School of Mathematical & Physical Sciences:

TITLE OF RESEARCH TOPIC	DESCRIPTION OF RESEARCH PROJECT	PRINCIPAL SUPERVISOR CONTACT DETAILS	RESEARCH GROUP/CENTRE	DISCIPLINE	SCHOOL
Operations Research	Summer project to advance knowledge in an area of interest in Operations Research. Please arrange a topic and supervisor for a potential project prior to submission of your application	Professor Natashia Boland P: 02) 4921 6717 E: Natashia.Boland@newcastle.edu.au	University Centre for Optimal Planning and Operations (C-OPT)	**Mathematics**	MAPS
Optimization over Integers: Applications, Models, Theory and Algorithms	Optimization is now a mature field of mathematics, with deep theory, a wide variety of effective algorithms and a huge range of successful applications in industry. Optimization problems often arise in decision-making situations, such as in planning or scheduling business activities, in which mathematical variables represent the decisions to be made. In recent decades, optimization over integer variables has burgeoned. Such variables expand the modelling power of optimization enormously, enabling nonlinear and logical relationships to be represented linearly, and there are now extremely powerful optimization technologies available to solve the resulting integer linear models. However challenges remain, with new applications, such as in water management and electricity, demanding greater precision in nonlinear modelling and the ability to handle multiple goals (objectives), particularly when environmental objectives, such as the health of an ecosystem or the greenhouse gas emissions of a system, need to be considered. New research in theory, algorithms and modelling is needed to address these challenges, and a variety of specific research topics is available within this area. The specific topic will be developed in consultation with interested candidate, to best suit their background and interests.	Professor Natashia Boland P: 02) 4921 6717 E: Natashia.Boland@newcastle.edu.au	University Centre for Optimal Planning and Operations (C-OPT)	**Mathematics**	MAPS
Mathematics area of interest	Summer project to advance knowledge in an area of interest in Mathematics, particularly mathematical optimization, number theory, analysis or computational mathematics. Current topics include algorithms for non-convex optimization problems, visualisation, fractal geometry, special functions of mathematical physics, and random walks.	Laureate Professor Jonathan Borwein P: (02) 4921 5535 E: jon.borwein@gmail.com	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS

Excursions in number theory	A summer excursion to advance knowledge in an area of interest in number theory. This could include, but is certainly not limited to, the study of classical areas such as the distributions of primes, transcendence of certain real numbers, special cases of Fermat's Last Theorem, or even subjects on the interface of theoretical computer science and number theory, such as sequences arising from finite automata.	Dr Michael Coons P: (02) 4921 5364 E: Michael.Coons@newcastle.edu.au	*Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)*	**Mathematics**	MAPS
Stack sorting and pattern avoiding permutations	Knuth showed that a permutation of n distinct numbers can be sorted in ascending order by passing the numbers through a (first in last out) stack if an only if the permutation contains no pattern of the form 231, meaning a big number cannot sit in between a medium and a small number. The number of such permutations of length n is the n-th Catalan number. One can try to generalise this result in several ways: count the number of permutations avoiding some specified list of patterns; classify (and count) the permutations that can be sorted using two or more stacks, or different kinds of (token passing) networks. Computer experiments could be useful in this project.	Dr Murray Elder P: (02) 4921 7472 E: Murray.Elder@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	
Exploring groups with SAGE	SAGE is an open source computer programming language whose mission is to be "a viable free open source alternative to Magma, Maple, Mathematica and Matlab" according to the website. Much of what is done in MATH3120 could be automated and computed in SAGE, and experiments can be done with more interesting groups that are seen in that course also. The purpose of this project would be to learn how to use the program and explore what it can do, and tackle some open problems in group theory and other areas using it. The student may also write up some "sage worksheets" for use in various undergraduate courses such as 3120.	Murray Elder P: (02) 40217472 E: Murray.Elder@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS
Mathematical modelling	Summer project to advance knowledge in an area or topic of interest in applied mathematical modelling. Please arrange a topic and supervisor for a potential project prior to submission of your application.	Dr Roslyn Hickson P: (02) 4921 6081 E: Roslyn.Hickson@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS

