2009
Year of Astronomy
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Established in 1853, the University of Melbourne is a public-spirited institution that makes distinctive contributions to society in research, teaching and knowledge transfer.

Melbourne’s teaching excellence has been rewarded two years in a row by grants from the Commonwealth Government’s Learning and Teaching Performance Fund for Australian universities that demonstrate excellence in undergraduate teaching and learning.

Melbourne was also one of only three Australian universities to win ten citations -- the maximum number of awards possible -- under the Carrick Citations for Outstanding Contributions to Student Learning. The citations recognise commitment by university staff who have shown outstanding leadership and innovation in teaching, and dedication and enthusiasm for student learning.

The final strand -- engagement -- encompasses interaction between the University and the wider society. It includes knowledge partnerships, interactions with alumni, advancement activities and international programs.

Knowledge partnerships are interactions between the University and external groups or individuals and are essential to the ensuring the University’s public-spirited character. Melbourne will continue to expand the number and scope of its knowledge partnerships and ensure effective metrics to promote excellence in these activities.

The University’s international strategy permeates every aspect of the institution’s activities. The University will continue to extend and develop its international character, through partnerships with international Universities and organisations and programs such as Melbourne Global Mobility. In addition, the University will work towards having a more ‘cosmopolitan’ campus, with a view to increasing the number of high calibre international staff and research higher degree students.

The University values its relationship with alumni, and acknowledges that there are many more opportunities to be explored. The University seeks to engage alumni as advisors on course content, as mentors for current students and guides for prospective applicants. The University also hopes to pursue new engagement opportunities with its growing international alumni. In return, alumni are able to attend many public events as well as access the University’s knowledge base and infrastructure.

Advancement programs support research, provide scholarships to students from a variety of backgrounds, establish chairs in specific disciplines, expand and maintain library facilities and establish new infrastructure. The University will continue to expand its advancement activities with a major campaign in 2010 designed to treble the University’s annual income from donations and gifts within five years.

The Melbourne Model undergraduate and graduate education have continued to be a central focus of thought and investment at the University.

THE UNIVERSITY OF MELBOURNE

THE TRIPLE-HELIX

The University of Melbourne seeks to be highly regarded in research and research training, learning and teaching, and engagement.

Together these three activities are envisaged as a metaphoric triple-helix in which they are closely bound, each reinforcing the other. Growing Esteem takes into account current national and international research priorities, aims to assist the University to address the pressures of space, size and coherence in undergraduate education and ensures a much stronger link between public outreach and teaching and research.

The first strand – research and research training – is core to the mission of the University, linking Melbourne to the great centres of scholarship around the world. The research and research training strand allows us both to achieve what we call our research outcomes and output and also to train research higher degree students including PhD or Doctoral research and Masters by research.

The second strand – learning and teaching – refers to our curriculum (or our courses) and to the experience of being a student (such as study groups, support services and scholarships). Learning and teaching has been of great importance to the University since its origin in 1854, and with the inception of
MELBOURNE MODEL

The Melbourne Model curriculum was introduced in 2008 and offers degrees in three broad cycles. At Bachelor degree level, students select from one of six degrees offering a total of 87 major fields of study. These programs lay the intellectual foundations for employment or further study.

Under the Melbourne Model, most professional qualifications are offered at Master’s level, where students can choose from a variety of professional or specialist graduate programs offering intensive, focused graduate-level experiences that promote deep professional learning. At Doctoral level, students develop research skills working alongside international leaders in a broad range of fields.

The key features of the Melbourne Model are choice and flexibility at undergraduate level, together with diversity and applicability at graduate level. The curriculum caters for students who enter University at undergraduate or graduate level with a variety of goals: those sure of their chosen path; those who have not yet determined their future vocation; and those who begin on one path then discover another.

A vital feature of the Melbourne Model is the diversity of flexible educational pathways that it offers to students. The Model encompasses a wide range of study options and pathways, and allows students to make more timely and informed decisions about career directions. Each individual student is assisted to choose a pathway through the Melbourne Model that is tailored to their developing interests and goals.

The Melbourne Model was introduced to:

- Provide flexibility at undergraduate level in order to allow for developing interests and enable more considered choices by students about further study or career options
- Improve intellectual coherence, research relevance and peer interaction at undergraduate level
- Provide intensive training at graduate level to students with greater maturity and breadth of perspective in order to deliver better personal and professional outcomes
- Strengthen preparation for doctoral research and academic mobility
- Develop graduates with defined educational, aspirational and personal attributes

2009 – A YEAR OF REFINEMENT

Since 2005 the global higher education market has continued to grow, with Australia now listing education as one of its major exports. Competition for students is significant, and not just from domestic institutions. China and India are building rapidly their own education capacity and shifts are apparent in Europe and North America. Despite our success in the undergraduate student market we still do poorly when it comes to research higher degree students compared to international competitors. Since 2005 aspects of the international student market have changed dramatically. Financial conditions, concerns over student safety, and rapid growth in the Asia-Pacific region all affect the dynamics of student mobility. Significantly, these issues are beyond the University’s influence, and must be seen as risk factors of an increasingly competitive global market. By 2005 research had already become a global enterprise with progress in many fields at most universities reliant on international funding, collaboration, shared data and co-produced outcomes.

Since 2005 research has continued to adapt to increased mobility and access, with far greater emphasis on addressing major societal concerns. Global problems drive broader research agendas and new multidisciplinary responses. Enabling this new approach is comprehensive disciplinary strength, a core attribute of the best universities in the world.

Nationally, there have been two significant reviews, the Bradley Review of Higher Education and the Cutler Review of the National Innovation System. Elements of both reviews have been adopted by the Federal Government during 2009, signaling significant changes for the tertiary sector. The new partially deregulated system (unrestricted places) is designed to allow for a massive expansion in student numbers, whilst maintaining tough regulatory restrictions on price. The principle of full funding for research has been accepted, and there is a strong push for greater numbers of students from backgrounds of disadvantage.

Within the University the degree structure has been standardised, aligning our educational offering with the best universities in Europe. The success of the program has been suggested both by the number and quality of new generation course students and via imitation by several Australian (and regional) universities. In 2011, these students will transition into graduate schools to commence their professional training.

Articulation of the University’s character has been achieved through adoption of the triple helix. As was the case over a century ago with research, the introduction of a new strand of activity has been slow but transformative. Governments, industry bodies and the community regard ‘third stream’ activities as a test of social relevance. Melbourne faces many of the challenges of other public universities.

Questions of financial stability, size, student mix, research breadth and external engagement continue to challenge us, and in many cases our strategy puts us at odds with ever changing government policy. Such challenges compel us to examine our strategy regularly and refine it when required.
THE FACULTY OF SCIENCE

ABOUT US
One of the oldest science faculties in Australia, we celebrated our centenary in 2003. The Faculty provides a range of teaching and postgraduate training programs and community services, based on a solid foundation of research in the pure and applied sciences. It comprises four schools and five departments - Botany, Chemistry, Earth Sciences, Physics, Genetics, Information Systems, Mathematics & Statistics, Optometry & Vision Sciences, and Zoology, and it has an active involvement in 13 competitively funded research centres. Over 6,500 undergraduate and postgraduate students are enrolled across its 10 undergraduate and 12 postgraduate courses and its Honours program.

Faculty staff gain approximately $22 million a year in competitive research grants, through peer-assessed grants, the Australian Research Council (ARC), the National Health and Medical Research Council (NHMRC) and other national funding and industry agencies. Its international agenda includes joint research ventures, exchange of staff and students, recruitment of overseas students and the inclusion of a global perspective in curricula. Through the quality of its research and teaching, the Faculty enjoys a strong reputation, both nationally and internationally.

HISTORY OF THE FACULTY
The Faculty of Science was established in 1903 at the University of Melbourne, under the first Dean, Professor Henry Laurie. Initially the disciplines taught within the Faculty included Chemistry, Physiology, Biology (including elementary Botany), Geology and Mineralogy, as well as subjects from the Schools of Mathematics and Natural Philosophy (Physics). Over the years, Genetics, Information Systems, and Optometry have been added to this list.

http://www.science.unimelb.edu.au/
It is an exciting time to be studying physics in the 21st century: it is an enabling science that expands our knowledge of the universe and underpins new technologies that benefit our society. The School of Physics is well established and is internationally respected for its research excellence, broad-based undergraduate courses, and a challenging and rewarding postgraduate experience. Our collaborations are aligned with the world’s leading research groups and facilities. We address some of the most important and fundamental problems of our age.

Our programs in astrophysics, theoretical particle and experimental particle physics explore questions relating to the origin, evolution and fate of our universe. Aligned with high energy physics programs taking place in Switzerland (CERN), the School has considerable expertise in grid computing, neutrino physics and physics beyond the ‘Standard Model’. The LIGO gravitational wave detector project is designed to measure gravity waves, as yet unseen but predicted by Einstein. The MWA low frequency radio telescope is a facility currently under construction in outback Western Australia. Designed to capture signals from the early reaches of the universe, it is another tool that will increase our understanding of the universe.

The School has strengths in the exploration of matter and light interactions, particularly in advanced materials utilising diamond and silicon, quantum information science, photonics, advanced electron microscopy, nanoscale imaging, nanoelectronics, all the way down to the single atom and photon. Working closely with the Australian Synchrotron, our leading Centre for Coherent X-Ray Science employs X-ray diffraction techniques and an interdisciplinary team of physicists, biologists and chemists to explore the structural determination of single biological molecules. Solving this problem is critical to rational drug design and biotechnology. With inter-institutional partners, the Centre for Quantum Computer Technology is building, at the atomic level, a solid-state quantum computer in silicon which will revolutionise computing industries.

The School, one of nine main departments within the Faculty of Science, comprises approximately 23 teaching & research staff, 50 research-only staff, 80 postgraduate students and 50 associates supported by 30 professional staff. The School additionally hosts 2 ARC Federation Fellows, 2 ARC Australian Professorial Fellows, 2 ARC QE11 Fellows and 1 Australian Postdoctoral Fellow.

Located in the heart of cosmopolitan Melbourne, the School is part of a vibrant campus environment and is a great place to study, as evidenced by internationally benchmarked ranking indicators.
Regarded by many as the first true Physicist, Galileo turned his beautifully hand-crafted telescope to the skies and made discoveries that changed the world. Our 21st Century Physicists celebrated the 400th anniversary of the telescope with 2009 declared the International Year of Astronomy.

Our July Lectures in Physics always attract large crowds and the Astronomy theme for the 2009 program filled the Elizabeth Murdoch Theatre with enthusiastic audiences on all five Friday nights in July! In July we also hosted the annual scientific meeting of the Astronomical Society of Australia with a distinguished line-up of local and international speakers including our own Astrophysics group who presented their latest research. A significant highlight of the meeting was a session dedicated to the Australian Square Kilometer Array Pathfinder project and its immense scientific potential. I am sure Galileo would have been impressed.

In November 2009 our Theoretical Particle Physics group organised “COSPA 2009”, the International Symposium on Cosmology and Particle Astrophysics. We hosted an impressive constellation of international visitors and took the opportunity to stage another very well attended public lecture by Prof. Sean Carroll from Caltech titled “The origin of the universe and the arrow of time”.

Our staff and associates had a very successful 2009 with an impressive array of awards and prizes. Prof. Bruce McKellar carried off the Flinders Medal of the Australian Academy of Science (AAS) for his work in particle physics, Assoc. Prof. (now Prof.) Stuart Wyithe won the AAS Pawsey Medal for his work on the early universe and Drs Roger Rassool and Andrew Melatos won the Dean’s awards for Outreach and Research respectively. On top of all this, Prof. Jeremy Mould, with two colleagues from the USA, won the 2009 Gruber prize for cosmology. The Gruber is one of the world’s most distinguished scientific prizes.

With regard to teaching, our roll-out of the Melbourne Model curriculum continues to go very well with unprecedented numbers of undergraduates taking our subjects (topping 1500 in semester 1 of 2010) and excellent participation in the MSc with 46 students enrolled at the start of 2010. These students, together with our 80 PhD/MPhil students are supported by 43 research fellows funded from national competitive grants obtained by our very active staff. Many of us were also very busy towards the end of 2009 preparing expressions of interest and full proposals to establish Australian Research Council Centres of Excellence. It is very pleasing to see that this work has paid off – from 2011 the School will host three new Centres of Excellence alongside our continuing Centre for Coherent X-ray Science led by Prof. Keith Nugent. I look forward to reviewing highlights from the new Centres in the next report!

Head of School, Professor David Jamieson
EXECUTIVE MANAGER’S REPORT

The Teaching and Research effort of the School has been well supported again this year by a strong team of professional staff. With students moving into the second year of the Melbourne Model BSc, laboratory staff continued to manage large numbers of students doing new labs including the staging of further night labs.

BUILDING WORKS

The major project completed early this year was the refurbishment of the Part II/III laboratories with the Dean of Science Prof Rob Saint officially opening the space in June. Students and staff had been using the new labs since March and provided very positive feedback on the layout, facilities and equipment.

Various rooms throughout the building were refurbished for staff, students and retirees with office space becoming increasingly tight as the School grows and becomes more successful.

The consolidation of experimental research space was largely completed maximizing available space for key research projects.

PROFESSIONAL STAFF CHANGES

Some major changes took place at the end of 2009 when Russell Walsh (Finance Manager) and Nick Nicola (Laboratory Manager) both retired after over 25 years service each. Our sincere thanks and good wishes go to these two outstanding professional staff leaders.

With their departure a restructure of the administration team on Level 1 saw Cheryl Burrell stepping up into the Finance Manager’s role and Cilla Gloger into a new role – Research and Administration Manager. Colin Entwisle was also promoted into the new Teaching and Laboratory Coordination position.

Joanne Kuluveovski, Research and Communications Manager gained a promotion to the Faculty of Engineering and Jo Gajewski from QCV left on maternity leave. Michael McDermott replaced Jude Prezens in the Undergraduate labs while Jude is working overseas for a year.

Executive Manager, Ms Helen Conley

SCHOOL GOVERNANCE

The School continues to be well served by the following Committee Structure and membership.

