

Summary of Successful Linkage International applications - Round 9 to Commence in 2005 by State/University

New South Wales

Macquarie University

LX0561261 Dr QA Parker; Prof EM Sadler; Prof RW Hunstead; Prof B Rocca-Volmerange
Title: **Stellar populations, Galaxy Formation and Large-scale structure**

2005 : \$21,000
2006 : \$21,000
2007 : \$21,000

Category: 2401 - ASTRONOMICAL SCIENCES

Collaborating Countries

France

Administering Institution: Macquarie University

Summary:

We request renewed support under the MoU with France to continue a fruitful cooperative research programme in astrophysics which has again been funded by the French CNRS for 2004 and, pending Australian equivalence, also for 2005 and 2006. This will further strengthen existing links in key areas of astrophysics where Australian and French researchers have complementary strengths. Previous support has enabled Australian and French astronomers to build successful collaborations across a broad range of important areas encompassing theory, survey astronomy (a key Australian strength), special observational techniques and large-scale observational programmes, many making use of the new generation of 8m telescopes.

The University of New South Wales

LX0561913 Prof R Amal; Dr C Selomulya; Prof R Williams

Title: **Development of an integrated methodology to assess dewatering system performance in solid-liquid separation**

2005 : \$15,000

Category: 2906 - CHEMICAL ENGINEERING

Collaborating Countries

UK

Administering Institution: The University of New South Wales

Summary:

3D visualisations of microstructures are possible with techniques such as confocal laser microscopy and high resolution X-ray microtomography. Data obtained in-situ enable direct computation of solids assembly properties and their permeability to fluids. A specific application involving aggregate formation and sediment networks could be evaluated through micro-scale analysis combined with robust fluid flow simulations. The method can potentially be utilized to predict trends such as filtration behaviour of materials under different states of compression. This offers significant benefits in formulating the design of flocculated systems pertinent to a number of industrial sectors wishing to design optimum solid-liquid separation processes.

LX0560177 Prof M Loosemore; Dr PX Zou; Prof D Fang

Title: **Community perceptions of environmental risks associated with large construction projects**

2005 : \$8,000
2006 : \$8,000

Category: 3102 - BUILDING

Collaborating Countries

China

Administering Institution: The University of New South Wales

Summary:

Large construction projects have an enormous environmental impact, yet there has been little research in this area, particularly in developing countries where many such projects are being procured. Furthermore, research tends to focus on ecological impacts and ignore social and cultural issues. The result is a poor understanding of how perceptions of environmental risk are shaped in affected communities. To address this problem, we aim to establish a research agenda to investigate how communities affected by large construction projects in China perceive environmental risks. The outcome will be recommendations to help construction companies develop sustainable, consultative and socially sensitive practices.

LX0559833 Adj/Prof JA Reizes; A/Prof F Stella

Title: **Enhancement of heat transfer by micro-electro-mechanical devices: numerical and experimental study**

2005 : \$24,400
2006 : \$24,400
2007 : \$19,500

Category: 2918 - INTERDISCIPLINARY ENGINEERING

Collaborating Countries

Italy

Administering Institution: The University of New South Wales

Summary:

The main goal of the present project is to approach a completely new concept for cooling electronic-micro-devices (EMD). We will integrate the cooling system in the EMD by mean of built micro-electro-mechanical systems (MEMS). The area of application is so innovative, that there is no engineering experience for modelling heat transfer at such small physical scales. The first goal of this project is to fill this lack of knowledge and to validate the possible numerical procedure using experimental data obtained from experiments, also planned for the present project. Once a suitable procedure has been established for evaluating heat fluxes , we will optimized configurations for heat transfer enhancers in micro devices.

LX0561259 Dr CC Tisdell; Prof L Erbe

Title: **Boundary Value Problems for Differential Inclusions**

2005 : \$2,800

2006 : \$2,800

Category: 2301 - MATHEMATICS

Collaborating Countries

USA

Administering Institution: The University of New South Wales

Summary:

Boundary value problems (BVPs) for differential inclusions are mathematical equations that accurately describe the complex world around us. This project aims to answer important mathematical questions such as:

(i) Under what conditions do BVPs for differential inclusions actually have solutions'

(ii) If solutions do exist, what are their properties'

(iii) If solutions are too complicated to be found explicitly, then how can they be approximated'

The approach is to use modern tools from mathematical analysis, including new differential inequalities.

The project outcomes will:

(a) Significantly advance mathematical knowledge for differential inclusions

(b) Have many applications to areas of science, engineering and technology.

