Chief Investigator Profiles

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Michael Withford

Professor 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 laser, termed kinetically enhanced copper laser, in 1998. His current research area is miniaturisation science and engineering encompassing studies into both laser / materials interactions and advanced processing methodologies, and their application to photonic device development. Projects include inscribing fibre Bragg gratings in both photosensitive and non-photosensitive glasses, and femtosecond laser direct writing of waveguides and lightwave devices in passive and active glasses. Withford is Director of the MQ Photonics Research Centre and leads the NCRIS Node *OptoFab* incorporating fabrication facilities at the Bandwidth Foundry, The University of Sydney, the University of Adelaide, and Macquarie University.

Key Areas of Research Contribution

Professor Withford is a member of the Quantum Integrated Photonics flagship project, contributing to the realisation of 2D and 3D quantum circuits created using ultrafast laser inscription. He jointly supervises PhD student Thomas Meany in a project both investigating the challenges fabricating 3D guided wave devices, such as controlling nearest and non-nearest neighbour coupling, with a goal to realising sophisticated quantum random walk architectures. Withford is also active in astrophotonics and independently collaborates with the Australian Astronomical Observatory and Professors Joss Bland-Hawthorn and Peter Tuthill in this field. Future plans for this initiative include developing mid-infrared compatible devices; hence he is also affiliated with the flagship project – Mid-infrared Integrated Photonics.

2011 Achievements

Professor Withford's group continues to generate high profile outcomes from legacy research programs of CUDOS 2003-2010 . Examples include the development of new nonlinear imaging techniques with collaborator Dr Martin Booth (University of Oxford) [1], new insights into the manner with which tightly focussed ultrashort laser pulses modify the lattice of glass substrates [2], demonstration of phase-shifted coupled waveguide Bragg gratings and a new writing regime for inscribing point-by-point fibre Bragg gratings using a MHz pulse rate laser. Their recent outcomes that build on the previous flagship project – *Waveguide Oscillators and Amplifiers* include ultrafast laser inscription of dual wavelength waveguide lasers based on sampled gratings [6], and an ongoing collaborative program with Professor Tanya Monro and A/Prof David Lancaster developing Tm doped ZBLAN waveguides lasers operating at 1.9 [3].

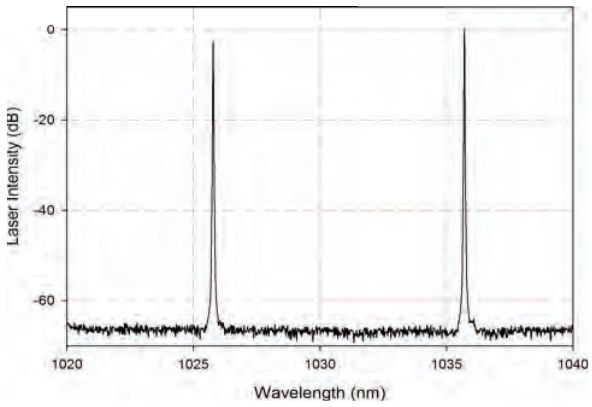

Figure 1: Output spectrum of a dual wavelength laser fabricated in a 10 mm long Yb-doped phosphate glass using phase modulated sampled grating

New initiatives include the successful demonstration of two photon quantum random walks in a 3D waveguide array, in collaboration with the group of Prof. Andrew White, University of Queensland [4]. Research in the field of astrophotonics also resulted in new insights into the origins of focal ratio degradation, improved understanding of the optimal design for arrayed waveguides chips used in astronomical spectrographs [5], and successful on-telescope tests of a 3D photonic pupil remapping system [6].

Recognition

In 2011 Professor Withford joined the SPIE Symposium Committee. Other professional activities include serving as Deputy Chair: Pac Rim CLEO *Laser Processing* Subcommittee, Sydney and membership of the Program Committee: SPIE Smart Materials, Melbourne 2011. Invited speaking opportunities include those at CLEO-Europe 2011 and the International Symposium on Optomechatronics Technology, Hong Kong 2011.

References

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