ACADEMIC PROGRAMS
Robert Scholten (Chair), Helen Conley, Tony Gherghetta, Andrew Greentree, Lloyd Hollenberg, Michelle, Livett, Jeff McCallum, Andrew Melatos, Elaine Miles, Julius Orva, Roger Rassool, Ann Roberts, Martin Sevior, Geoff Taylor, Ray Volkas, Rachel Webster, Colin Entwisle (Executive Officer)

KNOWLEDGE TRANSFER & MARKETING
Andy Martin (Chair), Elisabetta Barberio, Chris Chantler, Helen Conley, Joanne, Kuluveovski, David Jamieson, Roger Rassool, Ann Roberts, Sebastian Saliba, Geoffrey Taylor, Cilla Gloger (Executive Officer)

POLICY
David Jamieson (Chair), Les Allen, Helen Conley, Tony Gherghetta, Lloyd Hollenberg, Thomas Jacques, Jeff McCallum, Keith Nugent, Steven Prawer, Ann Roberts, Robert Scholten, Geoff Taylor, Ray Volkas, Rachel Webster, Hayley Wards (Executive Officer)

RESEARCH & RESEARCH TRAINING
Les Allen (Chair), Nicole Bell, Helen Conley, Brant Gibson, Joanne Kuluveovski, Vivien Lee, Andrew Melatos, Ray Volkas, Stuart Wyithe, Cilla Gloger (Executive Officer)

ENVIRONMENTAL HEALTH & SAFETY
Jeff McCallum (Chair), Simon Bell, Helen Conley, Colin Entwisle, Steve Gregory, Justin Kimpton, Ling Lin, Phil Lyons, Paul Spizziri, Julie Warden (Executive Officer)

SCHOOL
David Jamieson (Chair), all staff, Melissa Makin, Hayley Wards (Executive Officer)

SCHOOL EXECUTIVE
David Jamieson (Chair), Les Allen, Cheryl Burrell, Helen Conley, Ann Roberts, Robert Scholten, Russell Walsh, Hayley Wards (Executive Officer)
Ex officios: Jeff McCallum, Andy Martin, Geoff Taylor, Rachel Webster
TEACHING & RESEARCH ACADEMICS

HEAD OF SCHOOL AND PROFESSOR
David Norman Jamieson
BSc(Hons), PhD Melb, FAIP, Finst, MAPS
Research Interests: Quantum computing, nanotechnology, quantum physics, diamond, silicon, ion beam physics and analysis, ion implantation, microprobes, semiconductors, charge injection in semiconductors
Teaching Interests: Advanced physics, Electromagnetism & Special relativity, Further Classical & Quantum Mechanics

DEPUTY HEAD OF SCHOOL AND ASSOCIATE PROFESSOR
Ann Roberts
BSc(Hons) PhD Syd, MAIP
Research Interests: Optics, Photonics, Nanophotonics, Imaging, Microscopy
Teaching Interests: Biomedical Physics, Astrophysics and Optics

FEDERATION FELLOW & LAUREATE PROFESSOR
Tony Gherghetta
BSc(Hons), UWA MS, PhD Chicago
Research Interests: Particle physics beyond the standard model, Supersymmetry, Branes and extra dimensions, AdS/CFT correspondence, Particle phenomenology, The early universe

FEDERATION FELLOW
Keith Alexander Nugent
BSc(Hons) Adelaide, PhD ANU, FAA FAIP
Research Interests: Optics, synchrotron science, x-rays, coherence, quantitative phase imaging, biophysics, protein membrane imaging

PROFESSORS
Steven Prawer
BSc(Hons), PhD Monash, DSc Melb, MAIP MRS
Research Interests: Quantum information processing, diamond, ion implantation, micromachining, quantum optics, quantum communication, ion beam analysis, single photon sources, qubits, nanotechnology
Teaching Interests: Biomedical Physics, quantum mechanics

Raymond Robert Volkas
BSc(Hons) PhD Melb FAIP
Research Interests: Beyond the standard model, neutrinos, branes and extra dimensions, particle cosmology, particle phenomenology, early universe
Teaching Interests: Advanced quantum mechanics, Quantum mechanics, quantum field theory

Rachel Lindsey Webster
BSc Monash, MSc Sussex, PhD Cambridge
Research Interests: radio astronomy, cosmology, terabyte datasets, low frequency radio telescope, first stars, epoch of reionisation, galaxy formation, solar wind, quasars, gravitational lensing, eResearch
Teaching Interests: Solar systems & cosmos, advanced electromagnetism and special relativity, astrophysics and optics

AUSTRALIAN PROFESSORIAL FELLOWS
Lloyd Christopher Hollenberg
BSc(Hons) PhD Melb, MAIP
Research Interests: theoretical quantum computing and information, qubit system modeling and control, algorithm, single electron transistor, decoherence of gate operations, quantum error correction
Teaching Interests: n/a

Geoffrey Norman Taylor
BSc(Hons) MSc UWA, PhD Hawaii, MAIP MAPS
Research Interests: high energy particle physics, physics beyond the Standard Model, CERN laboratory, ATLAS project, supersymmetry, Higgs boson, CP violation, GRID computing, positron emission topography, medical physics
Teaching Interests: Principles and Applications of Physics B, advanced electromagnetism and special relativity
ASSOCIATE PROFESSORS & READERS

Leslie John Allen
BSc(Hons), MSc Port Elizabeth, PhD Sth Africa
Research Interests: Atomic resolution imaging and spectroscopy, electron scattering, inner-shell ionization, phase imaging
Teaching Interests: Atomic, Molecular and Solid State Physics; Scattering & Imaging

Christopher Thomas Chantler
BSc(Hons) UWA, DPhil Oxford
Research Interests: X-ray Optics, Synchrotron, X-ray Absorption Fine Structure, powder diffraction, radiation shielding, atomic physics & quantum electro-dynamics, condensed matter physics
Teaching Interests: Electromagnetism & Special Relativity; Thermal Physics; Advanced Quantum Optics

Robert Scholten
BSc Adelaide, BSc(Hons) PhD Flinders, MAIP, MAPS
Research Interests: atom optics, quantum optics, atomic physics, laser cooling, imaging, quantum imaging, atomic coherence, lasers
Teaching Interests: Advanced Physics, biomedical physics, astrophysics and optics, quantum mechanics

ASSOCIATE PROFESSORS

Michelle Livett
BSc(Hons), PhD LaTrobe, DipEd MCAE, MAIP
Research Interests: Physics education
Teaching Interests: Biomedical Physics

Martin Edmund Sevior
BSc(Hons) PhD Melb, FAIP
Research Interests: High Energy Physics, quarks, anti-matter, Higgs particle, Data Grid
Teaching Interests: Principals and applications of Physics, Quantum Mechanics and Thermal Physics, Electrodynamics

ARC QUEEN ELIZABETH II FELLOWS

Andrew Greentree
BSc Adel, PhD Anu
Research Interests: Quantum Computing, Phosphorus in silicon, diamond in quantum information processing, qubits, atom-photon interactions, Electromagnetically-induced transparency

Stuart Wyithe
BSc(Hons) PhD Melb
Research Interests: Astrophysics, cosmology, first stars, reionization, black holes, gravitational lensing, the early universe, eclipsing binaries, quasars
Teaching Interests: Extragalactic astrophysics & Cosmology; Computational Physics

SENIOR LECTURERS

Luigia Elisabetta Barberio
MSc Bologna, PhD Siegen
Research Interests: Experimental particle physics, dark matter, cosmology, ATLAS experiment, CERN laboratory, Higgs boson, structure of the universe, origin of the mass
Teaching Interests: Standard Physics, Subatomic Physics, Particle Physics

Andrew McCallum Martin
BSc(Hons) PhD Lancaster
Research Interests: Theoretical condensed matter physics, Bose-Einstein Condensation, Quantum Hall Effect, superfluids, superconductivity
Teaching Interests: Further classical & Quantum mechanics, Advanced Thermal Physics, Condensed Matter physics

Andrew Melatos
BSc PhD Syd
Research Interests: Neutron stars, gravitational waves, plasma physics, superfluids
Teaching Interests: Advanced electrodynamics, Statistical Mechanics

Jeffrey McCallum
BSc(Hons) PhD Melb
Research Interests: Epitaxy and defect studies in silicon, semi-conductor physics disorder defects and amorphisation, open volume defects, ion implantation, solid phase epitaxial growth, shallow junctions, new materials science
Teaching Interests: Standard Physics, Advanced Physics, Quantum Mechanics and Thermal Physics

Roger Paul Rassool
BSc(Hons) PhD Melb
Research Interests: Particle and nuclear physics, nuclear particle photons, industrial applications of physics, instrumentation, silicon detectors, medical physics
Teaching Interests: Standard Physics, Instruments for Scientists, Energy & Environment

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LECTURERS

Nicole Bell  
BSc(Hons) PhD Melb  
Research Interests: Beyond the Standard Model, cosmology, neutrino physics, branes and extra dimensions, particle cosmology, particle phenomenology, early universe  
Teaching Interests: Quantum Mechanics, Advanced Physics, Thermal Physics

TUTORS

James Richmond  
LLB(Hons) BSc(Hons) Melb

RESEARCH-ONLY ACADEMICS

PROFESSORIAL FELLOW

Robert John Sault  
BE(Hons) PhD Syd

SENIOR RESEARCH FELLOWS

Shane Huntington, BSc(Hons) PhD Melb  
Harry Morris Quiney, BSc(Hons) MSc Monash, DPhil Oxford  
Steven Trpkovski, BSc(Hons) PhD VUT

LYLE FELLOW

Fulvio Melia, BSc(Hons) Melb PhD, MIT

AUSTRALIAN RESEARCH FELLOW

Nicoleta Dragomir, BSc Romania PhD UT GAIP

AUSTRALIAN POSTDOCTORAL FELLOW

Maximillian Scholosshauer, MSc Lund, MSc PhD UW

RESEARCH FELLOWS

Brian Abbey, MSc PhD Cambridge  
Andrew Alves, BSc(Hons) PhD RMIT  
Eric Ampem-Lassen, DipEd BSc MPhil Ghana, PhD Melb  
Susan Angus, BE(Hons) PhD UNSW  
Catherine Buchanan, BSc(Hons) PhD ANU  
Stefania Castelletto, BSc(Hons) MSc PhD Turin
Bo Chen, BEng Heifei, PhD Science & Technology China
Alberto Cimmino, BSc Naples MSc PhD Melb
Ruben Dilanyan, BSc(Hons) PhD Russia
Tim Dyce, BSc(Hons) Melb
Uli Felzmann, PhD Germany
Robert Foot, BSc(Hons) PhD Melb
Kumaravelu Ganesan, BSc MSc Sri Lanka, PhD Canterbury
Brant Gibson, BE PhD LaTrobe
Stewart Gleadow, BE(Hons) Melb
Charles Hill, BSc(Hons) ANU PhD Queensland
Faruque Hossain, BSc(Hons) MSc Dhaka MEngSc NSW PhD Tokyo
Brett Johnson, BSc(Hons) PhD Melb
Mark Junker, BSc Louisiana MSc PhD Texas
Justin Kimpton, BSc(Hons) PhD Swinburne
Archil Kobakhidze, BSc MSc PhD Tbilisi Ivanc Javakhishvili State
Jessica Kvensakul, MSc PhD London
Hermine Landt, MSc PhD Germany
Antonio Limosani, BE BSc(Hons) PhD Melb
Ling Lin, MSc PhD New Zealand
Glenn Moloney, BSc(Hons) PhD Melb
Julius Orwa, MSc USA, PhD Melb
Bart Pindor, BSc Canada PhD USA
Olena Ponomarenko, MSc Ukraine, BMAT PhD Newcastle
Claire Rollinson, BSc VUT
Nicholas Setzer, BSc BA PhD USA
David Simpson, BSc(Hons) PhD VUT
Paul Spizzirri, BAppSc Swinburne PhD Melb
David Vine, BSc(Hons) PhD Monash
Benedict Von Harling, BSc MSc PhD Germany
Garth Williams, BSc Akron MS PhD Illinois
Chris Witte, BSc(Hons) Melb
Changyi Yang, BSc Nanjing, MSc Shanghai, PhD Lund

HONORARY ACADEMICS

PROFESSORS EMERITUS
Herbert Bo lotin, BSc CUNY MSc PhD Indiana DSc FAIP
David Caro, DSc(Hons) MSc LLB(Hons) Tas PhD Birm. OBE AE FACE FAIP
Colin Arnold Ramm, MSc UWA PhD Birm FinstP FAIP

PROFESSORIAL FELLOWS
Allan Clark, BSc(Hons) Tas, DPhil Oxford
Tien Kieu, BSc(Hons) Qld PhD Edin
Anthony George Klein, AM BEE PhD DSc Melb FAA HonFAIP
Bruce HJ McKellar, BSc(Hons) PhD Sydney DSc Melb, FAA FinstP FAIP FAPS
Jeremy Mould, BSc(Hons) Melb PhD ANU

PRINCIPAL FELLOWS WITH THE TITLE ASSOCIATE PROFESSOR
Kenneth Albert Amos, BSc PhD Adelaide DSc Melb, FAIP
Zwi Barnea, BSc MSc PolytechLNY PhD Melb MAIP
Leslie Arthur Bursill, DipEd BSc Melb, PhD Monash DSc Melb
David Cookson, BSc(Hons) PhD Monash
Trevor Finlayson, BSc Qld PhD Monash
Norman Edward Frankel, BSc MIT PhD Melb
Girish Chandra Joshi, BSc Agra MSc Alld PhD Delhi MAIP
James Jury, BSc MSc PhD Tor
Tomas Kron, BSc PhD Germany
George Legge, BSc(Hons) MSc PhD Melb
Fulvio Melia, BSc(Hons) Melb PhD MIT
Edmund Gerard Muirhead, MSc PhD Melb MAIP
Chris Ryan, BSc(Hons) PhD Melb
Vassilios Sarafis, BSc CBiol MIBiol UK
Alan Edwin Charles Spargo, BSc PhD UWA MAIP
Maxwell Norman Thompson, MSc PhD Melb DSc FAIP
Stuart Norman Tovey, BA Cambridge, PhD Bristol, MAIP
John William Graydon Wignall, BA BSc MSc Melb PhD Cambridge
SENIOR FELLOWS