Colour image processing with the quaternionic Fourier transform	Recent developments in harmonic analysis and Clifford analysis (a higher dimensional version of complex analysis), particularly the construction of "quaternionic" Fourier transforms and related tools such a quaternionic wavelet transforms, have led to the possibility of improved treatment of colour images, particularly compression. This project is aimed at the production of software for the implementation of these techniques, and will require strong analytical and programming skills.	Dr Jeff Hogan P: (02) 4921 7235 E: jeff.hogan@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS
Hydroelasticity	Hydroelasticity is the study of the interaction between elasticity and fluid flow. It has a huge range of applications from floating airports to blood circulation. Currently most of the methods used to analyze hydroelastic problems focus on either the elasticity or fluid problem. This project will aim to build a model for some typical hydroelastic problem incorperating consistently both the elastic and fluid effects. This aim will be to develop novel mathematical and numerical methods to solve practical problems in engineering or biology.	Dr Mike Meylan P: 492116792 E: Mike.Meylan@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS
Platonic Scattering	Platonics is the name given by Ross McPhedran to the study of the viration of elastic plates focused on developing metamaterials which can control the vibrational waves. Such materials are analogous to those of electronics and photonics. This is a very new field which has already shown a number of remarkable devices applications, more example a cloaking system which could be used to deflect earthquake waves. In this project the mathematics of platonics will be investigated with the aim of understanding and developing novel metamaterials.	Dr Mike Meylan P: (02) 4921 6792 E: Mike.Meylan@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS
Numerical Analysis	Summer project to advance knowledge in an area of interest in numerical analysis. Please arrange a topic and supervisor for a potential project prior to submission of your application	Dr Bishnu Lamichhane P: (02) 4921 5529 E: Bishnu.Lamichhane@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS
Linear or nonlinear analysis	Summer project to advance knowledge in an area of interest in linear or nonlinear analysis. Please discuss potential projects prior to submission of your application	A/Prof Brailey Sims P: (02) 4921 5540 M: 0404 554154 E: brailey.sims@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS

Dynamic Assortment and Pricing under Demand Learning	Retailers, from high-end fashion stores to day-to-day groceries, face the common challenge of optimally deciding what product range to offer and what prices to set; known as assortment and pricing management. New trends in business, like mass customization and emerging markets, force retailers to encounter situations where size of the market, as an important parameter of the demand function is not well known in advance. In this project, we would like to provide mathematical models for on-line learning using Bayesian updates and dynamic programming. The model should be able to develop managerial insights about this process, which can increase the retailers' efficiency and profitability and enable them to offer lower prices and better services.	Dr Masoud Talebian P:(02) 4921 5525 E: Masoud.Talebian@newcastle.edu.au	Centre for Optimal Planning and Operations (C-OPT) / Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS
Optimisation in Operations Research	Project to advance knowledge in an area of interest in optimization, in particular, integer programming and discrete optimisation, using state-of-the-art techniques. Please arrange a topic for a potential project with me prior to submission of your application.	Dr Hamish Waterer P: (02) 4921 5951 E: hamish.waterer@newcastle.edu.au	Centre for Optimal Planning and Operations (C-OPT) / Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS
Mathematics	Symmetry groups of structures, such as the group of rotations of a sphere for example, encapsulate important features of the structures. Investigation of symmetry groups of relational structures, such as combinatorial graphs and in particular infinite trees, is currently at the cutting edge of research in this area. This summer project will advance knowledge of this subject.	Prof George Willis P: (02) 4921 5666 E: George.Willis@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS
Mathematics	Summer project to advance knowledge in an area of interest in Mathematics, for instance, number theory and special functions.	A/Prof Wadim Zudilin P: (02) 4921 5530 E: Wadim.Zudilin@newcastle.edu.au	Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)	**Mathematics**	MAPS

