EPSRC Centre for innovative manufacturing in ultra precision

CDT-UP Newsletter

Centre for Doctoral Training in Ultra Precision Engineering

November 2015

New MRes in Ultra Precision Engineering Students

We are joined by our new cohort of MRes students, Lily Delimata, Nadeem El-Gabbani, Will Fowler, Katjana Lange and James Ryley. On the 6th October our new students attended a welcome event, giving them the opportunity to meet the course leaders and current students. Since the start of term, they have completed their first laboratory session in Ultrafast Laser Processing & Metrology here at the Institute for Manufacturing and have attended a module in Precision Engineerning at Cranfield University.

From MRes to PhDs...

Having successfully completed their MRes course, Daniel Gortat, Alexandre Diaz, Dulce Aguilar-Garza & Xin Chang have begun their PhD projects.

Daniel will continue his studies at the Institute for Manufacturing under the supervision of Martin Sparkes, the title of his PhD project is 'Anode materials for high power microwave devices'.

Alex's PhD project, 'Development and Optimisation of an Optofluidic Nano Tweezers System for Trapping Nanometre Crystals for Synchrotron X-Ray Diffraction Experiments' is a joint project between the Institute for Manufacturing and the Diamond Light Source synchrotron facility.

Dulce has started her PhD under the supervision of Dr Athina Markaki, in the Materials Engineering & Material-Tissue Interactions (MEMTI) group. Her project, 'Fabrication and Characterisation of Hierarchical Branching Vascular Networks' looks at how artificially engineered tissue has diverse potential applications, with the most notable being the creation of organs for transplantation.

Xin Chang's PhD research topic 'Spatial light modulator and its application in holographic displays', focuses on spatial light modulators (particularly liquid crystal on silicon) and their application in holographic displays. Xin is continuing his studies at the CAPE (Centre for Advanced Photonics and Electronics, Cambridge) under the supervision of Prof. Daping Chu.

CDT-UP Online PhD Lecture Series

We have introduced a monthly online lecture series for the CDT-UP to integrate the three centres where we currently fund PhD students - Cambridge, Cranfield & Nottingham. These sessions will take place on a monthly basis using the online meeting system, WebEx. Each centre will host a series of lectures, giving the PhD students an opportunity to provide a technical presentation of their PhD, followed by discussions and possible collaboration between the centres. The presentations will be available on our website after each session.

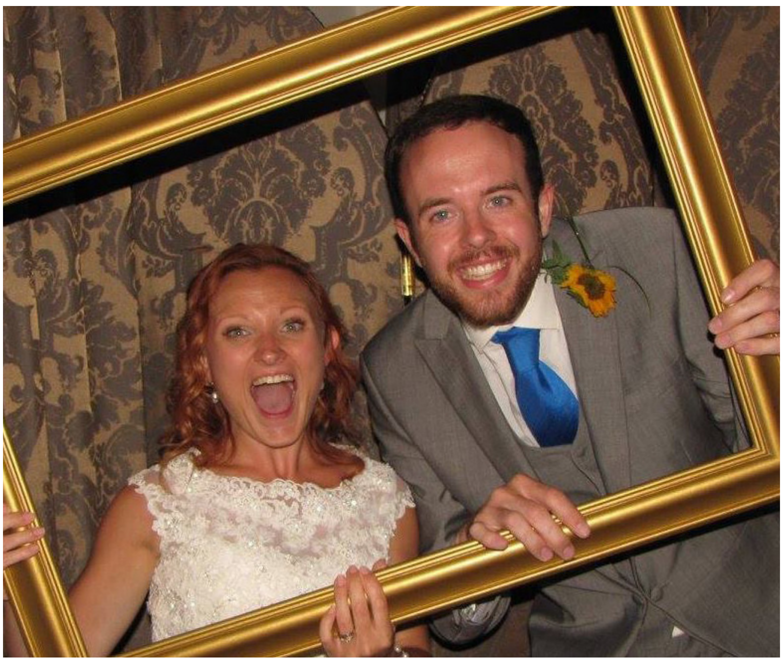
Recruitment - Limited Places

The CDT-UP is currently recruiting students for the MRes/MSc in Ultra Precision Engineering for October 2016 starts. With limited places available at Cranfield University and the University of Cambridge early application is strongly advised. For those interested in joining the course contact us –

CDTUP-enquiries@eng.cam.ac.uk

Congratulations to Mr & Mrs Parkins!!

Congratulations to PhD student, Jon Parkins, from the Centre for Industrial Photonics, who married Lily on Sunday 23 August at the King Arthur Hotel in Swansea.



UNIVERSITY OF CAMBRIDGE

Cranfield UNIVERSITY

EPSRC Pioneering research and skills

Project Feature: High Power Laser system with Built-in Dynamic Spatial Phase Modulation

Traditionally, a laser beam shaping problem considers redistribution of the intensity profile of a laser beam into another more desirable or useful intensity profile. One of the most useful beam shape is the top hat beam profile; the conventionally quoted advantage of this beam shape is that the entire processing area can be made just above the processing threshold instead of in, for example, a Gaussian beam where the peak in the centre and the significant but insufficient intensity on the periphery may lead to undesirable effects.