Brendan Allman, BSc(Hons) PhD Melb DipEd Monash MBA LaTrobe
David Bardos, BSc(Hons) PhD Melb
Mark Boland, BSc(Hons) PhD Melb
Valery Natan Gurarie, MSc PhD Moscow
Gareth Moorhead, BSc(Hons) PhD Melb GAIP
Graeme O’Keeffe, BSc PhD Melb
Salvy Peter Russo, BSc Melb PhD RMIT

FELLOWS

Jared Cole, PhD Melb
Roland Crocker, BSc(Hons) PhD Melb
Barbara Etschmann, BSc(Hons) PhD UWA
Duncan Galloway, BSc(Hons) PhD Tas
David Hoxley, BSc(Hons) PhD Melb
Steven Karataglidis, BSc MSc Melb AssDipMusic PhD Melb
Victor Kowalenko, BSc PhD Melb
Martin Meyer, BA BSc(Hons) PhD Melb
Matthew O’Dowd, BSc(Hons) PhD Melb
Victoria Millar, DipEd BSc(Hons) MSc Melb
Alicia Oshlack, BSc(Hons) PhD Melb
Christopher Pakes, BSc(Hons) PhD Birmingham
Donald Payne, BSc(Hons) PhD Melb
Andrew Peele, BSc LLB PhD Melb
Carlos Peralta, BSc(Hons) PhD Melb
Andrew Alan Rawlinson, BSc PhD Adel

Patrick Reichart, PhD Munich
Juris Svenne, BASc Canada PhD MIT
Ben Toner, BSc(Hons) PhD Melb MSc PhD USA
Maurizio Toscano, DipEd BSc(Hons) PhD Melb
Chanh Tran, BE BSc(Hons) PhD Melb
Phillip Urquijo, BSc(Hons) PhD Melb
Meryl Waugh, BSc(Hons) Monash DipEd TTC PhD Melb
Cameron Wellard, BSc PhD Melb
Richard Wilman, Mphys(Hons) PhD UK
PROFESSIONAL STAFF

EXECUTIVE MANAGER
Ms Helen Conley, BSc Deakin DipEd Monash, Adv. Dip Gestalt Psychotherapy

ADMINISTRATION
Ms Rosslyn Ball
PA & Administrator – Center of Excellence for Coherent X-Ray Science

Ms Cheryl Burrell, BA Swinburne

Ms Janet Carlon
Administrator – Microanalytical Research Centre/ Center for Quantum Computer Technology

Ms Patricia Gigliuto, BSc Melb

Cilla Gloger, NH Dip Administration South Africa
School Administrator

Ms Helga Kendy
Reception (part-time)

Ms Joanne Kuluveovski, BSc (Hons) Melb
Research & Communications Manager

Dr Joanna Gajewski, BSc (Hons) PhD MBA Melb
Business and Marketing Manager – Quantum Communications Victoria

Mrs Lisa Lansfield, BA, DipML (Japanese) Melb
Administrator - MWA Project, Astrophysics

Ms Tania Smith, GradCert VETiS and AdvDip Arts VUT
Chief Executive Officer – Center of Excellence for Coherent X-Ray Science

Mr Andrew Tierney,
Executive Officer - Melbourne Materials Institute

Mr Russell Walsh
Finance & Resources Manager

Mrs Julie Warden
Administrative Assistant (Finance)

Ms Hayley Wards
PA to Head & Administrator

LIBRARIAN
Ms Kamala Lekange

LABORATORY SUPPORT
Mr Achilleas Nicola, BAppSc RMIT
Laboratory Manager

Mr Steven Damen, BSc Ballarat
Technical Officer

Mr Colin Entwisle, BSc(Hons) Melb
Teaching Administrative Officer

Mr Philip Lyons
Technical Officer

Mr Jude Prezens, BAppSc RMIT
Undergraduate Laboratory Assistant

Mr Stephen Marshall, BSc DipEd
Undergraduate Laboratory Assistant & 2nd and 3rd Year Laboratory Coordinator

TECHNICAL SUPPORT
Mr Roland Szymanski, Postgrad Dip Vacuum Technology, Certificate Industrial Electronics
Technical Manager

Mr Eliecer Bonilla Parra, Certificate Fitter & Turner
Technical Officer

Mr Ashley French, Certificates in Mechanical Instrumentation Making, Fitter & Turner
Technical Officer

Mr Stephen Gregory, BAppSci(Hons), BE Melb
Technical Officer

Mr Jonathan Wayne Powrie, Certificates in Toolmaking, Fitter & Turner
Senior Technical Officer

Mr Sandor Szilagyi
Senior Electronics Technician

Mr Michael Zammit, Certificate Fitter & Turner
Technical Officer
<table>
<thead>
<tr>
<th>Name</th>
<th>Degree(s)</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof Steven Abel</td>
<td>BSc(Hons) PhD</td>
<td>Mathematical Sciences, Durham University, UK</td>
</tr>
<tr>
<td>Dr Krzysztof Bolejko</td>
<td>MSc PhD</td>
<td>Recipient Of The Grace And Patricia Gruber Fellowship From Nicolaus Copernius Astronomical Center, Warsaw</td>
</tr>
<tr>
<td>Prof Fu-Rong Chen</td>
<td>PhD USA</td>
<td>Department of Engineering And System Science, National Tsing Hua University, Hsin Chu, Taiwan</td>
</tr>
<tr>
<td>Prof Leonard Feldman</td>
<td></td>
<td>Miegunyah Fellow, Rutgers University, USA</td>
</tr>
<tr>
<td>Prof Eliezer Finkman</td>
<td>BSc MSc DSc</td>
<td>Department Of Electrical Engineering, Technion - Israel Institute of Technology</td>
</tr>
<tr>
<td>Prof Mark Fromhold</td>
<td>BSc(Hons) PhD</td>
<td>Lyle Fellow, School of Physics and Astronomy, University of Nottingham, UK</td>
</tr>
<tr>
<td>Prof Xin-Heng Guo</td>
<td>BSc PhD</td>
<td>College of Nuclear Science and Technology, Beining Normal University</td>
</tr>
<tr>
<td>Prof Rafi Kalish</td>
<td>MSc PhD</td>
<td>Institute Of Solid State Physics, Technion, Israel</td>
</tr>
<tr>
<td>Ms Rose Footini Koopman</td>
<td></td>
<td>University of Amsterdam, The Netherlands</td>
</tr>
<tr>
<td>Dr Katherine Mack</td>
<td>BSc(Hons) PhD</td>
<td>Postdoctoral Fellow, Institute of Astronomy, University of Cambridge, UK</td>
</tr>
<tr>
<td>Dr Paolo Olivero</td>
<td>BSc PhD</td>
<td>Experimental Physics Department, Centre of Excellence Nanostructured Interfaces and Surfaces, University of Torino</td>
</tr>
<tr>
<td>Dr Mark Oxley</td>
<td>BSc(Hons) PhD</td>
<td>Oakridge National Laboratory USA</td>
</tr>
<tr>
<td>Ms Ainhoa Pardo Perez</td>
<td></td>
<td>Instituto de Ciencia de Materiales de Madrid (ICMM)</td>
</tr>
<tr>
<td>Dr Brian Patton</td>
<td>MSc(Hons) UK PhD</td>
<td>Department of Materials, Oxford University, UK</td>
</tr>
<tr>
<td>Dr Michal Prange</td>
<td></td>
<td>The STEM Group, Materials Science and Technology Division, Oak Ridge National Laboratory, USA</td>
</tr>
<tr>
<td>Dr Robin Scott</td>
<td>MSc PhD</td>
<td>School of Physics and Astronomy, University of Nottingham, UK</td>
</tr>
<tr>
<td>Prof Reuben Shuker</td>
<td>BSc Israel MSc PhD USA</td>
<td>Physics Department, Gen-Gurion University, Israel</td>
</tr>
<tr>
<td>Dr Amihai Silverman</td>
<td>BSc MSc PhD MBA</td>
<td>Taub Computer Center, Technion, Israel</td>
</tr>
<tr>
<td>Mr Joscha Specks</td>
<td>Diploma Germany</td>
<td>Technical University of Munchen, Germany</td>
</tr>
<tr>
<td>Prof Gerard Stephenson</td>
<td>BSc PhD MIT</td>
<td>University of New Mexico, USA</td>
</tr>
<tr>
<td>Prof Dieter Suter</td>
<td>MSc PhD Switzerland</td>
<td>Department Of Physics, University Of Dortmund</td>
</tr>
<tr>
<td>Mr Edward Taylor</td>
<td>BSc(Hons) Melb</td>
<td>University Of Leiden, The Netherlands</td>
</tr>
<tr>
<td>Ms Jolanda Van de Ven</td>
<td></td>
<td>Technicin at Endhoven University of Technology, Department of Applied Physics</td>
</tr>
<tr>
<td>Prof Kameshwar Wali</td>
<td></td>
<td>Distinguished Research Professor Emeritus, Department of Physics, Syracuse University, USA</td>
</tr>
<tr>
<td>Dr Mark White</td>
<td>BA MSc PhD</td>
<td>Department of Physics, University of Cambridge, UK</td>
</tr>
<tr>
<td>Prof Edmund Wilson</td>
<td>BA MA Oxford</td>
<td>CERN, Switzerland And Visiting Professor At John Adams Institute, Physics Department, University Of Oxford And Lyle Fellow, University Of Melbourne</td>
</tr>
</tbody>
</table>
# RESEARCH FUNDING & OPERATING BUDGET

The School of Physics is proud of its success in competitive research grants, particularly from external funding sources such as the Australian Research Council as listed below.

<table>
<thead>
<tr>
<th>Primary Researcher (1st CI)</th>
<th>Title</th>
<th>Funding $ Received for 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof Lloyd Hollebnerg et al</td>
<td>Atom defined nanostructures: atom-electronics beyond miniaturization limit</td>
<td>200,000</td>
</tr>
<tr>
<td>Prof Ray Volkas</td>
<td>Branes and Unification</td>
<td>95,000</td>
</tr>
<tr>
<td>Prof Ray Volkas et al</td>
<td>The standard model of particle physics and beyond, in the Large Hadron Collider era</td>
<td>260,000</td>
</tr>
<tr>
<td>Dr James Bolton</td>
<td>The first two billion years: the structural, chemical and thermal evolution of the intergalactic medium</td>
<td>95,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Researcher Title</th>
<th>Funding $ Received for 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/Prof Jeff McCallum et al</td>
<td>200,000</td>
</tr>
<tr>
<td>Dr Andrew Melatos et al</td>
<td>160,000</td>
</tr>
<tr>
<td>Prof Keith Nugent et al</td>
<td>100,000</td>
</tr>
</tbody>
</table>

The School of Physics was also named on the following successful grants as a non-lead institution.

<table>
<thead>
<tr>
<th>Type</th>
<th>Secondary Researcher</th>
<th>Title</th>
<th>Funding $ Received for 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISCOVERY PROJECTS (DP)</td>
<td>A/Prof Jeff McCallum et al (lead ANU)</td>
<td>Defect-induced luminescence from ion-implanted silicon: Towards silicon photonics applications</td>
<td>200,000</td>
</tr>
<tr>
<td>DISCOVERY PROJECTS (DP)</td>
<td>Dr Andrew Melatos et al (lead ANU)</td>
<td>Exploring the transient universe</td>
<td>160,000</td>
</tr>
<tr>
<td>DISCOVERY PROJECTS (DP)</td>
<td>Prof Keith Nugent et al (lead Swinburne)</td>
<td>A new window on photosynthesis: ultrafast coherence dynamics in biomolecules and semiconductor nanostructures</td>
<td>100,000</td>
</tr>
</tbody>
</table>

**FINANCIAL SUMMARY FOR 2009**

**Income**

- School Operating: $5,418,394.00
- Consultancies and small grants: $1,533,025.00
- Large Grants (ARE, EU etc): $3,908,451.00

**Reserves (Carried Forward from Previous Year)**

- School Operating: $1,808,263.63
- Consultancies and small grants: $2,960,445.14
- Large Grants (ARE, EU etc): $4,581,237.03

**Expenditure**

- Salaries: $13,688,028.00
- Other expenditure: $4,284,689.00

**Net Surplus/Deficit**: $5,224,302.66

NB: Trust income and expenditure not included in this report.
SPEAKERS AND VISITORS AFFILIATED WITH THE SCHOOL GAVE THE FOLLOWING COLLOQUIA AND SEMINARS DURING 2008. UNLESS INDICATED ELSEWHERE, THE LECTURES TOOK PLACE IN THE LABY OR HERCUS THEATRES.