Physics	Summer project to advance knowledge in an area of interest in Physics or Photonics. Please arrange a topic and supervisor for a potential project prior to submission of your application.	Dr John Furst P: (02) 4348 4117 E: John.Furst@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS
Molecular Photodissociation	The breakup of a diatomic molecule by UV light is possibly the most basic chemical reaction. Experiments at the Advanced Light Source, in Berkeley California, involving the measurement of circular polarisation emitted from neutral hydrogen and nitrogen after the breakup of H_2 and N_2 have generated a large amount of data. This project will involve the analysis of this data using Mathematica or Matlab and the development of skills in the use of angular momentum techniques to look at the fundamental processes involved in the transfer of angular momentum into molecules.	Dr John Furst P: (02) 4348 4117 E: John.Furst@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS
Chiral Devices	Creating devices which can separate identical pharmaceutical drugs is of utmost importance. This project will provide the student with experience in the creation of chemical devices as well as experience synchrotron experiments.	Dr Michael Gladys P: (02) 49215435 E: michael.gladys@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS
Methanol Fuel Technology	Direct Methanol Fuel cell's are a alternative fuel source for hydrogen for general energy use in the transport industry. Data has been taken from the Elettra synchrotron on one such device. This project will give the student experience in analysing XPS data from one of the world's leading research facilities.	Dr Michael Gladys P: (02) 4921 5435 E: michael.gladys@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS
Modelling CO reactions on Iridium	Data was taken using Low Energy Electron Microscopy in Italy on on the oxidation of CO on new clean burn car cataysts. This project will involve modelling this data using an existing computer code.	Dr Michael Gladys P: (02) 4921 5435 E: michael.gladys@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS
Dosimetry imaging based dosimetry for arc-IMRT treatment	We have developed a method to determine the 3D distribution of delivered dose during arc-IMRT, an advanced radiation therapy treatment where a linear accelerator rotates around the patient continuously delivering a beam targeted to the tumour. We record images during rotation and use these to reconstruct at 3D dose in a virtual phantom. This project would perform dosimetric measurements to compare to the reconstructed data. This could lead to clinical implementation of this technique at the Calvary Mater Newcastle for patient treatments.	A/Prof Peter Greer P: (02) 4921 1892 E: peter.greer@newcastle.edu.au	Priority Research Centre for Information Based Medicine Medical Physics Research Group	**Physics**	MAPS

Spectroscopic MRI imaging for brain radiation therapy	The Calvary Mater has a state-of-the-art 3T MRI system. Anatomical brain images are currently used for radiation therapy planning to identify the tumour location and extent in order to plan a treatment that will deliver a high radiation dose to the tumour. However the anatomical images currently do not show all tumour extent and treatments often fail locally. Spectroscopic MRI can identify individual metabolites which can be markers for tumour activity and could potentially better identify the tumour extent. The aim of this project is to acquire spectroscopic MRI scans for patients, develop methods to incorporate the data into treatment planning and assess whether the extent of tumour identified is different to that based on anatomical MRI. This project would be a collaboration with radiation oncology physicists, MRI physicists, radiation oncologists and therapists at the Calvary Mater Newcastle.	A/Prof Peter Greer P: (02) 4921 1892 E: peter.greer@newcastle.edu.au	Priority Research Centre for Information Based Medicine Medical Physics Research Group	**Physics**	MAPS
Surface Plasmons in Metal Nanostructures	Surface plasmons are collective excitations of valance electrons that propagate along a surface. They are currently of enormous technological interest for applications such as single molecule detection, sub-wavelength optics and even tumour therapy. Surface plasmons can be generated by light or by fast electrons. There are clear connections between the two types of excitations because both can be represented by time-varying electric fields. However the time and spatial dependence of these fields is distinctly different. The aim of this project is due explore the classical electrodynamics calculations for these excitations to determine the connections and differences between the two types of excitations.	Dr Vicki Keast P: (02) 4921 6653 E: vicki.keast@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS
Calculating optical properties from first principles	Predicting and understanding the optical properties of materials from first principles can be considered as one of the "last frontiers" in solid state physics. Whilst many other properties of materials, such as mechanical and electronic properties are very well described by fundamental quantum mechanical methods, optical properties often remain poorly described. The reason for this lies in the fact that the optical properties are related to the excited electron states within the material, where the complex response of the electrons to the incident light, including the response of the other electrons must be included. This project will use the latest generation of computer codes to perform such calculations. A variety of metals, semiconductors and insulators will be examined and the applicability of the different levels of approximation to each of these types of materials will be examined.	Dr Vicki Keast P: (02) 4921 6653 E: vicki.keast@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS

TEM of Metal Nanoparticles	A modern transmission electron microscope (TEM) uses the wave properties if electrons to image materials at very high resolution, enough to see the arrangement of the atoms in the material. The University of Newcastle has recently taken delivery of a new TEM which has thus capability. However, the performance of this microscope has not been stringently tested since this arrival. In this project you will learn how to use the TEM and test the performance of the instrument to observe nanoscale gold particles.	Dr Vicki Keast Phone: 4921 6653 Email: vicki.keast@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS
Why Don't Girls Do Physics?	Many other fields have overcome the traditional gender imbalances and yet the number of girls choosing to study physics at the secondary and tertiary level remains stagnant. This project will question and explore the nature of physics itself, in the context of gender interests and preference.	Dr Vicki Keast P: (02) 4921 6653 E: vicki.keast@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS
Diffusion in Samples returned from the NASA Genesis Mission	In the NASA Genesis mission a spacecraft orbited the sun for 3 years, collecting atoms given off by the sun into silicon wafers. The spacecraft returned to Earth and we are now analysing the wafers. The atoms implanted into wafers have however diffused from their expected positions. We will measure the diffusion in Genesis and implant standards using the secondary ion mass spectrometer in the Physics department.	Prof Bruce King P: (02) 4921 5548 E: bruce.king@newcastle.edu.au	Surface and Nanoscience Group	**Physics**	MAPS
Plasma wave signatures of geomagnetic substorms	Geomagnetic substorms resulting in auroral displays are some of the most spectacular sights in nature. The auroras are one manifestation of extremely energetic events in geospace that result in the production of plasma waves. This project will use data from arrays of ground-based magnetometers and VLF radio sounders to examine the properties of these waves and hence determine how the waves are generated.	Prof Fred Menk P: (02) 4921 2007 E: fred.menk@newcastle.edu.au	Centre for Space Physics	**Physics**	MAPS
Effect of magnetic fields on global climate	Everyone is aware of intense discussion on anthropogenic influences on global climate. Some years ago it was proposed that global cloud formation is correlated with cosmic ray fluxes, which in turn are connected with the open solar flux. This project will investigate whether there is a possible relationship between global temperature and the interplanetary and terrestrial magnetic fields, which would modulate cosmic ray fluxes.	Prof Fred Menk P: (02) 4921 2007 E: fred.menk@newcastle.edu.au	Centre for Space Physics	**Physics**	MAPS

