPhedran
(Sydney)



Ross McPhedran is an expert in modeling of wave problems, particularly those involving periodic systems. He has worked on thin film optics, composite materials, diffraction grating theory, mathematical methods, high performance computing and optical fibres. He was one of the first researchers in Australia to enter the new field of photonic crystals.

His principal responsibility in CUDOS is to lead (with Boris Kuhlmeiy) the Microstructured Optical Fibres and Devices Project. He is also active in the Radiation Dynamics Project and the Computational Modelling Project.

He is a member of the Editorial Boards of Proceedings of the Royal Society A, Waves in Random and Complex Media and Journal of Optics A. He also referees for a range of journals in the fields of optics, electromagnetism and theoretical physics. He is one of four Convenors of the Conference ETOPIM7, and Chair of its Local Organizing Committee. He was a Member of the Organizing Committee of the Conference Bragg Gratings, Poling and Photosensitivity, which took place in July 2005. He serves as a Member of the Committee of AFAS NSW, the association which promotes scientific links between France and NSW. He was awarded an ARC Professorial Fellowship in 2005.



Chief Investigator: Wieslaw Krolikowski (ANU)



Wieslaw Krolikowski has been involved in both theoretical and experimental studies in linear and nonlinear optics. His research interests include fibre and integrated optics, optical phase conjugation, self-trapping of light and soliton formation and interaction. Within CUDOS, Wieslaw is responsible for the experimental studies of linear and nonlinear aspects of localization and control of light in periodic photonic structures.

Wieslaw serves as a referee to a number of technical journals including Physical Review Letters, Optics Letters, Optics Express, Journal of the Optical Society of America B. Currently he is Guest Editor the IEEE Journal of Selected Topics in Quantum Electronics. In 2005, he served as a member of the program committees of the Quantum Electronics and Laser Science Conference QELS 2005 (USA) and the International Conference on Nonlinear Optics Applications (Warsaw, Poland)

During 2005 Wieslaw Krolikowski presented several invited talks on his recent research activities at international conferences, including SPIE International Congress on Optics and Optoelectronics (Warsaw, Poland), Soliton Workshop (Dresden, Germany), The 4th IMACS International Conference "Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory" (Athens, USA).

Chief Investigator: Jim Piper (Macquarie)



Jim Piper is Professor of Physics at Macquarie and Deputy Vice Chancellor (Research). He leads research programs in high power gas lasers, novel solid-state lasers, and applications of lasers and associated optical systems in microfabrication and biomedicine. He is author or co-author of some 200 international refereed journal articles and full-length conference proceedings, and

a further 100 published international conference abstracts, as well as inventor or co-inventor of 10 awarded patents. He has been awarded close to \$20 million of competitive research funding over his career at Macquarie and has also developed strong collaborative ties with Australian and international industry. He has served as a Director of a number of proprietary companies and has had significant experience of technology transfer and commercialisation

Jim has served for several years as a member of Australian Research Council committees including 4 years as Program Manager (International and National Cooperation) and as a

member of the Council. He was General Chair of the 20th International Quantum Electronics Conference held in Sydney in 1996, and serves on Program Committees for the leading international conferences in lasers and applications. In 2004 he was awarded the Carnegie Centenary Professorship, Carnegie Trust Universities of Scotland.

Flagship Project Leader: David Moss (Sydney)



David Moss is the leader of the Flagship Project "Integrated Chalcogenide Glass All Optical Regenerator". He has been engaged in research in linear and nonlinear optics as well as semiconductor materials and devices for over 20 years and has over 110 combined journal/conference papers. He is the founder and

current Chair, Australian NSW Branch of the IEEE Lasers and Electro-Optics Society (LEOS).

During 2005 Dr Moss chaired the technical program committee for a number of IEEE/LEOS meetings in Australia and North America and served as a program committee member for the CLEO meeting in Baltimore and the ACOFT/BGPP meeting in Sydney. He is a referee for: Photonics Technology Letters, Optics Express, Electronics Letters, International Optical Physics (IOP) and Optics Letters.

Chief Operations Officer: Chris Walsh



Chris Walsh has over 25 years experience in research and research management in university, CSIRO and industry. His research activities span a wide range of areas of physics, from plasma physics to nonlinear optics, optical fabrication and testing to photonics. His role within CUDOS as Chief Operations

Officer involves all aspects of reporting, financial and intellectual property management. As a member of the CUDOS Executive he contributes to the strategic and operational planning for the Centre and chairs the Centre's Commercialisation Committee.

During 2005 Chris was a member of the Organising Committee for the Photonic Crystals Workshop. With Professor John Love (ANU), he coordinated a successful bid to hold the 2008 General Congress of the International Commission for Optics (ICO) in Sydney, and is the Chair for that meeting. He is a referee for Applied Optics, Optics Express and Photonics Technology Letters.