## COLLOQUIA

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Affiliation</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-Feb</td>
<td>Dr Troy Porter</td>
<td>Santa Cruz Institute for Particle Physics, University of California, Santa Cruz</td>
<td>USA First 6 months of the Fermi/LAT Mission</td>
</tr>
<tr>
<td>10-Mar</td>
<td>Professor Kameshwar Wali</td>
<td>Department of Physics, Syracuse University, USA</td>
<td>Satyendra Nath Bose (1894-1974) and Subrahmanyan Chandrasekhar (1910 – 1995)</td>
</tr>
<tr>
<td>17-Mar</td>
<td>Professor Paul Midgley</td>
<td>Department of Materials Science and Metallurgy, University of Cambridge, UK</td>
<td>3D Nanoscale Imaging with Electron Tomography</td>
</tr>
<tr>
<td>24-Mar</td>
<td>Dr Martain White</td>
<td>Department of Physics, University of Cambridge, UK</td>
<td>Measuring SUSY dark matters at ATLAS</td>
</tr>
<tr>
<td>31-Mar</td>
<td>Professor Mark Eriksson</td>
<td>Department of Physics, University of Wisconsin-Madison, UK</td>
<td>Silicon artificial atoms and nanomembranes</td>
</tr>
<tr>
<td>7-Apr</td>
<td>Dr Peter D Drummond</td>
<td>ARC Centre for Quantum-Atom Optics and Centre for Atom Optics and Ultrafast Spectroscopy, Swinburne University of Technology</td>
<td>The world of the ultracold has made astonishing advances over the last decade</td>
</tr>
<tr>
<td>21-Apr</td>
<td>Professor Igor Bray</td>
<td>Department of Applied Physics, Faculty of Science and Engineering, Curtin University of Technology</td>
<td>Recent progress in atom collision theory</td>
</tr>
<tr>
<td>28-Apr</td>
<td>Professor Feng Wang</td>
<td>Centre for Molecular Simulation, Swinburne University of Technology</td>
<td>Simulating Electron Spectroscopy for Biological Molecules</td>
</tr>
<tr>
<td>5-May</td>
<td>Professor John Close</td>
<td>Department of Quantum Science, The Australian National University</td>
<td>Bose Einstein Condensates the Atom Laser and Precision Measurement</td>
</tr>
<tr>
<td>26-May</td>
<td>Professor John Love</td>
<td>Research School of Physical Sciences and Engineering, The Australian National University</td>
<td>Optical Fibres- Yesterday Today &amp; Tomorrow</td>
</tr>
<tr>
<td>23-Jun</td>
<td>Professor Kenneth Baldwin</td>
<td>Deputy Director of the ARC Centre of Excellence for Quantum-Atom Optics, The Australian National University</td>
<td>Metastable helium: atom optics and precision measurement</td>
</tr>
<tr>
<td>28-Jul</td>
<td>Prof Simon Ringer</td>
<td>Director, Australian Key Centre for Microscopy &amp; Microanalysis, University of Sydney</td>
<td>Atomic Clustering in Multi-Component Alloys- New Transformation Pathways and New Property-Performance Space</td>
</tr>
<tr>
<td>4-Aug</td>
<td>Professor Andrea R Gerson</td>
<td>Applied Centre for Structural and Synchrotron Science, University of South Australia</td>
<td>Synchrotron micro-analytical case studies from toenails to dirt to steel</td>
</tr>
<tr>
<td>11-Aug</td>
<td>Dr Chris Hall</td>
<td>Monash Centre for Synchrotron Science, Synchrotron Computed Tomography Applied to Cell Tracking</td>
<td></td>
</tr>
<tr>
<td>18-Aug</td>
<td>Professor Stephen Buckman</td>
<td>Research Director, Australian Research Council Centre for Antimatter-Matter Studies,</td>
<td>Positron Interactions with Atoms Molecules and Materials</td>
</tr>
<tr>
<td>Date</td>
<td>Speaker</td>
<td>Affiliation</td>
<td>Title</td>
</tr>
<tr>
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<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>8-Sep</td>
<td>Dr Tim Duty</td>
<td>Department of Physics, University of Queensland</td>
<td>Artificial atoms and microwave quantum optics using nano-structured superconduction circuits</td>
</tr>
<tr>
<td>15-Sep</td>
<td>Michael Brown</td>
<td>School of Physics, Monash University</td>
<td>Slow Galaxy Growth within Rapidly Growing Dark Matter Halos</td>
</tr>
<tr>
<td>22-Sep</td>
<td>Professor Joss Hawthorn</td>
<td>School of Physics, University of Sydney</td>
<td>The HERMES project- reconstructing the early history of the ancient Galactic disk</td>
</tr>
<tr>
<td>29-Sep</td>
<td>Professor John Rehr</td>
<td>Department of Physics, University of Washington</td>
<td>Unravelling the mysteries of complex systems with x-ray and electron spectra: ab initio theory and computation vs experiment</td>
</tr>
<tr>
<td>6-Oct</td>
<td>Dr Emma Ryan-Weber</td>
<td>Swinburne University</td>
<td>First Light</td>
</tr>
<tr>
<td>10-Nov</td>
<td>Mr Mark Wardle</td>
<td>Department of Physics &amp; Engineering, Macquarie University</td>
<td>The role of magnetic fields in the origin of planetary systems</td>
</tr>
<tr>
<td>17-Nov</td>
<td>Professor Victor Plambaum</td>
<td>Department of Theoretical Physics, School of Physics, The University of New South Wales</td>
<td>Variation of fundamental constants from Big Bang to atomic clocks: theory and observations</td>
</tr>
<tr>
<td>18-Nov</td>
<td>Professor Robert P Kirshner</td>
<td>Cloves Professor of Science, Harvard University, Fundamentals of Supanova Cosmology</td>
<td></td>
</tr>
<tr>
<td>20-Nov</td>
<td>Dr Paolo Olivero</td>
<td>Experimental Physics Department Centre of excellence &quot;Nanostructured Interfaces and Surfaces&quot;, University of Torino</td>
<td>Micro-fabrication of diamond with ion beams</td>
</tr>
<tr>
<td>24-Nov</td>
<td>Professor Fedor Jelezko</td>
<td>Department of Physics, University of Stuttgart</td>
<td>How to build a Diamond Based Quantum Computer that promises Expotentially Greater Power</td>
</tr>
</tbody>
</table>

**THEORY SEMINARS**

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Affiliation</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-Jan</td>
<td>Professor Leszek Roszkowski</td>
<td>University of Sheffiled</td>
<td>Is the Constrained MSSM already ruled out?</td>
</tr>
<tr>
<td>25-Feb</td>
<td>Dr Benedict von Harling</td>
<td>School of Physics, University of Melbourne</td>
<td>Energy transfer in warped string compactifications and an application to dark matter</td>
</tr>
<tr>
<td>4-Mar</td>
<td>Associate Professor Andrew Waldron</td>
<td>Department of Mathematics, University of California</td>
<td>Davis Weyl Invariance and the Origins of Mass</td>
</tr>
<tr>
<td>30-Mar</td>
<td>Dr Elizabeth Winstanley</td>
<td>University of Sheffield, United Kingdom</td>
<td>Black holes at the LHC</td>
</tr>
<tr>
<td>31-Mar</td>
<td>Professor Achim Kempf</td>
<td>Perimeter Institute for Theoretical Physics, Ontario, Canada</td>
<td>Reconciling Spacetime Continuity and Discreteness using Tools from Information Theory</td>
</tr>
<tr>
<td>22-Jul</td>
<td>Professor Ray Volkas</td>
<td>School of Physics, University of Melbourne</td>
<td>Horava- Lifshitz (2009): The Rise and Fall of a Quantum Field Theory of Gravity</td>
</tr>
<tr>
<td>5-Aug</td>
<td>Dr Marco Drewes</td>
<td>DESY, Hamburg</td>
<td>Quantum Effects in Leptogenesis</td>
</tr>
<tr>
<td>25-Nov</td>
<td>Csaba Csaki</td>
<td>Cornell and KITP</td>
<td>Searching for the Origin of Electroweak Symmetry Breaking at the LHC</td>
</tr>
<tr>
<td>2-Dec</td>
<td>Emilian Dudas</td>
<td>Ecote Polytechnique, Paris, France</td>
<td>GUT’s and gauge mediation</td>
</tr>
</tbody>
</table>

**ASTROPHYSICS SEMINARS**

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Affiliation</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-Feb</td>
<td>Andrew Hopkins</td>
<td>Head of Anglo-Australian Telescope Science, Anglo-Australian Observatory</td>
<td>Progress and Opportunities at the Anglo-Australian Observatory</td>
</tr>
<tr>
<td>18-Feb</td>
<td>Dr Paul Lasky</td>
<td>Centre for Astrophysics and Supercomputing, Swinburne University</td>
<td>Neutron Stars as a Test of Bekenstein’s Modified Theory of Gravity</td>
</tr>
<tr>
<td>25-Feb</td>
<td>Professor Michael Drinkwater</td>
<td>Head of Physics, University of Queensland</td>
<td>The origin of ultra-compact dwarf galaxies</td>
</tr>
<tr>
<td>4-Jun</td>
<td>Dr Rainer Hollerbach</td>
<td>University of Leeds, England</td>
<td>The Hall Effect in Neutron Stars</td>
</tr>
<tr>
<td>16-Jul</td>
<td>Maria Cunningham</td>
<td>School of Physics, University of New South Wales</td>
<td>The Chemistry and dynamics of star formation in the G333 molecular cloud complex</td>
</tr>
</tbody>
</table>
### RESEARCH SEMINAR SERIES

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Institution</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-Sep</td>
<td>Daniel Bayliss</td>
<td>The Australian National University</td>
<td>Searching for Southern Transiting Planets</td>
</tr>
<tr>
<td>9-Oct</td>
<td>Adam Deller</td>
<td>National Radio Astronomy Observatory</td>
<td>Milliarcsecond resolution radio “surveys” as a tool for galactic evolution studies</td>
</tr>
<tr>
<td>14-Oct</td>
<td>Dr Rob Crain</td>
<td>Centre for Astrophysics and Supercomputing, Swinburne University</td>
<td>GIMIC: the Galaxies-Intergalactic Medium Interaction Calculation</td>
</tr>
<tr>
<td>9-Dec</td>
<td>Dr Katherine Mack</td>
<td>Cambridge University</td>
<td>Axions Inflation and the Anthropic Principle</td>
</tr>
<tr>
<td>16 Dec</td>
<td>Professor Joss Bland-Hawthorn</td>
<td>University of Sydney</td>
<td>Astrophotonics: the next wave in observational cosmology</td>
</tr>
</tbody>
</table>

### MARC SEMINARS

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Institution</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-Jan</td>
<td>Jessica van Donkelaar</td>
<td></td>
<td>Fabrication And Applications Of Precision Arrays Of Single Atoms</td>
</tr>
<tr>
<td>18-Feb</td>
<td>Michael Phillips</td>
<td></td>
<td>TCAD simulations of the Hall effect</td>
</tr>
<tr>
<td>5-Mar</td>
<td>Daniel MacDonald</td>
<td>Department of Engineering, ANU</td>
<td>Impurities in crystalline silicon solar cells</td>
</tr>
<tr>
<td>16-Apr</td>
<td>Changyi Yang</td>
<td></td>
<td>Single ion implantation technology in CQCT: challenging issues and future development</td>
</tr>
<tr>
<td>23-Apr</td>
<td>Andrew Alves</td>
<td></td>
<td>Absolute quantification of charge collection efficiency</td>
</tr>
<tr>
<td>30-Apr</td>
<td>Virginia Gill</td>
<td></td>
<td>Investigation of diamond properties</td>
</tr>
<tr>
<td>7-May</td>
<td>Brett Johnson</td>
<td></td>
<td>DLTS/CV measurements on CQCT devices</td>
</tr>
<tr>
<td>21-May</td>
<td>Paul Spizziri</td>
<td></td>
<td>Nano-materials for imaging and spectroscopy</td>
</tr>
<tr>
<td>18-Jun</td>
<td>Giuseppe Tettamanzi</td>
<td>Kavli Institute For Nanoscience, Delft, The Netherlands</td>
<td>Atomic-Scale Electronics</td>
</tr>
</tbody>
</table>

### PUBLIC LECTURES

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Institution</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-May</td>
<td>Michael S Turner</td>
<td>Bruce V and Diana M Rauner Distinguished Service Provider at the University of Chicago</td>
<td>The Dark Side of the Universe: Beyond the stars and the star stuff we are made of</td>
</tr>
<tr>
<td>19-Aug</td>
<td>Dr Jeff McCallum</td>
<td>School of Physics University of Melbourne</td>
<td>Rutherford and the Atomic Nucleus: the 100th Anniversary of a Remarkable Discovery</td>
</tr>
<tr>
<td></td>
<td>Prof Robert Kirschner</td>
<td>Clowes Professor of Science Harvard University</td>
<td>Exploding Stars and the Accelerating Cosmos: Einstein’s Blunder Undone</td>
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### COMPLETION SEMINARS

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<td>3-Apr</td>
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<td>5-Jun</td>
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<td>Sally Langford</td>
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<td>4-Dec</td>
<td>Stephen Petrie</td>
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<td>29-May</td>
<td>Leneke Jong</td>
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<td>29-May</td>
<td>Jinghua Fang</td>
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<td>12-Jun</td>
<td>Anthony Morely</td>
<td>What to do next time your $1,000,000,000 experiments is waiting for a $10,000,000,000 part?</td>
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<td>Paul Geil</td>
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<td>Angela Torrence</td>
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<td>Chun Hsu</td>
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<td>David Peake</td>
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<td>Evan Curwood</td>
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<td>Sebastian Saliba</td>
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<td>David Shelduko</td>
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<td>Lucas Smale</td>
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<td>Melissa Makin</td>
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* Geoff Opat Seminar Series
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<td>Image Reconstruction in Fresnel Coherent Diffractive Imaging.</td>
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<td>Jones, Gareth Rhys</td>
<td>Development of a non-invasive arterial monitor</td>
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<td>Macalurin, Dougal</td>
<td>Quantum entanglement, decoherence and imaging in nanoscale systems</td>
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<td>Milicevic, Marko</td>
<td>Enhanced transmission through sub-wavelength apertures</td>
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<td>Petrie, Stephen</td>
<td>Determining the characteristic host halo mass of damped Lyman-alpha absorbers (DLAs)</td>
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<tr>
<td>Ryan, Rebecca Anna</td>
<td>Fresnel Coherent Diffractive Imaging</td>
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<tr>
<td>Strack, Michelle Angelina</td>
<td>Investigation of single-crystal diamond cantilevers sculpted by ion beam lithography</td>
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<td>High resolution x-ray imaging</td>
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<td>Fabrication of nickel related single photon centres in Diamond</td>
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<td>Degenerate four-wave mixing in rubidium vapour cell</td>
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<td>Bennett, Mark Francis</td>
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<td>Bourke, Jay</td>
<td>Investigation of X-ray absorption fine structure: Development of theoretical models to describe interactions between X-rays and solid state/atomic systems</td>
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<tr>
<td>Bruns Jr, Loren Richard</td>
<td>Modelling and analysis of gravitational lensing</td>
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<tr>
<td>Callen, Benjamin David</td>
<td>Physics beyond the standard model.</td>
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<tr>
<td>Chung, Christine Tsung Yi</td>
<td>To be advised</td>
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<tr>
<td>Corro, Ivan</td>
<td>Vortices and turbulence in dilute gas condensates</td>
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<tr>
<td>Curwood, Evan Keith</td>
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<td>D’Alfonso, Adrian John</td>
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<td>Davey, William Edwin</td>
<td>Electronic decay modes of the Higgs boson in ATLAS</td>
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<td>Search for supersymmetry with the ATLAS detector at LHC</td>
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<td>Doherty, Marcus William</td>
<td>The implementation of diamond colour centres in quantum communication devices</td>
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<td>Drumm, Daniel Warren</td>
<td>initio investigations of single atom defined nanostructures</td>
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<tr>
<td>Drumm, Virginia Sue</td>
<td>Fabrication of devices in diamond for control of colour centres.</td>
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<td>Elbracht, Stefanie</td>
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<td>Evans, Zachary William Ede</td>
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<td>Fairchild, Barbara Anne</td>
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<td>Geil, Paul Michael</td>
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<td>Greig, Bradley</td>
<td>Effects of higher order corrections on the post reionization power</td>
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<td>Hall, Liam Terres</td>
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<td>Henderson, Clare Anne</td>
<td>phase retrieval of an optical vortex</td>
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<td>Quantum squeezing by four-wave mixing in rubidium vapour</td>
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<td>Jong, Lenneke Maria</td>
<td>Quantum charge transport in counted-atom silicon devices</td>
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<td>Julius, T’Mir Danger</td>
<td>The Improvement of Correct Mode Identification of B decays.</td>
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<td>Lee, Vivien</td>
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WE CONGRATULATE THE FOLLOWING STUDENTS ON THEIR THESES COMPLETIONS

MSC

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<tr>
<td>Islam, M Tauhidul</td>
<td>X-ray mass attenuation coefficient of gold and ion-chamber modelling</td>
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PHD

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<td>Law, Sandy Sheung Che</td>
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<td>Martin, Andrew Vincent</td>
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<td>Wedd, Robin Heathcote</td>
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A major redevelopment of the Part II/III (2nd & 3rd year) undergraduate student laboratories was completed in time for the second half of semester one 2009.