Does the Sun affect GPS signals?	Solar flares and coronal mass ejections cause a variety of space weather effects that may impact on technological systems. This project will investigate whether satellite-to-ground GPS signals are adversely affected by these phenomena. This is particularly important given society's increasing reliance on the GPS system for timing and navigation, and the fact that the next solar maximum will occur in 2-3 years.	Prof Fred Menk P: (02) 4921 2007 E: fred.menk@newcastle.edu.au	Centre for Space Physics	**Physics**	MAPS
The Ionospheric Alfven Resonator	The Earth's ionosphere acts as a resonant cavity for electromagnetic plasma waves. This project will involve numerically solving the time dependent Maxwell wave equations to explore the properties of this cavity. The model is unique in combining realistic descriptions of the conductivity and geomagnetic field.	Dr Murray Sciffer P: (02) 4921 5800 E: murray.sciffer@newcastle.edu.au	Centre for Space Physics	**Physics**	MAPS
FoF2 effect on ULF wave observations	The aims of this project is to establish if the F2 regions electron concentration is important in the damping the ULF waves or if the damping is associated with seasonal, global changes in particle densities in the coupled ionosphere-plasmasphere system. The use of existing models of Ultra Low Frequency (ULF) wave in the earth's Ionosphere will be used to estimate the effect of ionospheric conductivities on the amplitude of these wave observed at the ground.	Dr Murray Sciffer / Prof Fred menk P: (02) 4921 5800 E: murray.sciffer@newcastle.edu.au	Centre for Space Physics	**Physics**	MAPS
Design your own Space Physics Project	The Centre for Space Physics has research interests in both the computer simulation and analysis of experimental data from HF radar, satellites and other ground based detectors. The data are mostly measurements of fields (electric and magnetic), particles and optical emissions (e.g. ultraviolet images of the aurora from space). If you have an interest in near-Earth space science and would like to explore a particular interest then come and see us.	Dr Murray Sciffer / A/Prof Colin Waters P: (02) 4921 5800 E: murray.sciffer@newcastle.edu.au	Centre for Space Physics	**Physics**	MAPS
Organic silicon hybrid devices	By using a scanning tunnelling microscopy (STM), this project involves a fundamental understanding on the interactions between organic molecules and silicon surfaces at an atomic level. The formed structures will be used to make organic silicon hybrid devices for biosensor applications.	Dr Xiaojing Zhou P: (02) 4921 6732 E: Xiaojing.Zhou@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS

Biosensors from Plastic Electronics	Diabetes currently affects over 300 million people worldwide, a number that is predicted to rise to over 500 million by 2020. Diabetes sufferers are condemned to a lifetime of painful, invasive blood testing many times a day. This project involves designing, building and characterising OTFT biosensors for diabetes management. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Explosives Detection: Arrays and Architectures	Current electronic detonator technology relies on expensive electronic components to provide detection and timing signals. In collaboration with a major industrial partner, the Centre for Organic Electronics (COE) has a major project to develop sensors based on organic thin film transistors (OTFTs) to detect a number of different signatures of explosives. This project will build on previous COE research to develop low cost printable sensor arrays for explosives detection. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Explosives Detection: Components and Circuits	Organic electronic components are now able to be assembled into complex electronic circuits. In collaboration with a major industrial partner, the Centre for Organic Electronics (COE) has a major project to develop circuits based on organic thin film transistors (OTFTs) to provide timing and wireless communications. This project will develop new components and circuits to provide low-voltage OTFT circuits capable of microsecond timing accuracy and RFID communications. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Helium Atom Beam Microscopy: Using Quantum Mechanics to Image Delicate Surfaces	Scanning helium atom microscopy offers the tantalizing possibility of using the wave-particle nature of helium atoms to image the structure of delicate surfaces with unprecedented resolution. This project will involve developing the new ARC-funded helium beam microscope at Newcastle and producing preliminary images. This project will involve collaboration with the Cavendish Laboratory at the University of Cambridge.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Extending the Spectral Response of Organic Solar Cells	Plants use a range of porphyrin-based molecules (such as chlorophyll) to allow photosynthesis to occur across the solar spectrum. This project aims to develop photovoltaic devices containing artificial porphyrin light harvesting molecules. This project will develop plastic solar cells that generate electricity from the entire solar spectrum. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Extending the Lifetime of Organic Solar Cells	One of the current challenges limiting the rapid uptake of organic solar cells is the limited lifetime of these devices. This project will study novel “inverted” device architectures with the goal of developing extended lifetime solar cells devices. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Field Ionisation He Detection using Carbon Nanotubes	Scanning helium atom microscopy is an emerging imaging technology that uses low energy helium atom beams as a completely non-perturbing probe of nanoscale structure. However, this exciting new technology is currently limited by the lack of an effective 2D imaging system for neutral He atoms. Carbon nanotubes (CNTs) offer the possibility of acting as effective field ionisation tips for He atoms thus allowing them to be detected. This project will aim to grow CNT arrays using a new state-of-the-art chemical vapour deposition (CVD) system in the Centre for Organic Electronics.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Large Area Printing of Organic Solar Cells	The development of new sources of renewable energy is urgently required if the worst effects of man-made climate change are to be avoided. This project will build on the recent exciting advances made by the Centre for Organic Electronics (COE) in device fabrication to develop new methods for printing large photovoltaic arrays based on semi-conducting polymers. This project will make use of the new state-of-the-art printing system that has been recently purchased by the COE for developing organic electronic circuits. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS

