Projects on offer by Dr. Adrian Keating, S2 2013

Creating a cloak of invisibility – possibilities using meta-materials

1. Investigate theory and models for cloaking of structures (making them invisible) – develop and investigate existing models, propose a design to make transparent material for applications in the GHz range, such as indoor wireless networks (operating at 2.4GHz)
2. Experimental evaluation of meta-materials for cloaking of structures (making them invisible) in the GHz range (with application for wireless networks)

Super secret spy vision – using bendable fibres to see around corners and inside the body

3. Investigate theory and models for light traveling through a fibre. The desire is to determine the optical performance (how much light get through and any degradation) of a single and multiple fibre bundle
4. Creating a visible and infrared light source for testing bendable fibres – a laser based system. Designing and characterising the beam size and beam propagation.
5. Image capture and analysis of the light output from fibres using a CCD/CMOS camera – design and development of an experimental system to characterise optical fibres in a bundle for image transmission.
6. Evaluation and measurement of lenses for image transfer into the fibre bundle – the aim is to get the most light in and out of the fibre without distortion. Commercial lenses will be selected, modelled, procured and tested. Some experimental system development may be require to evaluate the lenses.
7. Fibre bundles – design and development of an experimental system to characterise optical fibres in a bundle for image transmission.

Using micromachines to shape light – reinventing Descarte’s view of the world

8. Technologies to improve image quality using micromachines – applications to stereo-lithography, photolithography and photonic biomarker applications. Investigate technologies and methods of operation of the current generation of micromachines which can be used to distort and alter a beam of light to remove aberrations and improve the image quality.
9. Using a Digital Micromirror Device (DMD) to modulate a laser beam. Requires mechanical design of a mount and alignment to an optical system to allow the deflection of a light beam – applications to stereolithography, photolithography and photonic biomarker applications. (http://en.wikipedia.org/wiki/Digital_micromirror_device)
10. Using a Digital Micromirror Device (DMD) to modulate a laser beam. Requires electrical and software interface to a DMD to allow the deflection of a light beam – applications to stereolithography, photolithography and photonic biomarker applications. (http://en.wikipedia.org/wiki/Digital_micromirror_device)
11. Analysis of the operation of the optical performance of a Digital Micromirror Device (DMD). Determining the highest resolution image which can be produced.

Mapping ocean waves – sensing changes to our environment.

12. Mapping waves at sea using pressure transducers – look at a range of materials and deformations of the sensing structure due to various wave pressures. Analysis will include finite element (ANSYS), numerical (matlab) or analytical models. Example http://www.comm-tec.com/Prods/mfgs/Aanderaa/Brochures/Wave%20Height%203595%20D232.pdf