The recently appointed Dean of Science, Professor Rob Saint officially opened the labs later that year on 24 June.

While it was great to see the completion of this large open plan flexible learning space on the ground level, we still aim to press on with a future development of the level above and continue to seek funds for the project.

The area outside the Laby/Hercus theatres would be enlarged to include the external walkway with the area flowing east into the student laboratories. The space would provide world class conference facilities with the Museum being incorporated into the open plan area, and provide magnificent flexible group learning and social interaction spaces for graduate or undergraduate students.

We need support to make this project a reality and continue to investigate all possibilities.
The Astrophysics group celebrated an outstanding year in all respects in 2009. It was the International Year of Astronomy, celebrating 400 years since the manufacture of the telescope by Galileo, and his subsequent observations of the solar system. The group was involved in a range of outreach activities to celebrate this event: five outstanding July lectures were organized by Jeremy Mould, including Reinhard Genzel, Brian Boyle, Michael Brown, Jeremy Mould and David Jamieson. Stuart Wyithe organized a screening of the Swinburne movie ‘Bigger than Big’ at the Natimuk Frinj with over 500 attendees, and Rachel Webster and Andrew Melatos delivered a number of public talks to different community and professional groups.

Group members were particularly successful with recognition from both outside the University and within. Jeremy Mould was awarded the Gruber Prize for Cosmology at the IAU General Assembly in Rio de Janeiro. Stuart Wyithe was awarded the Pawsey Prize of the Australian Academy of Science, Andrew Melatos received the Dean’s Research Award and Rachel Webster received the University Award for Research Higher Degree Supervision. In addition, Stuart Wyithe was promoted to professor.

The group was not less active in organizing meetings: Stuart Wyithe organized the AGM of the Astronomical Society of Australia, with over 230 attendees. He was ably assisted by all members of the group. Andrew Melatos organised a half-day session on gravitational wave sources at the 12th Marcel Grossmann Meeting. In addition, Andrew gave six invited talks at international conferences, including at the 58th Fujihara Seminar (to inform Japanese governmental agencies on the scientific impact of building a GW detector in Japan) and the 4th International Sakharov Conference on Physics.

Andrew Melatos was accepted as a member of the LIGO collaboration and is making a significant impact within that group. Some other notable scientific achievements during the year included:

- LIGO placed the best upper limit to date on the amplitude of the stochastic GW background in the Universe. The result, published in Nature, rules out a range of cosmological equations of state and certain classes of string theory models for the fundamental forces of nature.

- Matthias Vigelius and Andrew Melatos published the most sophisticated models of magnetic mountains to date, including new effects like resistive relaxation. The updated predictions of signal strength confirm that they are promising source candidates for Advanced LIGO.

- Sally Langford and Stuart Wyithe published their results on earthshine, and the story was featured by Catalyst, the Australian Higher Education Supplement and other publications.

- The MWA project, which includes Rachel Webster and Stuart Wyithe, successfully built the first 32 tiles of their new telescope at Boolardy in WA, and fully tested the array.

The group members published 32 refereed publications during the year, mostly in A and A* journals. The group graduated two new PhDs – Nick Bate and Sally Langford and Stephen Petrie finished an MSc and has started a PhD in population health. The group welcomed new postdoctoral fellows Jamie Bolton and David Floyd and bid farewell to Stewart Gleadow.
GROUP REPORTS & PUBLICATIONS

ASTROPHYSICS

PUBLICATIONS:


This allows clusters of computers to be tightly integrated and allows the rapid sharing of data to members of a grid-enabled collaboration. In the case of ATLAS this is some 2000 Physics located all over the globe. The Melbourne Tier-2 facility is fully integrated into this network and is the only internationally connected grid site in Australia.

The implications of the ATLAS experiment are enormous with the possibility of the discovery of new particles and physics beyond the standard model of our understanding. One of the main goals remains the unearthing of the Higgs Boson, the quantum of the postulated all pervasive Higgs Field which is assumed to give all particles their mass. Although it will be quite some time before the machine and its ensuing data have been refined sufficiently to be able to identify the signatures of these Higgs particles, either way its discovery or non-discovery will be momentous. If it is seen, it will be a triumph for a theory that has given the answer to the very basic question "Why are some particles more massive than others?". If it is not seen it will be back to the drawing board as physicists grapple with the most fundamental questions in our Universe. Either way, it is certain that both ATLAS and its competitor CMS will be adding to the scientific text books of the future. We are eagerly looking forward to the ramp up of the experiment expected in 2010 and to start the search for "New Physics" in earnest.

The EPP group is heavily involved in analysis of ATLAS data. Through the leadership of Elisabetta Barberio and Geoff Taylor, we play a major role in the analysis of ATLAS data through our work in the dilepton and tau reconstruction groups.

In 2009 Antonio Limosani won an ARC Australian Postdoctoral Fellowship for his proposal: "Searching for Supersymmetry in the Universe with the ATLAS experiment at the Large Hadron Collider". He is currently working as inner detector software release coordinator for the ATLAS experiment.

BELLE

Belle is the experiment at the KEK asymmetric electron-positron accelerator which provides the world highest luminosity collider and makes copious numbers of B-mesons. Belle has made numerous discoveries since it commenced data collection in 1999, including the observation of CP violation in B-meson decays, the first such measurement...
outside the neutral kaon system. The significance of Belle was recognized by the 2008 Nobel Prize for Physics, awarded to Nambu, Kobayashi and Maskawa for “the discovery of the origin of the broken symmetry which predicts the existence of at least three families of quarks in nature”. The citation prominently highlights the results of Belle. The EPP group has played a major role in the Belle collaboration and has significantly contributed to the success of this experiment.

Over the past year the KEKB accelerator has continuously improved the performance of the “crab cavities” which rotate beam bunches to allow them to interact and collide head-on. A number of key parameters have been identified which have limited the performance of the cavities were been identified and fixed. As a result the KEKB accelerator achieved a new world-record Luminosity of 2.1x10^34 cm^2 sec^-1. This value is some 20% higher than the previous world record, also set by KEKB, even though the new beam currents employed were substantially smaller than previously used. Also in 2009, Belle announced the result of a number of measurements which are 1-2.8 sigma away from expectations of the Standard Model. We will need a substantial increase in data to determine if these results are the effect of “New Physics” or simply statistical fluctuations.

In 2009 KEK received preliminary approval for an upgrade of the KEKB accelerator which is planned to increase the luminosity by approximately a factor of 50. Construction of the new facility will commence in 2010. At the same time Belle members have formed the Belle II collaboration to design and build a detector to exploit this increase of luminosity. The increase in luminosity will enable the Belle II experiment to perform precision measurements where the effects of Physics beyond the Standard Model of Particle Physics will be manifest. Consequently Belle II will search for “New Physics” in a way complementary to that of ATLAS.

The Australian group makes significant contributions to Belle through data analysis and Distributed Computing. Tom Fifield joined the Belle and Belle II projects this year as a Software Engineer. Martin Sevior leads the Belle II Distributed Computing group.

This year Antonio Limosani, Phillip Urquijo and Robin Wedd submitted papers to refereed Journals describing their measurements of the branching ratios for \( B \rightarrow X_s \gamma \), \( B \rightarrow X_u \ell \) and \( B \rightarrow K \eta' \gamma \) respectively. Both Antonio Limonsani and Phillip Urquijo’s papers were submitted to the prestigious Journal Physics Review Letters.

Finally, Craig Everton was awarded his Ph.D. on the topic “Measurements of various \( B \rightarrow D_s \ell \bar{\nu} \) decays” and Robin Wedd submitted in Ph.D. thesis, “Measurement of the branch ratio for \( B \rightarrow K \eta' \gamma \)”. Both these are based on Belle data.

DISTRIBUTED COMPUTING.

Martin Sevior and Tom Fifield, made the first detailed investigations of Cloud Computing for High Energy Physics. These investigations were presented at the Computing in High Energy and Nuclear Physics 2009 conference in Prague, the International Symposium on Grid Computing, in Taipei and at a special Colloquium at the Victorian Partnership for Advanced Computing. Our results were also heavily cited by Neil Geddes in his talk ”Future Perspectives of Computing in HEP” at the premiere conference in High Energy Physics for 2009, International Symposia on Lepton and Photon Interactions at High Energies in Hamburg, Germany. In this work we showed how the versatile commercial Elastic Computing Cloud (EC2) of the Amazon.com company can be used to supplement the computing resources of High Energy Physics experiments.

ADVANCED ACCELERATOR AND INSTRUMENTATION GROUP

Roger Rassool leads this group’s research into the development of advanced accelerators and instrumentation. The group has continued to develop its collaboration, both locally and internationally.

In particular, the collaboration at the Paul-Schierer Institute has developed considerably with the installation of the Pilatus 1M detector at the Australian Synchrotron. This detector is based on a novel photon counting approach, pioneered by the SLS-Detector group for use in the CMS experiment.
Several of the students are now involved in the development of the next generation pixel detector for synchrotron application. The intention is to ultimately refine the technology to the point where it can be used in medical application. Much of this work is being done in collaboration with Christian Broenniman (DECTRIS), Graeme O’Keefe (Austin PET Centre) and the CRC for Biomedical imaging. With an energy resolving detector, it will be possible to obtain energy specific xray images in clinical environments, and ultimately pave the way for tissue specific imaging of the human body.

Complementing this program is the accelerator research being undertaken in conjunction with Mark Boland and the accelerator physics group at the Australian Synchrotron Light Source (ASLS). Here the group’s focus is directed towards an improved understanding of the beam dynamics of the high energy electron beam at the facility. Building upon the expertise gained during commissioning of the facility, the group is now developing a dynamic feedback system for compensate for beam instabilities. As the facility grows, there will be more demands insertion devices. Meeting this demand will only be possible with real-time, turn-by-turn control of the circulating electrons. The research being undertaken by the students in the PhD program will be critical for the future growth of the facility.

This year has been a busy one, with two PhDs and one MSc completion. We are pleased to congratulate Bryn Sobott, Viliami Takau and Gareth Jones on the completion and submission of their theses. All three are actively employed, Gareth at the Austin hospital PET Centre, Viliami at the ASLS and Bryn as a postdoc within the CRC-BID.

**PUBLICATIONS:**


The Microanalytical Research Centre (MARC) undertakes research in the areas of advanced materials and device fabrication and characterization. The research effort of the MARC group is predominantly in the areas of silicon and diamond materials and device development, with a strong emphasis on ion beam processing and ion beam analysis.

An activity of key importance in the MARC group is the experimental program of the Melbourne node of the Australian Research Council Centre of Excellence for Quantum Computer Technology (CQCT). The CQCT is internationally recognized for its groundbreaking research into quantum device development and measurement. The Melbourne node of CQCT is headed by Prof. Lloyd Hollenberg who also leads the Centre’s theoretical program. The experimental programs at Melbourne are centred on our expertise in single ion implantation, lead by Prof. David Jamieson, for single atom quantum bit (qubit) formation and materials characterization and development, lead by Dr Jeff McCallum. There is very strong collaboration between researchers at the Melbourne node and researchers at the other major nodes, particularly the team at the University of New South Wales (UNSW).

Prof. Jamieson also leads the Melbourne contribution to the Atomic Functionalities in Silicon Devices (AFSiD) project that is funded through the European Union Seventh Framework.

The diamond group within MARC is lead by Prof. Steven Prawer. This group has a strong international reputation in the field of diamond-based quantum optics and quantum computing and is part of the consortium that at the end of 2009 was awarded $42M funding to develop the bionic eye. This is a major and prestigious initiative which will conduct an ambitious program of research over the next four years and will bring a number of new post-doctoral fellows and research endeavours to the group. The MARC group also has strong research linkages with the Australian National University, Royal Melbourne Institute of Technology and other research groups worldwide.