Novel Electrodes for Organic Solar Cells	The capability of organic solar cells to provide large scale global sustainable energy solutions will be limited by the current high costs and supply issues associated with the current electrode materials. This project will explore novel inverse architectures and transparent conducting materials to address the issue of developing low cost electrode structures for these exciting new devices. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Novel Encapsulants for Organic Solar Cells	State-of-the-art organic solar cells are limited by the durability and lifetime of the active layer materials in these blended devices. This project will study the role of new encapsulant materials and structures to extend the lifetime of these devices. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Phase Contrast Mechanisms in Scanning Helium Microscopy	The aim of this multinational collaborative research project is to develop the world's first imaging detector for neutral helium atoms for use in a new surface-imaging instrument – the scanning helium microscope. Currently, there is little understanding of the mechanisms that would provide contrast in this microscopy. This project will involve modelling work with the goal of understanding the phase contrast processes.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Photocurrent Mapping of Organic Solar Cells	State-of-the-art organic solar cells are limited the complex morphology and structure of these blended devices. This project will use a Near-Field Photocurrent Microscopy (NSPM) to simultaneously map the photocurrent and the morphology of organic solar cells. NSPM is a new technique that has been recently developed at the University of Newcastle and is the first technique that is capable of directly measuring the photocurrent from organic solar devices. This project will apply NSPM to the study of P3HT/PCBM blend structures, which are the most efficient blend materials currently available. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS

Printing of Electronic Arrays using State-of-the-art Ink Jet Printing	The Centre for Organic Electronics has recently purchased a new state-of-the-art ink jet printer for developing organic electronic circuits. This project will involve developing organic thin film transistor arrays for a variety of sensor applications. The project will involve developing an understanding of the device physics of these transistor arrays. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Structure and Morphology of Conducting Polymer Blends	Conducting polymer blends underpin all of the activities of the Centre for Organic Electronics, especially in the areas of organic solar cells and biosensors based on organic transistors. This project will study the role of structure and morphology in these blend materials as characterised by advanced synchrotron based techniques. The successful student will be required to undertake experiments at the Advanced Light Source, Berkeley, USA. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Ultra-fast Laser Spectroscopy of Organic Electronic Materials	The charge generation and charge conduction mechanisms involved in organic electronic devices occur on extremely short timescales and as such are not well understood. This project will aim to use a state-of-the-art femtosecond laser spectroscopy system to probe these mechanisms using pump-probe spectroscopy. This project is suitable for students with backgrounds in Physics, Chemistry and Engineering.	Prof Paul Dastoor P: (02) 4921 5426 E: Paul.Dastoor@newcastle.edu.au	Priority Research Centre for Organic Electronics (PRCOE)	**Physics**	MAPS
Categorical data analysis	Summer project to advance knowledge in the application of categorical data analysis. Please arrange a topic and supervisor for a potential project prior to submission of your application.	A/Prof Eric Beh P: (02) 4921 5113 E: Eric.Beh@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS
Statistical methods in climate change research	This project will develop statistical theory and methods for climate research in any of the following areas: time series clustering; combining time series; wavelet methods; functional data analysis in time and space; meta analysis for global studies; synchronization mathematics; trajectory analysis using Bayesian and non Bayesian mixture analysis; transition state methods and Bayesian hierarchical methods.	Prof Irene Hudson P: (02) 4921 6402 E: Irene.Hudson@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS

Bioinformatics and Chem-informatics in Drug Discovery	This project will develop novel Bayesian and non Bayesian methods (mixture, artificial intelligence and support vector machines) for classification and create new indicators of molecular ligand binding for drug discovery. The theory will be tested on calpain inhibitors for cataract treatment. The mathematical tools and new indicators developed will provide alternatives to diagnostics currently used in molecular libraries, and aim to provide better prediction and less false positives and negatives in drug evaluation. This research is part of an ongoing collaboration with the University of Cambridge, UK, the University of Adelaide, and GKSS, Berlin.	Prof Irene Hudson P: (02) 4921 6402 E: Irene.Hudson@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS
Using movements to uncover mental processes	There are well-established mathematical theories of the cognitions underlying simple choices, but discriminating between the most sophisticated competing theories is difficult, given existing data. A new source of data might help constrain the theories and shed light on what happens in the moments before a choice is made. One new method uses data measured from movements - an observer makes a decision and simultaneously reaches their arm toward a target. This project will involve integrating data from movement-based experiments with cutting-edge theories of decision making and related statistical theory (wavelets, survival methods, transition state approaches, dynamic mixture models).	Prof Irene Hudson P: (02) 4921 6402 E: Irene.Hudson@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS
Sleep Research: Fatigue modelling algorithms for railway drivers	This project involves the development of multivariate Bayesian mixture and other multivariate time series methods to classify railway drivers' sleep/duty/wake/break profiles. Methods will accommodate time series of highly disparate lengths across drivers, and of high dimension. This research is part of a CRC Rail Innovation Grant funded project, and a collaboration with the University of SA, Centre for Sleep Research.	Prof Irene Hudson P: (02) 4921 6402 E: Irene.Hudson@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS
Statistical surveillance methods in climate and health:	The field of health informatics, a discipline at the juncture of information science, computer science, and health care has experienced a tremendous growth in tandem with the development of new computational and e-technologies. This project will explore and develop spatial and temporal and also mixture statistical methods for surveillance studies, as applicable to topological climate maps, and to the surveillance of health, disease and injury. Data will be available from the School of Medicine and Public Health, the School of Health Sciences (Faculty of Health) and the WHO.	Prof Irene Hudson P: (02) 4921 6402 E: Irene.Hudson@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS

Modelling Trajectories: Longitudinal and Time Series methods:	This project will explore/ develop a theoretical framework for joint modelling of multivariate profiles (trajectories) over time. The methods will be tested and applied to datasets, based on NHMRC funded research - in collaboration with investigators at the University of Newcastle and the University of Adelaide. The student can choose the data set. This project offers choice of areas of application in stroke research, neuro-physiological and/or psychometric research.	Prof Irene Hudson P: (02) 4921 6402 E: Irene.Hudson@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS
Spatial patterns of disadvantage	The spatial pattern of disadvantage shows different features at different geographic levels. This project will consider the role of geographic level, particularly the effects of different types of boundaries, and investigate social statistics of areas in the Hunter region. This project would ideally suit a student with a background in both statistics and geography.	Dr Robert King P: (02) 4921 5548 E: Robert.King@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS
Image analysis for Robot soccer:	This project involves work with the University of Newcastle's robot soccer team, the NUBots. The robots find where they are on the field (localise) using information from the picture taken by the camera in their head. This project will work on improving the image analysis module.	Dr Robert King P: (02) 4921 5548 E: Robert.King@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS
Statistics	Summer project in an area of Multivariate analyses involving structural equation modelling.	Dr Elizabeth Stojanovski P: (02) 4921 5346 E: Elizabeth.Stojanovski@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS
Statistics	Summer project in an area of Bayesian Statistics.	Dr Frank Tuyl P: (02) 4921 8854 E: Frank.Tuyl@newcastle.edu.au	Statistics Research Group	**Statistics**	MAPS