Today, the approach to beam shaping has beam much generalised. For example, a spatial light modulator (SLM) can dynamically impose some phase profile onto an oncoming laser beam such that after a certain distance of light propagation, a different desired beam shape shall result. However, these light modulating devices will often be the limiting factor in terms of power handling capabilities, which can be in the order of 10s of W. There are deformable mirrors that quote power limits up to 400W, but these devices are somewhat limited in the degrees of freedom available for light modulation.

We propose that a laser system can be designed so as to take advantage of the arbitrary dynamic beam modulation capabilities of a spatial light modulator, while shielding it from the full power of the laser output. The currently pursued design would use a spatial light modulator to launch light into several optical fibres, arranged in a grid. The spatial light modulator choose the relative phase of light that enters each fibre. The light in each fibre would then be directed into separate fibre amplifiers, and the amplified output would then be combined. The interference pattern can be controlled by adjusting the relative phase of the output from each amplifier.

This kind of arrangement is often referred to as coherent beam combining, but the current research in this area usually focus on obtaining one powerful coherent beam by adding a few less powerful beams. We propose that if we can find a way of scaling up the number of separate amplifiers, the resulting system scales not only with total coherent power, but also in imaging fidelity.

If the concept it proven, we may be able to construct a multi kW laser with which an arbitrary intensity profile can be; an ‘optical stamp’ like process could be envisaged. We could use the full power of the laser while distributing it over an appropriate area, to maximise the through-put. Applications which would be able to take advantage of high average power and spatial beam modulation are of particular interest, such as marking, engraving, machining, lithography, and selective laser melting.

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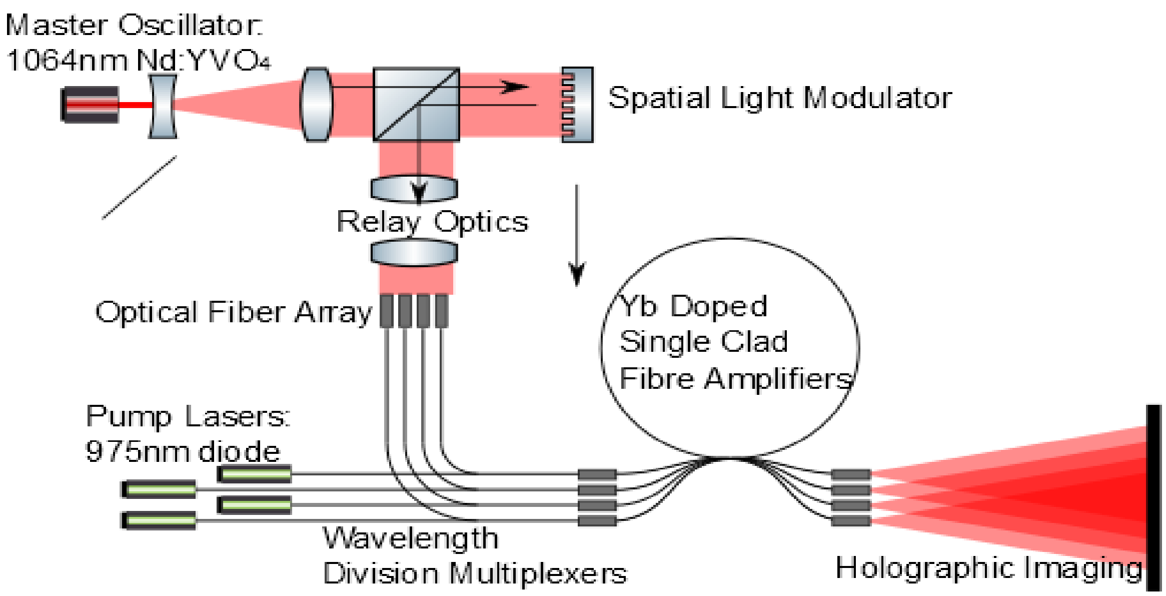

The schematic diagram of the currently pursued design for the laser system.

Energy Beam Processing Module - February 2016

We are pleased to be able to offer a limited numbers of places on this course to graduates, industrial laser system users, original equipment manufacturers (OEM), and laser users. The aim of this course is to provide participants with an understanding of the ways in which energy beam technologies are used to deliver ultra precision materials processing capabilities in engineering applications. It does this by focusing on two key energy beam technology systems widely applied in a number of ultra precision manufacturing applications. Strong emphasis is placed on presenting the underlying science of laser and ion beam technologies and the systems that deliver them. In addition, the methods are both theoretically and practically explored in a number of application case studies. It will provide attendees with an understanding of the issues and the practical means of dealing with these advanced ultra precision manufacturing solutions. For further information, please see here - www.ifm.eng.cam.ac.uk/events/energy-beam-processing/

Save the Date:

Science Festival, 19 March 2016 at the Institute for Manufacturing