The CQCT’s quantum device (Ion Beam) program at the University of Melbourne collaborates closely with the quantum device program at the University of New South Wales on the fabrication of Si:P devices containing single or few dopant atoms by top-down methods. Over the past decade the group has perfected an integrated method of counting single atoms into silicon devices that is now commonly referred to as deterministic doping. In 2009 a number of the Si:P devices showed extremely interesting characteristics based on the transfer of single electrons between a gate-defined quantum dot structure and a small number of phosphorus donors implanted nearby. This research is detailed in the CQCT Annual Report. A highlight of 2009 was the invitation to present our work at an interdisciplinary workshop “Atomics09” in Germany with delegates working on different strategies for the exploitation of the quantum attributes of single atoms. The group has also worked on developing a step-and-repeat system that incorporates our on-chip single ion detectors and employs a scanned nano-scale aperture that collimates the ion beam to less than 100 nm. This system will, when it is fully functional, provide precise control over the location of our single ion implants. The nano-scale apertures are fabricated by focused ion beam milling of Si cantilevers and SiN membranes and use SEM and TEM imaging to characterise the milling process. In 2010 the system will be used to demonstrate controlled implantation of low energy single ions.

The CQCT’s Materials Program at the University of Melbourne has developed and utilizes a number of defect characterization techniques in order to inform the Centre on optimal processing strategies and defect control in its device structures. In 2009, the fixed oxide charge and the Al-Si work-function difference were measured for the gate structures used in the Centre devices. The group is also moving towards measurement of spin-dependent transport in electrically detected magnetic resonance (EDMR) devices completely fabricated with ion implantation techniques. This is another important collaboration with colleagues at UNSW. A temperature-dependent Hall measurement capability was also added to the group’s characterization suite this year. The system will allow measurement of carrier-type, concentration and mobility over the temperature range 20 - 320 K. The Hall system is also equipped with a 1 Tesla electro-magnet.
GROUP REPORTS & PUBLICATIONS

MICRO-ANALYTICAL RESEARCH CENTRE (MARC)

The diamond group receives considerable national and international recognition for its work on development of optical centres in diamond for potential applications in quantum computing and for its work in engineering of diamond structures. In 2009, a particular highlight was the recognition of the group’s work in discovering a new ultrabright single photon source in diamond based on Cr. The work was published in the high impact journal Nano Letters: Aharonovich, I., Castalletto, S., Simpson, D. A., Stacey, A., McCallum, J., Greentree, A. D., and Prawer, S., Two-Level Ultrabright Single Photon Emission from Diamond Nanocrystals, Nano Letters, 9, 3191-5, (2009). The group’s work on MeV and focused ion beam processing of diamond to form free-standing membranes, waveguide, photonic and cavity structures has lead to strong international and industry linkages in this important area of development for future quantum optical and engineering applications of diamond. The group’s recognized expertise in engineering of diamond structures was also instrumental in it being part of the consortium that secured $42M funding from the Australian government to develop the bionic eye. The diamond group’s task is to engineer an electrically-conductive diamond electrode array which will interface to the optic nerve. They have already made considerable progress toward the development of these structures.

In addition to the bionic project funding, MARC group members were successful in attracting research funding from a number of sources for research programs commencing in 2010. One particular highlight has been the Education Infrastructure Fund/Superscience Heavy Ion Accelerator Project which is jointly funded between ANU and University of Melbourne and will provide $1.3M over the next three years to develop equipment and resources for the Pelletron laboratory. This is a great funding boost for this part of our core infrastructure. The end of 2010 marks the end of the funding cycle for CQCT and during 2010 a new centre bid which expands on the activities of the Centre will be formulated. In January 2010, the MARC group will also be reviewed by a panel of distinguished scientists. 2010 will be a very busy year and we look forward to continued international success for the MARC group and the CQCT.

PUBLICATIONS.


GROUP REPORTS & PUBLICATIONS

MICRO-ANALYTICAL RESEARCH CENTRE (MARC)


PROF STEVEN PRAWER - DIRECTOR

THE MELBOURNE MATERIALS INSTITUTE HAD SOME MAJOR ACHIEVEMENTS IN 2009

In March, Andrew Tierney was appointed as Executive Officer to support the Director, Professor Steven Prawer in establishing the Institute. In September, after rounds of careful planning, the MMI Business Case was submitted to the Deputy Vice-Chancellor Research by the Dean of Engineering, Professor Iven Mareels and the Director. In December, the MMI moved into its new offices on the Ground Floor of the David Caro Building, giving the Institute a physical home.

FUNDING

The MMI was a foundation partner in the successful Bionic Vision Australia consortium which received a grant of $42 million to develop a prosthesis that will restore sight to people suffering from macular degeneration. This consortium includes the MMI, the School of Engineering, the Bionic Ear Institute, the Centre for Eye Research Australia, NICTA, the Centre for Nanoscience and Nanotechnology (University of Melbourne) and the University of New South Wales. The MMI’s role is to deliver materials solutions to the challenge of creating a bionic eye, including a biocompatible diamond electrode array that will be attached to the retina.

The MMI also supported a number of successful ARC Linkage grants (totalling $2 035 000) and Discovery grants (totalling $650 000). The MMI supported a Laureate Fellowship application for Dr Fedor Jelezko and a number of Future Fellowship applications. If successful, these appointments will significantly strengthen the materials science and engineering area.

The MMI was pleased to support six successful bids for the inaugural Interdisciplinary Seed-Funding Scheme. We supported projects that cover topics as diverse as early detection for Legionella, tracking neural stem cells, developing electroactive polymer foams and developing nanoparticle mucosal vaccines for dentistry applications. This scheme was critical in developing the interdisciplinary interactions within the University and catalysing those relationships into new and innovative research. MMI now has over 40 researchers associated with it, under the four themes of Nanomedicine, Materials for Energy, Materials Processing, and Quantum Technologies.

PARTNERSHIPS

The Director spearheaded the University’s efforts to secure a number of major partnerships. In August, the Vice-Chancellor Glyn Davis signed a MoU with the CEO of Better Place Australia, Evan Thornley. The partnership envisions an energy education centre being built on the campus. This agreement saw a major ARC grant application being submitted with the Dean of Engineering as Chief Investigator. The ultimate goal is the conversion of the University’s car fleet to electrical vehicles powered entirely by renewable sources.

The Director also led the University’s engagement with the DSTO. This culminated in a MoU being signed in March that will facilitate a university-wide research agreement, greater collaboration between researchers in the two organisations and the development of a Defence Science Institute, to look at issues such as Bioterrorism, Human Platforms, Signature Management, Energy & Propulsion Systems, Radar on a Chip, and Data Management.

The MMI also initiated partnerships with key international materials science institutes, including the London Centre for Nanotechnology and the Vanderbilt Institute for Nanoscale Science and Engineering. In 2009, we hosted visits by the Directors, Professor Gabriel Aeppli and Professor Len Feldman. Professor Feldman also delivered the 2009 Miegunyah Lecture ‘The Quantum Revolution’.

The MMI, in partnership with Materials Australia, hosted the annual Borland Lecture and the Gifkin Lecture, providing a valuable link between industry and the university’s research.
2009 was a great year for CXS. It began with the news that we had done very well in the ARC review at the end of 2008 and that our funding level is to be increased and extended until December 2013. This is very exciting for us and we celebrated in a joint event with another University of Melbourne led centre, the CoE for Free-Radical Chemistry and Biotechnology which also had a similarly successful review outcome.

The acquisition of guaranteed funding for a further five years means that we can re-focus on the long-term goals that should be at the centre of the planning of an organisation such as CXS. With this in mind, in September, CXS held a very enjoyable and productive planning retreat in Beechworth in which we gave considerable thought to the directions we should take. With the able assistance of the members of our Scientific Advisory Board, well-informed decisions were made and we are already seeing many of these bearing fruit.

Another response to the review was our decision to do some re-casting of the directions of the centre. Accordingly, we invited a group led by Dave Kielpinski from Griffith University to join us so that we can enhance our experimental work in the study of the interaction of high-fields with atomic structures, an important aspect of our long term goal of enabling the analysis of molecular structures using X-ray free electron lasers. We have named this new part of CXS the Attosecond Science Program as it will concentrate on the interaction of extremely short light pulses with atomic systems. An attosecond is extremely short – there are \(10^{18}\) attoseconds in one second, which is a 1 followed by eighteen zeroes, and this is the same as the number of seconds in the age of the universe.

As part of this re-structuring, we also have elected to close down the Detectors & Beamline Development Program based at Monash University. This decision was made easier by the news that Chris Hall had been offered an ongoing position at the Australian Synchrotron with the result that the program was no longer viable. Rob Lewis also took the opportunity to resign from CXS so as to enable him to re-focus on his work related to biomedical imaging. We wish both of these former CXS members well in their future research and fully anticipate an ongoing relationship with both of them. Our association with work on detectors will continue as we anticipate an ongoing relationship with both of them. Our CXS members continue to be highly productive and we expect that this will continue over the coming years.

2009 was also a year in which some of our outreach activities hit a new level of achievement. The movie project continues to proceed well and we were able to see a preview of it at our end-of-year function. We also formed a partnership with Santa Maria College, Northcote which we have called Growing Tall Poppies. This program was supported by the Catholic Education Office and the University of Melbourne through a Knowledge Transfer grant, and it went on to be selected as the winner of the Victorian State Impact Award from the new Schools First grant system sponsored by the National Australia Bank and the Federation of Young Australian. As a result, the partnership was awarded a cash grant of $100,000 to support its further development. This award has led to considerable publicity for CXS and Santa Maria College and will lead to further exciting developments over the coming years.

We have had some staff depart from CXS and so we wish them well. In particular, Garth Williams has been with CXS since its beginning and he has now moved on to an ongoing position at the X-ray free electron project at the SLAC laboratory run by Stanford University in California. We wish Garth well, but expect to continue to work with him in the coming years.

For publications produced from the University of Melbourne Physics staff, please refer to the Optics group report. For publications produced by all ARC nodes and participating partner institutions, please refer to: www.coececs.org
Ann Roberts’ collaboration with the University’s Centre for Cultural Materials Conservation continues to gain strength with students co-supervised by Ann and members of the CCMC, completing their PhD studies. Both Nicole Tse and Elizabeth Hinde successfully negotiated the myriad challenges of interdisciplinary research to make significant contributions to cultural materials analysis and conservation using novel optical techniques.

Research into plasmonics and metamaterials, led by Ann Roberts and supported by an ARC Discovery Project, has also led to the development of a new nanophotonic metamaterial device that could form the basis of new compact plasmonic devices such as lenses and nanoantennas.

Ann Roberts and Keith Nugent continued with their work on a linkage project aiming at developing novel forms of projection screens.

The ultracold plasma project made substantial progress during 2009. We have designed, constructed, demonstrated and installed a novel slow atom source, using a Zeeman atom slower with a tapered helix solenoid. We have competed a demonstration of a new non-iterative technique for imaging inhomogeneous cold atom clouds, using phase retrieval from a single diffraction measurement. We have also improved the laser technology for our UCP experiments, establishing critical factors affecting laser linewidth and mode stability. An exciting development is the successful demonstration of cold electron bunches by photoionisation of a cloud of cooled and trapped atoms. Finally, in collaboration with the CXS Theory and Modelling Program, we are developing a computational simulation of partially coherent electron imaging, using Fresnel wave propagation in combination with a Gaussian-Schell model for partial coherence.

In the diamond colour-centre spectroscopy project we have designed and developed a single-photon confocal microscopy system with optically detected magnetic resonance. The system readily demonstrates anti-bunching, Rabi oscillations, and spin-echo with diamond NV centres in bulk and nanocrystal form. We are now able to make quantum measurements of a single quantum spin.

We were delighted to have been successful in application for an ARC Discovery project with the Theoretical Condensed Matter Physics Group. The application High-resolution electron diffraction imaging for the nanosciences received a total sum of $750,000 over three years.

www.physics.unimelb.edu.au
GROUP REPORTS & PUBLICATIONS

OPTICS

PUBLICATIONS:


A/PROF LES ALLEN

Highlights from the Centre for Quantum Computing Technology (CQCT) theory program led by Professor Lloyd Hollenberg include:

- a concept paper on decoherence based detection (Nanotechnology),
- a proposal for mapping donor electron wave functions in silicon using $^{29}$Si spin probes (Physical Review Letters), with the Purdue group,
- a follow up on the theory for decoherence detection sensitivity for randomly fluctuating magnetic fields (Physical Review Letters) by PhD student Liam Hall.

The use of NV diamond for a novel detection of the Aharonov-Casher phase was carried out by PhD student Dougal Maclaurin in collaboration with Dr. Andy Martin and Dr. Andy Greentree (Physical Review A, Rapid Communication).

CQCT postdocs A. Fowler and C. Hill completed work in surface code based quantum communication protocols and multiple receiver quantum transport protocols respectively.

The group also participated in the first single electron spin readout in silicon achieved at the UNSW node of the CQCT.

A/PROF LES ALLEN

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The group also participated in the first single electron spin readout in silicon achieved at the UNSW node of the CQCT.

QE II Fellow Dr Andy Greentree and his students continued investigating single photon nonlinear optics and the Jaynes-Cummings-Hubbard model (solid-light). Outputs from the year included

- an invited book chapter (with Prof. Hollenberg), 16 published journal articles, and, with Prof. Steven Prawer,
- two ARC grants relating to quantum optics in diamond were obtained. The first grant is a Discovery Project that will bring Dr Tomljenovic-Hanic to the TCMP group in 2010 as a new Australian Research Fellow. The second is a linkage project with Hewlett-Packard. Dr Greentree maintains active collaborations with NII Tokyo, HP Bristol and HP Palo Alto, TU Karlsruhe, UNSW and the University of Adelaide.

Dr Andy Martin, Senior Lecturer in the TCMP Group, published 7 papers (including two in A* ERA ranked journals) in the fields of ultracold dilute gas dynamics and topological phase measurements using defects in diamond. This work involved several international collaborations (UK, the Netherlands, Canada, New Zealand, Japan and Germany). Highlights of this work include

- a proposal to measure large topological Aharonov-Casher phases in nitrogen vacancy centers in diamond and presented a new technique to study the fundamental properties of ultracold dipolar gases. As a result of this work Dr. Andy Martin gave an invited talk at the University of Otago, New Zealand.