The University of Sydney

LX0561442 Dr HY Liu; Dr W Yan; Prof Q Sun

Title: **Theoretical and Experimental Investigation of the Wear Behaviour of NiTi Shape Memory Alloy**

2005 : \$6,500

2006 : \$6,500

Category: 2905 - MECHANICAL AND INDUSTRIAL ENGINEERING

Collaborating Countries

Hong Kong

Administering Institution: The University of Sydney

Summary:

Exploring high wear-resistant materials is always an active issue in tribology and material engineering in order to extend the life of the wide-ranged wearing components and devices. NiTi shape memory alloy (SMA) demonstrates a superior wear resistance to stainless steel. This project aims to theoretically and experimentally exam the wear mechanism of NiTi SMA and quantify its wear rate. The expected outcome will discover the contributions of phase transition and plasticity on the wear property of NiTi SMA, formulate a reliable wear model and stimulate the application of NiTi in tribology and modern micro-electric-mechanical systems.

LX0561916 Prof AS Weiss; Prof RS Langer

Title: **Biomaterial applications of synthetic elastin**

2005 : \$24,520

Category: 2915 - BIOMEDICAL ENGINEERING

Collaborating Countries

USA

Administering Institution: The University of Sydney

Summary:

The grant will develop a new collaboration between two established laboratories. The Weiss Lab (synthetic elastin; University of Sydney, Australia) will send elastin materials to the Langer Lab (interface of biotechnology and materials science; MIT, USA). Prof. Weiss will visit the Langer Lab and be trained in and participate collaboratively in the use of established MIT methodologies that will focus on applications in cardiac tissue engineering, controlled release of drugs and vocal fold repair. The MIT group will benefit from access to and the use of elastin materials that are developed in Australia

University of Technology, Sydney

LX0561319 Prof S Vigneswaran; Dr HH Ngo; Prof HJ Kim; Prof IS Kim; Prof H Moon

Title: **An innovative wastewater treatment system for the removal of persisting organic pollutants (POPs)**

2005 : \$16,000

Category: 2908 - CIVIL ENGINEERING

Collaborating Countries

Korea

Administering Institution: University of Technology, Sydney

Summary:

Photocatalysis is an emerging technology in wastewater treatment that is capable of completely converting POPs into harmless compounds. In this research, we will combine the expertise of Gwangju Institute of Science and Technology (GIST) in water reuse technologies, and Chonnam National University (CNU) in advanced oxidation processes with that of UTS' in physico-chemical treatment processes to develop a novel photocatalysis hybrid system. Through long term collaboration we aim to: (i) establish an innovative hybrid system for POPs removal, (ii) prepare industry grants, (iii) research training of postgraduate research students, and (iv) help to commercialize our research outcomes for domestic benefit and export.

University of Wollongong

LX0560106 Dr MJ Qin; Prof S Ding

Title: **Molecular dynamic simulation and experimental study on the mechanisms of high critical current density in superconductors**

2005 : \$11,300

2006 : \$11,300

2007 : \$11,300

Category: 2914 - MATERIALS ENGINEERING

Collaborating Countries

China

Administering Institution: University of Wollongong

Summary:

The aim of this project is to establish a collaboration between the Institute for Superconducting and Electronic Materials (ISEM) and the team at Nanjing University to study the mechanisms of high critical current density (or flux pinning) in superconductors. Molecular dynamic simulation combined with experimental techniques, such as transport and magnetic measurements will be used. The results of this work will expand our understanding of the pinning mechanisms of high temperature superconductors and MgB₂ superconductors, with the hope of further enhancing the current carrying capacity, and therefore promoting the practical applications of superconductors.

LX0561454 Dr J Xi; A/Prof Y Yu; Prof JF Chicharo; Dr E Li; A/Prof H Ye

Title: **Measuring the linewidth enhancement factor and optical feedback level factor of semiconductor lasers based on optical feedback self-mixing interferometry**

2005 : \$18,000

2006 : \$18,000

Category: 2499 - OTHER PHYSICAL SCIENCES

Administering Institution: University of Wollongong

Summary:

This project aims to develop a high performance solution for the challenging problem of measuring the linewidth enhancement factor (LEF) of semiconductor lasers (SLs) and the optical feedback level factor, C, for the optical feedback self-mixing (OFSM) systems. Specific outcomes of the research include (1) a new model for an optical feedback self-mixing effect, (2) a new approach for measuring LEF and C based on the proposed model, (3) signal processing algorithms for improving the performance of the proposed approach, and (4) an OFSM system prototype based on the new model and algorithms.

