

Director's Report



Ben Eggleton

The ARC Centre of Excellence for Ultrahigh bandwidth Devices and Optical Systems commenced its seven year period of operations in February 2011 following our successful application to the Australian Research Council. The application process commenced in 2009 and culminated in the announcement by the Minister in mid 2010.

While our Centre has the same name as its predecessor, the Chief Investigators see it as having a very different research focus and *modus operandi*. The photonic integration platform that we worked hard to achieve during 2003 – 2010 is now a reality, and one of our key aims as a Centre is to capitalise on this platform to explore new opportunities in *mid infrared integrated photonics* and *quantum photonics* as well as continuing to build on our successes in *terabit per second photonics*.

At its core, the Centre's research is about new ways to control photons. We look for ground-breaking approaches to control dispersion and optical nonlinearities so that photons do what we want them to do. The fields of *metamaterials* and *nano-plasmonics* are perfect matches to this aspiration, and so new programs in these exciting fields are central to our research program.

Metamaterials are synthesised on the sub-wavelength scale to have optical properties (refractive index, dispersion) that can differ dramatically from those of bulk materials: perfect lenses, cloaking, and negative refractive index materials are just some of the exciting theoretical predictions. We have a very clear idea of what metamaterial properties we need for entirely new ways to control photons. Our research in 2011 was directed towards theoretical modelling of nonlinear metamaterials and development of novel fabrication approaches, and will form a solid base for research into functionalised metamaterials in later years.

Our research over the past decade has shown that the full range of optical functions – amplification, nonlinear switching, low loss photon transport for example – can only be obtained in one photonic platform if different materials are used. We must meet this challenge of *hybrid integration* to successfully integrate our novel optical materials into one compact circuit. Our researchers are exploring approaches that are different to

those of other groups and that build on our existing, world-leading expertise in producing nonlinear waveguides in films of chalcogenide glass.

We've built new alliances and invited new Partner Investigators into the Centre to collaborate with us in these new areas. Sir John Pendry (Imperial College) and Nikolai Zheludev (Southampton) will collaborate on metamaterials, Kobus Kuipers (Foundation for Fundamental Research on Matter (Amsterdam)) and Tony Wilson (Oxford) on nano-plasmonics, Jeremy O'Brien (Bristol) and John Sipe (Toronto) on quantum photonics, Roel Baets (Ghent), Thomas Krauss (St Andrews), and Steven Duvall (Silanna Australia) on mid infrared photonics, and Leif Oxenlowe (Danish Technical University), Juerg Leuthold (Karlsruhe), Steve Frisken (Finisar Australia), Shu Namiki (AIST Japan), Trevor Anderson (NICT Australia), and Franz Kärtner (MIT) on terabit per second photonics. Many of our Partner Investigators will collaborate across a number of project areas. This group of researchers leads the world in their fields and will complement and enhance the capabilities of our Chief Investigators. We are particularly excited to have two leading Australian technology companies – Finisar Australia and Silanna – as partners and collaborators in the Centre.

With the new Centre comes a new Advisory Board and a re-invigorated management and governance structure. I am delighted that Dr Greg Clark, presently a Board Member of ANZ Bank and Chairman of KaComm Communications, has accepted my invitation to chair the Advisory Board. Greg had a distinguished career as a bench scientist and R&D Manager in CSIRO and IBM before joining News Limited in a senior executive capacity and moving on to senior executive and director's positions in other publicly listed companies. I also welcome Dr Simon Poole: Simon is a co-founder of Engana, the fore-runner to Finisar Australia (now more than 400 employees) and before that a founder of Indx, a start up that grew to more



Professor Eggleton and the (former) Minister for Industry, Innovation, Science and Research, Kim Carr at the launch of CUDOS in April 2011.

than 350 people as JDS Uniphase Australia. Simon will work closely with me and the executive team as Commercialisation Advisor to the Centre. There is no more knowledgeable person on this topic in Australia in the photonics field.

I also thank Professor Simon Fleming, who has worked closely with me as Chief Operations Officer. Simon, with Shelley Martin (Administration Manager) and Vera Brinkel (Administrative Assistant) played major roles in assisting me to get the Centre up and running. I thank the administrative staff at each node for their contributions to the Centre's successful start in 2011.

It gives me great pleasure to report that 15 new research staff have been recruited during 2011 to work on Centre projects. All our positions are internationally advertised, and we have attracted recruits from the US, the UK, Europe and Asia as well as Australia. The quality of these researchers and their geographical spread is testimony to the strong international reputation enjoyed by our Centre, and I look forward to seeing this next generation of academics play major roles in helping to grow this reputation, and with it the international standing of Australian science.

Director, CUDOS
ARC Federation Fellow