The highlight for the subgroup of Professor Les Allen, working mainly on imaging beyond the nanoscale, was a paper published with the group of Professor Susanne Stemmer from the University of California in Santa Barbara in which quantitative bright field imaging in scanning transmission electron microscopy was described for the first time. These results are related to imaging in a conventional transmission electron microscope by the quantum mechanical principle of reciprocity and thus make direct comment on the long standing and important problem of lack of contrast (typically 200 - 500%) typically found in that mode of imaging (the so-called Stobbs factor). Our results show that it is not the theory of how fast electrons interact with condensed matter which is at the root of the contrast problem, as has been widely speculated. Papers were also published on quantitative Z-contrast imaging of crystals containing heavy elements, a model of phonon excitation by fast electrons in a crystal with correlated atomic motions and a paper incorporating the theory of multiple scattering of the probe electron in electron energy-loss spectroscopy. Professor Allen delivered invited keynote contributions at international conferences in Canada, the UK and Taiwan.


GROUP REPORTS & PUBLICATIONS

THEORETICAL CONDENSED MATTER PHYSICS (TCMP)


Professor Ray Volkas continued his research on domain-wall brane models. Two pieces of work completed in 2009 were a study with Chkareuli (Tbilisi) and Kobakhidze of domain-wall solutions using vector fields rather than scalar fields, and the development of a new kind of grand-unified domain-wall brane model with his student Jayne Thompson. On-going work with student Ben Callen on the flavour problem in models of this type will be discussed more fully in the 2010 report.

There were a number of personnel changes in 2009. It was with great pleasure that we welcomed Dr Kalliopi Petraki as a research fellow specialising in astroparticle physics to the group. Petraki completed her PhD under Professor Alex Kusenko at UCLA, and Melbourne is her first postdoc. Two PhD students graduated: Damien George and Sandy Law, who were both supervised by Prof Ray Volkas. George is now a postdoc at Nikhef, the Netherlands institute for high energy physics, in Amsterdam. Law also moved on to a postdoc position, at Chung Yuan Christian University in Taiwan. We continue to enjoy the contributions of Drs Robert Foot, Benedict von Harling, Archil Kobakhidze and Nicholas Setzer as postdocs. Visitors to the group included Professor J. L. Chkareuli from Tbilisi, Georgia, and Professor Emilian Dudas from the Ecole Polytechnique in Paris.

From 18-20 November, the group hosted the CosPA 2009 International Symposium on Cosmology and Particle Astrophysics, one of an annual series of conferences in the Asia-Pacific region. Approximately 50 participants came from Asia-Pacific regions such as mainland China, Japan, Korea, New Zealand and Taiwan, plus several participants from other institutions in Australia, with good representation also from the US. Professor Sean Carroll of the California Institute of Technology delivered a very well received and attended public lecture on the origin of the arrow of time as part of the conference.
### PUBLICATIONS:

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Journal</th>
<th>Volume</th>
<th>Pages</th>
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<tbody>
<tr>
<td>Agashe, K., Gopalakrishna, S., Han, T., Huang, G.-Y. &amp; Soni, A.</td>
<td>LHC signals for warped electroweak charged gauge bosons</td>
<td>Physical Review D.</td>
<td>80</td>
<td>075007.</td>
</tr>
<tr>
<td>Bassler, K.E., Forrester, P. &amp; Frankel, N.</td>
<td>Eigenvalue separation in some random matrix models</td>
<td>Journal of Mathematical Physics</td>
<td>50</td>
<td>033302.</td>
</tr>
<tr>
<td>Christandl, M. &amp; Toner, B.</td>
<td>Finite de Finetti theorem for conditional probability distributions describing physical theories</td>
<td>Journal of Mathematical Physics</td>
<td>50</td>
<td>042104.</td>
</tr>
<tr>
<td>Foot, R.</td>
<td>Evidence for mirror dark matter from the CDMS low energy electron recoil spectrum</td>
<td>Physical Review D.</td>
<td>80</td>
<td>091701.</td>
</tr>
<tr>
<td>Gherghetta, T. &amp; Sword, D.</td>
<td>Fermion flavor in the soft-wall AdS model</td>
<td>Physical Review D.</td>
<td>80</td>
<td>065015.</td>
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Photo courtesy of Fermilab 95-759

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www.physics.unimelb.edu.au
Dr Stuart Wyithe, Postgraduate Physics Coordinator

Within the School of Physics, postgraduate research is an integral part of all research areas. Physics postgraduates are therefore integrated into School life at all levels. For example, the crucial role played by students in the research success of the School is highlighted during the weekly postgraduate seminar series. This series serves to inform the School as a whole of individual research programs. Since 2006, the School has expanded the postgraduate seminar series to include a full colloquium by final year students, describing the work presented in their thesis. This final colloquium provides the opportunity for the School to celebrate the achievements of postgraduate students. This initiative has been well received in 2009 by staff and students alike in the quality and excellence of the presentations received. The profile of completion seminars was raised by the staging of some in the primary Physics colloquium time slot.

In addition, the seminar series offers our students valuable experience in scientific and oral presentation skills. Postgraduate students are also integrated into the day-to-day workings of the School through representatives on each of the Schools committees. Postgraduate student participation on School committees is coordinated by the Postgraduate student society, and aims to ensure that postgraduate student needs are met at all levels.

The School aims to assist postgraduates with the skills they will need to successfully complete their degree and to move forward in the future. To prepare postgraduate students to make the most of their time within the department, the School conducts an induction day, where the roles and perceptions of students and supervisors alike, as well as the requirements of postgraduate study are discussed.

The School recognises the importance of bridging the gap between undergraduate and postgraduate study. To this end the School organises a Postgraduate student research exhibition. This exhibition showcases the work of our postgraduates to interested 2nd and 3rd year physics students, and provides an opportunity for them to find out what work in research is like from the student perspective.

Melissa Makin, PPSS President

This year, the Postgraduate Physics Student Society (PPSS) continued to perform its vital role in supporting the graduate students of the school. This cohort increased significantly this year, as it was the first year in which the new Masters (previously Honours) students have been officially part of the graduate cohort, and their presence was keenly welcomed - in both the committee and the general members. We gratefully acknowledge the continued funding and support given by the Graduate Student Association (with whom we are affiliated) with our increased membership.

We continued to perform our essential role of organising student representation on School committees, as well as organising a number of social events during the year. These included a pool competition, a barbecue, and the fabulously successful trivia night.

A key success during this year was to ensure the continued provision of drinks after the Friday afternoon seminar (GOSS or completion seminar). The presence of these drinks ensures the presence of staff and students, which facilitates a healthy, happy well-socialised school where the degree of communication between research groups is high.

For more information, visit the PPSS website at www.ph.unimelb.edu.au/PPSS/
## UNDERGRADUATE

<table>
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<tr>
<th>PRIZE</th>
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<th>Value</th>
<th>Recipient</th>
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<tbody>
<tr>
<td><strong>DWIGHT PRIZE</strong></td>
<td>Awarded to the student achieving the highest results in First year advanced level, on recommendation by the Head</td>
<td>$700</td>
<td>Andrew Bennet</td>
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<tr>
<td><strong>E M AND J F WARD PRIZE FOR EXPERIMENTAL PHYSICS</strong></td>
<td>Awarded to the most outstanding student in experimental physics in the final year of the BSc degree with a major in physics.</td>
<td>$1,000</td>
<td>Sophie Dawson</td>
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<tr>
<td><strong>RAMM PRIZE IN EXPERIMENTAL PHYSICS</strong></td>
<td>Prize is awarded to a student enrolling in either Honours or postgraduate degree by research in Experimental Physics who has demonstrated excellent research potential.</td>
<td>$2,000</td>
<td>Gabrielle Fejes</td>
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<tr>
<td><strong>T F RYAN (ROENTGEN) PRIZE</strong></td>
<td>Prize is awarded to the student with the highest aggregate score in 640-182 Physics for Biomedical Science at First Year.</td>
<td>$400</td>
<td>Lev Gutkin</td>
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<tr>
<td><strong>WILLIAM SUTHERLAND PRIZE</strong></td>
<td>Awarded to the student achieving the highest results in Second Year Physics who is proceeding to study Physics at the Third Year level.</td>
<td>Book vouchers worth $200</td>
<td>Timothy Trott</td>
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## POSTGRADUATE

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<tr>
<td><strong>THE CISRA PRIZE IN PHYSICS</strong></td>
<td>Eligible candidates must be enrolled in, or have completed in the previous 12 months, the degree of PhD in the School of Physics at the University of Melbourne.</td>
<td>$2,000 approx</td>
<td>Liam Hall</td>
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<tr>
<td><strong>PROFESSOR KERNOT RESEARCH SCHOLARSHIP IN PHYSICS</strong></td>
<td>Awarded on recommendation of the Head on the basis of Honours results. Holders are required to conduct research in Physics at postgraduate level.</td>
<td>$2,000 approx</td>
<td>Brendan Mulkerin</td>
</tr>
<tr>
<td><strong>DIXSON RESEARCH SCHOLARSHIP IN PHYSICS</strong></td>
<td>Awarded on the basis of Honours results in Physics. The holder is required to conduct research in Physics at the University at postgraduate level</td>
<td>$1,500 approx</td>
<td>Sudhir Raskutti</td>
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<tr>
<td><strong>KLEIN PRIZE IN EXPERIMENTAL PHYSICS</strong></td>
<td>Awarded to a student who has completed fourth year Honours (or equivalent) in the School of Physics at the University of Melbourne, and who is currently enrolled in a Research Higher Degree in the School of Physics at the University of Melbourne.</td>
<td>$500 approx</td>
<td>Michelle Strack</td>
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<tr>
<td><strong>JOHN TYNDALL SCHOLARSHIP PRIZE</strong></td>
<td>Awarded to a student who is enrolled in a Research Higher degree who is conducting advanced studies or research in the School of Physics</td>
<td>$350</td>
<td>Kent Wootten</td>
</tr>
<tr>
<td><strong>WOMEN IN PHYSICS PRIZE</strong></td>
<td>Awardees are to be selected on the basis of academic excellence and demonstrated research potential, financial need may also be considered.</td>
<td>$1,000 approx</td>
<td>Sarah McLeod</td>
</tr>
<tr>
<td><strong>DIEUL-KURZWEIL SCHOLARSHIP</strong></td>
<td>Awarded to a student who has been admitted to candidature for a Research Higher degree in the School of Physics and is in need of financial assistance to pursue the course.</td>
<td>~$2,360</td>
<td></td>
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<tr>
<td><strong>DEAN’S AWARD (HONOURS LEVEL) - PHYSICS</strong></td>
<td>The Dean’s Honour List - Honours Level is determined by academic merit and is comprised of students with outstanding distinction. It is awarded at the honours level of the Bachelor of Science in all areas of study.</td>
<td></td>
<td>Dougal Maclaurin</td>
</tr>
</tbody>
</table>
BRYAN SCHOLARSHIP IN BIOLOGICAL SCIENCE
Determined by academic merit and awarded to a student enrolled in the Bachelor of Science (Honours) in a branch of Natural Science in a Biological Science department.

Linden Gearing

STUDENT PRIZE IN PHYSICAL SCIENCES - ROYAL SOCIETY OF VICTORIA
The winner is picked based on an extended abstract and a talk intended for a non-specialist audience.

Lila Warszawaski

WYSELASKI SCHOLARSHIP IN NATURAL SCIENCE
Awarded on academic merit to a student who is enrolled in a Masters, Postgraduate Diploma or Honours in a branch of Natural Science

$1,500 Lyndon Koens

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<tbody>
<tr>
<td>DEAN’S AWARD IN RESEARCH EXCELLENCE</td>
<td>This award is presented in recognition of excellence in research activities being undertaken within the Faculty of Science</td>
<td></td>
<td>Dr Andrew Melatos</td>
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<tr>
<td>DEAN’S AWARD FOR EXCELLENCE IN TEACHING - OUTREACH ACTIVITIES</td>
<td>This award is presented in recognition of ongoing, outstanding performance in educational activities within the Faculty of Science and the wider community</td>
<td></td>
<td>Dr Roger Rassool</td>
</tr>
<tr>
<td>FLINDERS MEDAL - AUSTRALIAN ACADEMY OF SCIENCE</td>
<td>The Matthew Flinders Medal and Lecture recognises scientific research of the highest standing in the physical sciences, and honours the contributions of Australia’s early scientific researchers. Nominations for this award are invited from AAS Fellows only.</td>
<td></td>
<td>Prof Bruce McKellar</td>
</tr>
<tr>
<td>PAWSEY MEDAL - AUSTRALIAN ACADEMY OF SCIENCE</td>
<td>This medal is awarded by the AAS for outstanding research in physics by scientists under 40 years</td>
<td></td>
<td>A/Prof Stuart Wyithe</td>
</tr>
<tr>
<td>MALCOLM CHAIKIN PRIZE</td>
<td>The Malcolm Chaikin Prize is awarded for Research Excellence in Physics at University of New South Wales</td>
<td></td>
<td>Dr Susan Angus</td>
</tr>
<tr>
<td>NAB SCHOOLS FIRST GRANT</td>
<td>Awarded for developing an outreach program, Growing Tall Poppies, with the aim of encouraging more students to study physics.</td>
<td></td>
<td>CXS</td>
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2009 GRUBER PRIZE COSMOLOGY PRIZE OF THE PETER AND PATRICIA GRUBER FOUNDATION
The recipients of the 2009 Cosmology Prize of The Peter and Patricia Gruber Foundation are, (pictured right, from left to right) Jeremy Mould, Professorial Fellow at the University of Melbourne School of Physics, Wendy Freedman, Director of the Observatories of the Carnegie Institution of Washington in Pasadena, California; Robert Kennicutt, Director of the Institute of Astronomy at the University of Cambridge in England.

These three renowned astronomers are being honoured for their leadership in the definitive measurement of the value of the Hubble constant, one of the most important numbers in astronomy. The Hubble constant indicates the rate at which the universe has been expanding since the “Big Bang,” thus connecting the universe’s age with its size.