Victoria

Monash University

LX0561272 Dr RP Jagadeeshan; Prof T Sridhar; Prof ES Shaqfeh

Title: **DNA Dynamics in Shear and Extensional Flows: Simulation and Single Molecule Experiments**

2005 : \$14,900

2006 : \$22,400

2007 : \$16,400

Category: 2906 - CHEMICAL ENGINEERING

Collaborating Countries

USA

Administering Institution: Monash University

Summary:

The proposal seeks to establish a collaboration between Monash University and Stanford University in order to combine several recent experimental and theoretical advances that have been made by the individual groups in single molecule experimental techniques, extensional rheometry, and molecular rheology, to obtain new insights into the structure and dynamics of biopolymers. The central aim is to make a significant contribution towards bringing state-of-the-art techniques used for the characterization of polymeric systems to bear on the nature and origin of the elastic properties of biopolymers.

LX0561094 Prof PJ Scammells; Prof RD Singer

Title: **The Development of Novel Task Specific and Biodegradable Ionic Liquids**

2005 : \$18,400

2006 : \$14,300
2007 : \$18,400

Category: 2599 - OTHER CHEMICAL SCIENCES

Collaborating Countries

Canada

Administering Institution: Monash University

Summary:

The advance of 'Green Chemistry' has become a forefront issue in mainstream chemistry. Green Chemistry is aimed at the reduction or elimination of hazardous substances in the design, manufacture and application of chemical products. The advent of ionic liquids (ILs) has made a significant contribution towards these goals. ILs have many beneficial properties including non-volatility, non-flammability, and a large stable liquid range. As ILs advance from academic curiosities to industrial solvents, the need to address the issue of their biodegradability and toxicity is paramount. The key objective of this project is to design new biodegradable and task specific ILs for environmentally friendly industrial use.

LX0560299 Dr L Spiccia; Dr Y Cheng; Prof DR MacFarlane; Prof M Gratzel

Title: Novel Materials for Dye Sensitised Solar Cells

2005 : \$15,900
2006 : \$15,650
2007 : \$15,650

Category: 2918 - INTERDISCIPLINARY ENGINEERING

Collaborating Countries

Switzerland

Administering Institution: Monash University

Summary:

Solar energy is the most attractive renewable energy source. Dye sensitised solar cells (DSSCs) are one type of device that can harvest this energy, offering advantages of low materials cost and ease of fabrication when compared to alternative devices. This project aims to develop efficient, flexible DSSCs by using polymer substrates in place of glass. Novel surface modification approaches and microwave processing will be employed to fabricate the nanoporous semiconductor electrodes on polymer substrates and to improve cell efficiency. Improved dyes and new electrolyte systems, such as plastic crystals, will be incorporated into the cell to improve efficiency, durability and stability.

Swinburne University of Technology

LX0561315 Dr F Wang; A/Prof W Pang

Title: Joint Theoretical and Experimental Electron Momentum Spectroscopic Studies for DNA Bases

2005 : \$8,000
2006 : \$8,000

Category: 2506 - THEORETICAL AND COMPUTATIONAL CHEMISTRY

Collaborating Countries

Canada
China

Administering Institution: Swinburne University of Technology

Summary:

The study of DNA structure is an area of intense research activity and continues to reveal new levels of complexity and diversity. Recent experiments (Science, 2002) provided direct evidences of the adenine non-planarity, indicating non-rigidity of DNA bases. Electron momentum spectroscopy (EMS) has been identified to be an appropriate technique in the study of chemical binding mechanism and orbitals at molecular level. The aims of the project is to study orbitals and interactions of DNA and RNA bases such as adenine, thymine (uracil), guanine and cytosine using momentum space quantum mechanics and EMS experimental techniques. The outcome of the project will improve our understanding of the DNA double helical strand structure.

The University of Melbourne

LX0561304 Prof F Grieser; Dr M Ashokkumar; Prof K Vinodgopal

Title: Sonochemical synthesis of nanoparticles for fuel cell applications

2005 : \$11,600

Category: 2501 - PHYSICAL CHEMISTRY (INCL. STRUCTURAL)

Collaborating Countries

USA

Administering Institution: The University of Melbourne

Summary:

The sonochemical synthesis of metal and semiconductor nanoparticles is one of several developing applications of ultrasound. Ultrasonically produced nanoparticles possess a number of specific properties, such as, pronounced catalytic activity. This project aims to ultrasonically synthesize metal nanoparticles and evaluate their suitability for fuel cell applications. The University of Melbourne and the Indiana University North-West research groups have a strong background and experience in the proposed research field. The outcome of this investigation will provide the basis for gaining other funding (e.g., ARC-NSF), which will establish a more extensive longer term collaboration between the universities.

