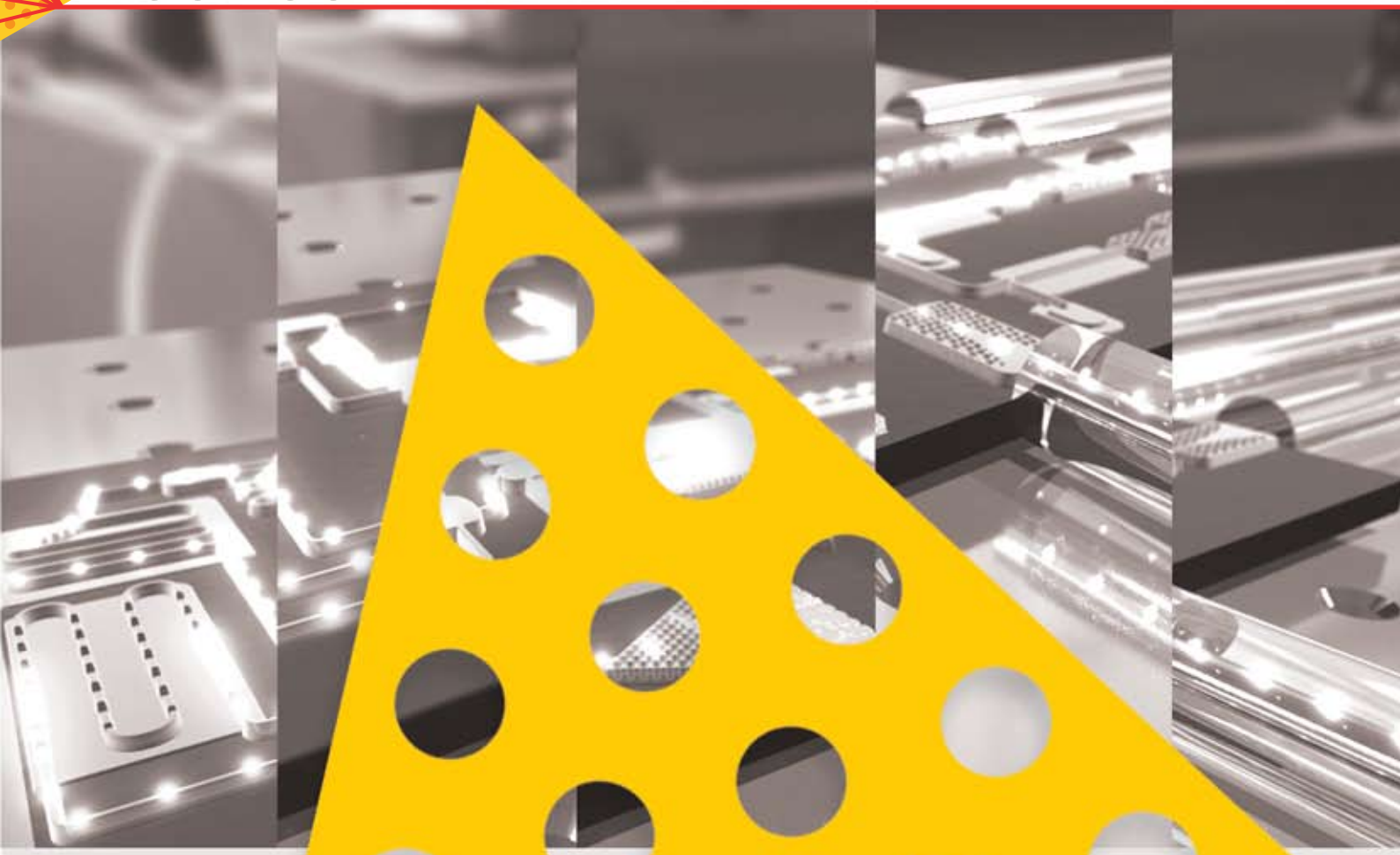
CUDOS

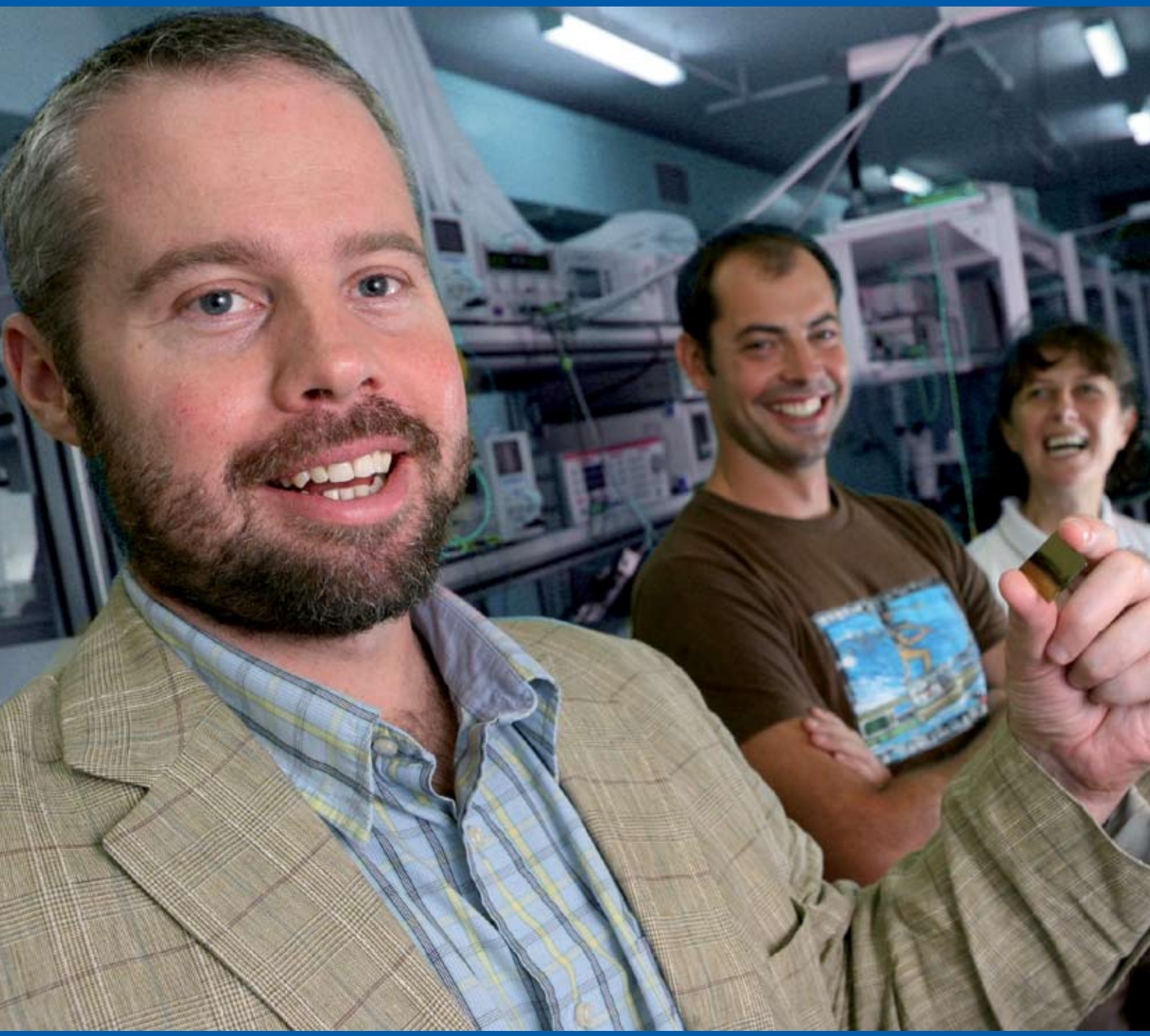
The Centre for Ultrahigh bandwidth Devices for Optical Systems (CUDOS)

An Australian Research Council Centre of Excellence



Annual Report 2007

Research Director



Professor Benjamin J. Eggleton

CI short biography

Benjamin Eggleton is currently an ARC Federation Fellow and Professor of Physics at the University of Sydney. He is Research Director of the Centre for Ultrahigh-bandwidth Devices for Optical Systems (CUDOS), an ARC Centre of Excellence. He studied at the University of Sydney, obtaining his BSc (Hons 1) in 1992 and his PhD in Physics in 1996. After graduation, he went to the United States to join the world's leading research institute in his field, Bell Laboratories, as a Postdoctoral Fellow in the Optical Physics Department. He then transferred to the Optical Fiber Research Department as a Member of Technical Staff and was subsequently promoted to Technical Manager of the Optical Fibre Grating group. Soon after this, he became the Research Director of the Specialty Fiber Business Division of Bell Lab's parent company, Lucent Technologies where he drove Lucent's research program in optical fibre devices. He has co-authored more than 200 journal papers, presented more than 50 invited and plenary presentations at international conferences, and has filed 35 patents. He has received several significant awards. Most notably, in 2007 he received the Pawsey Medal from the Australian Academy of Science and was awarded a Bright Sparks award from Cosmos Magazine, in 2004 he received the Prime Minister[1]s Malcolm McIntosh Science Prize for Physical Scientist of the Year, in 2003 the ICO Prize (International Commission for Optics), and in 1998 was awarded the Adolph Lomb Medal from the Optical Society of America. Other achievements include the award of the Distinguished lecturer award from the IEEE/LEOS, a R&D100 award, and being made an OSA Fellow in 2003. He was an Associate Editor for IEEE Photonic Technology Letters from 2003-2007, and is current Chief Editor for Optics Communications. Professor Eggleton is currently the Vice-President of the Australian Optical Society.

