MT 070
Can a Colour Centre in Diamond be Useful for Quantum Computer?

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Experimental measurements within the Laser Physics Centre, ANU have shown that the nitrogen-vacancy colour centre in diamond is invaluable for illustrating the properties of a two-level atom interacting with electromagnetic fields. Related to this more recent measurements using the same system has provided insight into the phenomenon of electromagnetically induced transparency.
Can the same system again be of value in demonstrating aspects of quantum computing? There are two current proposals whereby the nitrogen-vacancy centre could be useful for quantum computing and the situation regarding each of these proposals will be reviewed including experimental development at ANU

MT 072
Interaction of an electromagnetic induced transparency and a spectrakl hole

Neil Manson

MT 074
Beam Collimation Using Wedged Plate Multiple Beam Shearing Interferometry

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Multiple beam shearing interferometry using a wedged plate in transmission can achieve accurate beam collimation with a small amount of shear. The accuracy of collimation in the presence of aberrations is also discussed, in terms of the effects apparent at the paraxial focus, circle of least confusion and marginal focus.

MT 076
Application of fringe counting interferometry to MEMS microppump characterisation

Alex Mazzolini

MT 078
Practical concepts for large, low cost, holographic lidar receivers

J. Munch, K. Avudainayagam, K. Corbett, T-L. Kelly, C. Killow and P. Veitch Adelaide University, SA

We shall present our design for a practical, holographically corrected, inexpensive large lidar receiver. The design makes use of novel lightweight mirrors, compact null correctors, and simple adaptive optics. The latest experimental results on mirror design, testing and experimental realization of the lidar receiver will be presented.

MT 080
Mixed State Quantum Entanglement Manipulation

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We introduce a simple experimentally realisable protocol for manipulating entanglement in mixed states of two polarisation-entangled qubits and show how an increase in the degree of concentration is achievable. We discuss a second protocol based on entanglement swapping with mixed states and show how the shared entanglement between distant parties can be improved.

MT 082
Thin film laser protection filters – design and production considerations

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Optical multilayer coatings are used to reject strong laser radiation, and hence protect human and machine vision in defence, scientific and industrial applications. There are many performance parameters to be considered including notch widths, notch wavelengths, optical density, field of view, colour saturation, and photopic and scotopic transmittance. Absorbing glasses are also usefully incorporated in the designs, as their rejection bands are angle-of-incidence independent. We will discuss several specific designs for different applications, as well as production considerations, such as layer uniformity and monitoring.

MT 084
Precision interferometric measurement of right angles with the aid of an etalon

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An interferometric set up has been developed to measure right angles between faces of components such as prisms or cubes, to sub arc second resolution. The component to be measured is placed inside an air spaced etalon and the right angle is measured by a Fizeau interferometer with respect to a transmission reference flat. The etalon consists of two precision glass flats which are aligned to be parallel by optically contacting these to a cylindrical Zerodur sleeve having flat and parallel ends. A circular cut out in the cylindrical sleeve is made to allow the test component and the light from the interferometer to enter the etalon. The phase difference in the two halves of the interferogram corresponding to the two sides of the test component is a measure of the angle deviation from 90^0.

Application of fringe counting interferometry to MEMS micropump characterisation.

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Abstract

As the design and construction of MEMS microsystems becomes more sophisticated, it becomes increasingly important to measure and characterise the dynamic mechanical performance of individual microstructures within the system. These measurements are required to better understand the modes of operation of the devices, and to optimise design as well as identify possible causes of failure. Because of the small size and mass of MEMS structures, it is essential that any measurement techniques perturb the structure as little as possible and hence minimise loading effects.

A simple, low cost fibre optic interferometric technique for non-contact dynamic displacement measurements of a micropump membrane surface is reported. The interferometer operates at 1500 nm, has a bandwidth of 200 KHz, a focussed spot size of 20 μm and a noise equivalent displacement of 0.35 nm. The advantage of this interferometric technique is that it is fibre optic based and hence can be used in inaccessible areas which would be generally considered inappropriate for conventional interferometric measurement techniques. Membrane displacement profiles have been obtained while pumping different gases and liquids using custom designed automated fringe counting and interpolation software to interpret the digitised fringe patterns from the interferometer.

Measurements show significant differences in membrane velocity, displacement and settling time between the different pumping media. In addition, transient underdamped vibration of the membrane surface was detected during the rapid excursion and recursion phases of the pump movement while pumping air. The damping ratio and resonant frequency of the structure were determined from analysis of these transients in the displacement waveform. The amplitude of the membrane displacement was observed to be dependent on the pumping frequency when pumping air. This behaviour was caused partly by frequency-dependent effects in the pump drive circuitry and partly by insufficient settling time between pump cycles, particularly at high pumping frequencies.