LX0560759 Dr SE Kentish; Mr SI Sandler

Title: The separation of carbon dioxide from industrial sources using nanoporous carbon

2005 : \$9,600
2006 : \$6,800
2007 : \$7,700

Category: 2906 - CHEMICAL ENGINEERING

Collaborating Countries

USA

Administering Institution: The University of Melbourne

Summary:

Carbon nanotubes and nanoporous carbon membranes offer the possibility of low cost energy efficient separations of gas mixtures. Possible applications include the purification of greenhouse gases for sequestration and the purification of hydrogen from reformer gas for use in a hydrogen energy economy. The proposed project involves the development of mathematical models and computer simulations to understand and optimise the nanoporous structure for different gas separations, and experimental research to produce the carbon nanoporous materials and determine their effectiveness of gas separation.

LX0561267 A/Prof A Roberts; A/Prof GW Baxter; Dr G Monnom; Dr B Dussardier; Dr W Blanc

Title: Microcharacterisation of rare-earth-doped optical fibres

2005 : \$12,300
2006 : \$11,300

Category: 2404 - OPTICAL PHYSICS

Collaborating Countries

France

Administering Institution: The University of Melbourne

Summary:

Rare-earth-doped optical fibres continue to play a central role in optical telecommunication systems and are increasingly being used as elements in optical fibre sensing devices and as fibre lasers. The aim of this project is the application of new high spatial resolution techniques for determining the physical properties of such fibres. These methods will permit unprecedented knowledge of the precise distribution of rare-earth ions in the fibre and its relationship with the fibre's refractive index profile. This information is critical to understanding the performance of rare-earth-doped fibres in a variety of applications and the outcomes of this work will inform the design of fibres optimised for use in specific applications.

Queensland

Queensland University of Technology

LX0561885 A/Prof JM Bell; Dr ER Waclawik; Dr B Wei; Dr H Zhou; Adj/Prof N Motta

Title: Modifying Structure and Properties of Carbon Nanotubes for Device Applications (MWN)

2005 : \$36,000
2006 : \$37,500
2007 : \$42,980

Category: 2402 - THEORETICAL AND CONDENSED MATTER PHYSICS

Collaborating Countries

USA

Administering Institution: Queensland University of Technology

Summary:

The focus of this project is to develop new heteroatom-doped carbon nanotube materials for use in conjugated-polymer composite photovoltaic cells. Synthesis of boron and of nitrogen doped carbon nanotubes (CNTs) by the US researchers will be complemented by ion-implantation post-synthesis of CNTs by the Australian team, to gain a thorough and detailed understanding of how the CNTs can act effectively as both an electron acceptor and charge transport medium in a conjugated polymer. Outcomes will include fundamental advances in our understanding of charge transport in the composite devices and prototype organic photovoltaic devices of improved efficiency.

South Australia

The University of Adelaide

LX0561273 Dr P Marschner; Prof Z Rengel; Prof F Zhang; Prof L Li

Title: The role of biological and chemical interactions in the rhizosphere in sustainable intercropping

2005 : \$10,000
2006 : \$10,000
2007 : \$10,000

Category: 3001 - SOIL AND WATER SCIENCES

Collaborating Countries

China

Administering Institution: The University of Adelaide

Summary:

Intercropping can result in large yield increases compared to mono-cropped systems. It is used extensively in China and could be an option for sustainable land-use in Australia. Belowground interactions between intercropped crop species may be important for the yield increase, but they are poorly understood, especially with regard to nutrient availability and soil biology. We will combine the field experience in intercropping systems of the Chinese scientists with the expertise of the Australian scientists in plant nutrition and rhizosphere ecology to characterise chemical and biological interactions in the rhizosphere governing nutrient availability and the competitive ability of intercropped species.