Description of expertise

Professor Eggleton is an experimental physicist with deep understanding of the fundamentals of photonics and optical propagation effects as well as a broad understanding of optical communications, optical networks and other applications of photonics. His specific areas of interest are nonlinear optics and optical solitons, optical gratings and photonic crystals, optical communications, photonic crystal fibres, optofluidics, supercontinuum generation and integrated optics. He has specialized in the fabrication of optical gratings and microstructured optical devices, such as photonic crystals and holey fibres. He has experience with nonlinear pulse propagation effects and ultrafast propagation in different optical systems.

Contributions to Centre

As the CUDOS Research Director, Professor Eggleton is responsible for setting the vision and focus for the research program and establishing and directing the research collaborations. He oversees and manages the six current CUDOS research projects and drives strong interactions with CUDOS Partner investigators and end-users. He also heads the University of Sydney CUDOS node and leads the Sydney experimental programs, in close collaboration with Professors de Sterke and McPhedran, which will be reported here. He is the Science Leader for the Nonlinear Optical Signal Processing project, providing the scientific and technical guidance for this highly collaborative projects that span across four Universities, and PIs, including NICTA, DSTO and USC. He will also actively collaborate and supervise staff and students in the Optical Switching Project, Slow Light Project and Tunable Microphotonics project.

International links and roles

During 2007 Professor Eggleton served on several international review committees, including a review panel for the DFG (Deutsche Forschungsgemeinschaft-- German Research Foundation) Cluster of Excellence Program.

During 2007 Professor Eggleton visited and presented seminars at a series of international Laboratories including: Stanford University, hosted by Prof. Jelena Vukovic; University of Southern California, hosted by Prof Alan Willner; Kyoto University, hosted by Prof. Susuma Noda; Hanzhou University, hosted by Prof Limin Tong; Laval University in Quebec City, hosted by Prof. Real Valee; Naval Research Laboratories in Washington DC, hosted by Dr Jas Sanghera; and Coractive Inc. in Quebec City.

Professor Eggleton served as the General Chair of the Bragg gratings, Photosensitivity and Poling Meeting, which was held in Quebec City in September. He also served on committees for the Optical Fiber Communication Conference, Conference on Lasers and Electro-Optics, and numerous other international meetings.

Research highlights

Eggleton's research is well aligned with the CUDOS Flagship projects and is well described in those sections of the Annual Report. Highlights in 2007 included demonstrations of all-optical signal processing functions at ultrahigh bit-rate, including OTDM optical switching from 160Gb/s to 10Gb/s and wavelength conversion at 80Gb/s. These heroic experiments were enabled by the progress in chalcogenide waveguide fabrication and fibre tapering. Initial experiments were reported in tapered chalcogenide fibres where ultrahigh optical nonlinearity was combined with dispersion engineered producing broadband supercontinuum generation at ultra-low peak power thresholds.

Innovative methods for reconfiguring photonic crystal circuits were demonstrated using a variety of different principles. By exploiting the photosensitivity of chalcogenide glass photo-tuning of photonic crystal properties was demonstrated. In collaboration with Stanford University (Prof Jelena Vukovic) this approach was extended to a hybrid approach whereby a thin layer of chalcogenide was deposited on to a GaAs photonic crystal cavity. By post-tuning with visible light the GaAs photonic crystal cavity resonance could be tuned and aligned to the emission wavelength of quantum dots. In a different approach, microfluidics was also exploited through selective infiltration of air-holes in photonic crystal devices. This approach yielded high Q cavities that are reconfigurable. Finally, evanescent coupling via optical fiber nanowires was exploited as a basis for tuning the cavity properties, specifically the resonant wavelength depends strongly on the displacement of the optical fiber nanowire from the PC slab.

In a project funded by an ARC Discovery grant we demonstrated a tunable supercontinuum source. Our approach involved collaboration with the Macquarie CUDOS node to fabricate high quality long-period gratings in highly nonlinear fibers utilizing the laser microfabrication capability. Following this approach we demonstrated tunable supercontinuum utilizing an acousto-optic grating.