University of South Australia

LX0562056 A/Prof D Fornasiero; Dr R Sedev; A/Prof N Dimitrov; Prof J Ralston

Title: Development of a New Type of Large-Area Robust Superhydrophobic Surfaces (MWN)

2005 : \$75,000

2006 : \$68,000

2007 : \$71,000

Category: 2501 - PHYSICAL CHEMISTRY (INCL. STRUCTURAL)

Collaborating Countries

USA

Administering Institution: University of South Australia

Summary:

Electrochemical manipulation will be used to produce robust metal surfaces of controlled roughness and characteristic size of the surface features in the 10-1000 nanometre range. Subsequent surface modification (e.g. self-assembled monolayers, silane chemisorption, plasma polymer deposition) will render these surfaces superhydrophobic. The surfaces will have highly depressed adhesion properties and hence a significantly improved chemical resistance and corrosion stability. A viable procedure for the making of polymer imprints from the metal surfaces will be developed. This will form the basis of a new method for cheap fabrication of various superhydrophobic surfaces with large areas and specific functionality.

LX0560252 A/Prof WY Saman; Prof Dr K Vajen

Title: Dehumidification and cooling driven by solar/waste heat using liquid desiccants

2005 : \$6,000

2006 : \$3,000

2007 : \$6,000

Category: 2905 - MECHANICAL AND INDUSTRIAL ENGINEERING

Collaborating Countries

Canada

Germany

Administering Institution: University of South Australia

Summary:

The provision of comfort cooling is responsible for a considerable and increasing portion of the world energy demand and electricity peak demand. To substitute electrically driven vapour compression machines with their high electrical energy consumption and especially high peak loads, the use of solar energy or waste heat for a cooling and dehumidification system driven by liquid desiccants is a promising opportunity. The project utilises the complementary strengths in the research groups to develop practical and economically feasible cooling/dehumidification systems for different types of buildings with different moisture removal and cooling requirements at different locations (Australia, Southern Europe).

Western Australia**The University of Western Australia**

LX0561280 Dr JG Hartnett; A/Prof ME Tobar; Dr MV Jacob; Prof J Krupka; Prof JE Mazierska

Title: Microwave characterisation of new magnetic and dielectric structures and materials

2005 : \$10,000

2006 : \$10,000

2007 : \$10,000

Category: 2909 - ELECTRICAL AND ELECTRONIC ENGINEERING

Collaborating Countries

NZ

Poland

Administering Institution: The University of Western Australia

Summary:

The main goal of the project is to characterize electromagnetic properties of single crystal dielectric and polycrystalline ferrite materials at microwave frequencies, from room temperature down to liquid helium temperature. Also cylindrical and spherical resonant Bragg structures will be investigated using some of these materials. The dielectric rod resonator technique will be used for all materials and the whispering gallery mode technique will be used to measure the lowest loss materials. Very accurately measured microwave parameters of electric and magnetic materials will be made available to designers of new components and systems (especially useful for operation at cryogenic temperatures).

LX0561252 Dr P Sharpe; Dr PC Maddern; Dr SM Broomhall; Dr SL Tarbin; Dr VA Harding

Title: A historical approach to the development of households

2005 : \$8,438

2006 : \$2,960
2007 : \$2,960

Category: 4301 - HISTORICAL STUDIES

Collaborating Countries

UK

Administering Institution: The University of Western Australia

Summary:

The LI Grant will enable our team to participate in international discussion to build new knowledge about households and families. We will exchange expertise with the UK specialist partners, gaining access to the latest quantitative scholarship in urban household history, providing qualitative analyses using innovative reading techniques in return. The exchange will result in new methodologies to uncover non-nuclear family relationships and household forms as we continue archival research. Presenting our findings to UK scholars through the proposed schedule of visits, symposia, residencies, e-networking and collaborative publication, will facilitate international consideration of the research questions generated by our project.

Australian Capital Territory

The Australian National University

LX0561260 Prof AL Carey; Prof Dr H Grosse; Prof J Phillips; Dr FA Sukochev; Dr AC Rennie

Title: **Noncommutative geometry and applications**

2005 : \$15,000
2006 : \$15,000
2007 : \$15,000

Category: 2301 - MATHEMATICS

Collaborating Countries

Austria
Canada
Finland
Germany
UK
USA

Administering Institution: The Australian National University

Summary:

Noncommutative geometry is a new field of mathematical research having its origins in quantum mechanics. The main feature of this theory is that it deals with geometric and topological aspects of objects for which the order in which we make measurements or perform operations or observations is relevant to the outcome. This happens with microscopic systems especially those at the atomic or subatomic length scale. The methods have been motivated by and found application in condensed matter physics, string theory, random media, algebraic structures and the geometry and topology of manifolds