The Cosmology Prize was the first to be awarded when the Gruber International Prize Program was inaugurated in 2000; and its tenth anniversary, which the Foundation celebrated this year, coincides with the International Year of Astronomy.

Freedman, Kennicutt, and Mould received the Prize on August 4, 2009, at the opening ceremony of the International Astronomical Union’s General Assembly in Rio de Janeiro, Brazil.

The prize consists of a gold medal and $500,000.
INSERVICE 2009

THE SCHOOL OF PHYSICS ANNUALLY ORGANISES AN IN-SERVICE DAY IN PHYSICS FOR VCE PHYSICS TEACHERS.

The 2009 program was held on Friday, 13th November, with over 100 teachers attending. The program included the following speakers:

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<th>Speaker</th>
<th>Institution</th>
<th>Topic</th>
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<tr>
<td>Dr. Andrew Melatos</td>
<td>School of Physics, University of Melbourne</td>
<td>Einstein’s Relativity</td>
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<td>Ben Keneally</td>
<td>Better Place</td>
<td>Electric Power and climate change</td>
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<td>Dr Nigel Kirby</td>
<td>Australian Synchrotron</td>
<td>The Australian synchrotron</td>
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<tr>
<td>Expert panel</td>
<td>VCE Physics teachers focus group</td>
<td>Standard responses to answers I physics exams or in class</td>
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<td>A/Prof Michelle Livett</td>
<td>Associate Dean of Undergraduate Studies, Faculty of Science, University of Melbourne</td>
<td>The Melbourne Model</td>
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<tr>
<td>Nick Nicola</td>
<td>Undergraduate Laboratory Manager, School of Physics, University of Melbourne</td>
<td>Lecture demonstrations 101: Physics from the dark side</td>
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JULY LECTURES

2009 THEME: INTERNATIONAL YEAR OF ASTRONOMY

This very popular series of free public lectures has a long and enviable history in the school. Presented by the School’s teaching and research staff, they are aimed at giving an insight into fundamental questions in physics, and advances in current research.

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<th>Date</th>
<th>Speaker</th>
<th>Institution</th>
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<tr>
<td>Friday 3-July</td>
<td>Professor David Jamieson</td>
<td>Head of Department, School of School of Physics, University of Melbourne</td>
<td>Galileo’s invention of the astronomical telescope and his remarkable discoveries: moons, stars and a new planet</td>
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<tr>
<td>Friday 10-July</td>
<td>Professor Jeremy Mould</td>
<td>Astrophysics group, University of Melbourne</td>
<td>The Hubble Space Telescope and the Hubble Constant</td>
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<td>Friday 17-July</td>
<td>Professor Michael Brown</td>
<td>Lecturer, Monash University</td>
<td>The Giant Magellan Telescope - 400+10 years after Galileo</td>
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<td>Friday 24-July</td>
<td>Professor Reinhard Genzel</td>
<td>Max-Planck Institute for Extraterrestrial Physics, Germany &amp; Dept of Physics, University of California, USA</td>
<td>The supermassive black hole at the centre of the Galaxy</td>
</tr>
<tr>
<td>Friday 31-July</td>
<td>Professor Brian Boyle</td>
<td>Director, CSIRO Australia Telescope National Facility</td>
<td>The Square Kilometre Array</td>
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WE HIGHLY VALUE THE SUPPORT WE RECEIVE FROM OUR ALUMNI FOR PRIZES AND AWARDS THAT SUPPORT OUR STAFF AND STUDENTS AS WELL AS OUR POTENTIAL BUILDING PROJECTS IN THE FUTURE

2009 VICTORIAN HONOUR ROLL OF WOMEN

DR JEAN E LABY

The Victorian Honour Roll of Women recognises and celebrates the achievements of Victorian women. All of the inductees have used their skills, knowledge, and commitment to better their communities. They have excelled in their chosen fields and are testament to the depth of talented women we have in this State.

“Being the first female PhD in physics showed it could be done. She pushed on the doors that were locked to women and burst through them - she was truly a trailblazer” commented David Jamieson when interviewed about Jean’s achievements.

In 1959 Dr Jean Laby became the first woman to receive the Doctor of Philosophy degree in physics at the University of Melbourne. Jean was one of Australia’s pioneer atmospherics physicists and the sole female atmospherics physicist of her generation, and her work gained international recognition. She had several papers published in Nature, the most prestigious scientific journal. As a role model she opened the way for women to participate equally with men within the scientific and academic world at a time when it involved obstinate gender hurdles.

There is a legion of female PhD students who have followed on from Jean’s legacy. Jean and her sister, Betty spent much of their childhood at the university accompanying their father, Professor Thomas H. Laby, who was head of what is now called the School of Physics. Not only did Jean inherit her father’s love of physics, but also the desire to teach. The two don’t always go together. Scientists aren’t always the best communicators but Jean possessed both these skills.

In 1961 she took up the position of senior lecturer at the Royal Australian Air Force Academy at Point Cook and remained the only woman on staff until 1980.

In 1975 she obtained a $US25,000 grant for a global study of climatic impact and developed lightweight micro-electric control systems to automate the collection of high altitude atmospheric data. Jean and her colleagues can claim to be the pioneers in an experimental technique that continues to be of critical importance today to our understanding of, and the interaction with, the earth’s climate. She laid the foundations for climate change and pollution studies with the techniques they developed. Jean also travelled to South Africa and South America to undertake atmospheric research with high-altitude balloons. She camped out in fields in primitive conditions and she just put up with it, along with all the discrimination.

All up an outstanding achievement by a remarkable woman - now appropriately recognized on the Victorian Honour Roll of Women.

Dr Jean E Laby
OFFICIAL OPENING OF THE PHYSICS MUSEUM

THE PATHWAY TO THE FUTURE IS BUILT
UPON THE PAST...

"Just 400 years ago a man put two small pieces of glass in a tube, pointed it at the sky and made discoveries that changed the world - that man was Galileo and its fair to say that his ideas shaped the world we live in today!" And so began David Jamieson in his welcome to a celebration in the School of Physics of the official opening of the museum. It may seem strange to "open" something that has been around for a while, but we felt that it was time to formally acknowledge the efforts of Ed Muirhead, former Chair of the School of Physics, and others in cultivating, shaping and building the School’s historic record.

In his address, the Vice-Chancellor Professor Glyn Davis, highlighted many of the achievements of the School and the pioneering efforts which have laid an exceptional path for successive generations of teachers and researchers. He warmly welcomed back many of the School’s graduate students, and made a special mention to Betty Laby whose family has had a long association with the School of Physics. As well as the Head, Betty & Jean’s father, Professor Thomas H. Laby was Chairman of the Optical Munitions Panel, and spearheaded the School’s contribution to the war effort with the manufacturing of optical glass and optical instruments in the Physics department - pure excellence in knowledge transfer.

Many items depicting these and other efforts have been painstakingly restored and catalogued in the collection. For almost twenty years, Ed has overseen this heroic task with the assistance of many including Anna Fairclough, Belinda Nemec and Nick Nicola to name but a few. Together they have established what can only be described as a long lasting legacy to the School. Their work has been made possible through generous support of the Cultural Collections Group, the Russell and Mab Grimwade Miegunyah Fund Committee, the Potter Foundation and our own Friends of the Physics Museum.

As evidenced on the day, it is a fitting location for a museum with students passing constantly through normal daily interaction. So with the foundation stones well laid, we are now walking the path. Our vision is to transform the space around our museum into a magnificent flexible group learning and social interaction space for new Generation Masters students. We need support to make this project a reality and continue to investigate all possibilities.
MEMBERS OF THE SCHOOL OF PHYSICS WERE REGULARLY FEATURED IN THE MEDIA DURING 2009

2009 ASTRO MEDIA COMMENTARY

Sally Langford: Earthshine reflects Earth’s oceans and continents from the dark side of the moon, Apr-7, ASTROBIOLOGY; Celestial mirror, 9-Apr, SYDNEY MORNING HERALD; Shedding light on exoplanet hunt, Apr, BBC NEWS; Spotting Distant Worlds from the Backyard, Apr-19, TIME HEALTH & SCIENCE; Astronomer takes shine to planets, 29-Apr, THE AUSTRALIAN.

Prof Jeremy Mould: Aussie astronomer wins for measuring universe, 4-Jun, AAP NEWSWIRE; Aussie’s out of this world, 4-Jun, MX; Astronomer a star, 5-Jun, DAILY TELEGRAPH; Astronomical award, 5-Jun, CANBERRA TIMES; Cosmic award winner, 5-Jun, ADELAIDE ADVERTISER; Aussie who measure space honoured, 5-Jun, HOBART MERCURY; Astronomer who found the universe’s number, 8-Jun, THE AUSTRALIAN; Prestigious price for Melbourne astronomer, 9-Jun, THE AGE; Gruber Foundation, 9-Jun, CYBER ED, COURIER MAIL.

Prof Rachel Webster: 400 Years of Astronomical Telescopes, Episode 67, Jun, UP CLOSE PODCAST, UNIVERSITY OF MELBOURNE; First Impressions: Rachel Webster, 27-Jun, THE AUSTRALIAN; Adelaide Festival of Ideas panel discussion, 3-Aug, LATE NIGHT LIVE - RADIO NATIONAL SYDNEY; Get science on to emissions, not taxes, 25-Jul, GEELOONG ADVERTISERS; A/Prof Stuart Wyithe: The First Galaxies, Jan/Feb, AUSTRALIAN SCIENCE; Pushing the limits of Lady Luck, Jul, THE AUSTRALIAN; Latrobe Valley Geothermal Energy, 3-Jul, ABC GIPPSLAND;

2009 OPTICS MEDIA COMMENTARY

MOGLabs Laser Diode Controller named in ‘Smart 100’ Index, 14-Apr, AUSTRALIAN ANTHILL.

Prof Tony Klein: Giant steps are what they took (for man), walking on the moon, 11-Jul, THE AGE; Apollo expert recalls ‘15 minutes of moon fame, 24-Jul, AUSTRALIAN JEWISH NEWS; Education is vital, 27-Aug, THE AGE; One small step for mankind, 20-Sep, THE AGE.

Mr James Richmond: Atheism, 28-Oct, THE AGE

2009 EPP MEDIA COMMENTARY

A/Prof Martin Siewor: Nuclear Power, 24-Jul, ABC2 NEWS BREAKFAST; Nuclear Power, 26-Aug, BREAKFAST - 2CC CANBERRA; Wind power, 13-Oct, STATEWIDE DRIVE - ABC VICTORIA STATEWIDE.

2009 TPP MEDIA COMMENTARY

Prof Tony Gherghetta: In Search of a 5th Dimension, May, AUSTRALIAN SCIENCE.

Prof Fulvio Melia: Cracking the Einstein Code.

Prof Ray Volkas: Angels and Demons, Jun, UNIVERSITY OF MELBOURNE REVIEW.
MASTER OF SCIENCE

With the change in curriculum to Melbourne Model, in 2009 the School was pleased to offer an exciting alternative to Honours, a new two-year Masters of Science in Physics degree, comprising both course work and research project.

The Master of Science - Physics program (Research Training) offers students an exciting array of topics, designed to prepare students for a career as a professional physicist and beyond.

Students can select seven from the following:
- Quantum Mechanics
- Quantum Field Theory
- General Relativity
- Statistical Mechanics
- Physical Cosmology
- Particle Physics
- Condensed Matter Physics
- Optics
- Experimental Methods

Advanced Seminars in:
- Astrophysics/Physical Cosmology
- Particle Physics
- Condensed Matter
- Optics

Students must undertake one of the following Professional Tools:
- Critical Analysis in Science
- e-Science
- Ethics in Science
- Systems Modelling and Simulation
- Thinking and Reasoning with Data
- Science and Communication
- Science in Context
- Money, People and Projects

HONOURS

The Honours year comprises course work (640-496) and research project (640-497). The content of course work may vary from year to year.

FIRST YEAR SUBJECTS

640-111/2 Physics 1/2: Advanced
640-131 Physics 1
640-132 Physics 2: Physical Science & Technology
640-171 Physics 1: Fundamentals
640-172 Physics 2: Life Sciences & Environment
640-182 Physics for Biomedicine

SECOND YEAR SUBJECTS

640-223 Quantum Mechanics & Thermal Phys (Adv)
640-225 Electromagnetism & Spec Relativity (Adv)
640-234 Further Classical & Quantum Mechanics
640-237 Astrophysics & Optics 2
640-243 Quantum Mechanics & Thermal Phys
640-245 Electromagnetism & Relativity
640-251 Instrumentation for Scientists
640-299 Part 11 Laboratory

THIRD YEAR SUBJECTS

640-311/12 Undergraduate Seminar
640-321 Quantum Mechanics (Advanced)
640-322 Thermal Physics (Advanced)
640-323 Electrodynamics (Advanced)
640-341 Quantum Mechanics
640-342 Statistical Physics
640-343 Electrodynamics
640-351 Astrophysics & Optics 3
640-353 Atomic, Molecular & Solid State Physics
640-354 Sub-atomic Physics
640-364 Computational Physics
640-381 Principles & Applications of Sensors
640-393/4 Part 111 Laboratory

SUBJECTS OFFERED

www.physics.unimelb.edu.au
IN ADDITION TO THE MANY UNIVERSITIES AND SCHOOLS THAT HIRE OUR GRADUATES AS LECTURERS, POSTDOCTORAL FELLOWS AND TEACHERS, OTHER ORGANIZATIONS THAT HAVE RECRUITED OUR GRADUATES INCLUDE:

ANZ Bank  
Australian Nuclear Science Technology Organisation (ANSTO)  
Austin Hospital  
Australian Synchrotron  
Australian Government  
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)  
Australian Strategic Policy Institute  
Bureau of Meteorology  
Boston Consulting Group  
Commonwealth Scientific and Industrial Research Organisation (CSIRO)  
Department of Human Services  
Department of Education, Science and Technology (DEST)  
Department of Finance  
Department of Primary Industries  
Department of Innovation, Industry and Regional Development (DIIRSD)  
Defence Science Technology Organisation (DSTO)  
Energy Core Geothermal Heating & Cooling  
Ernst & Young  
GBC Scientific Equipment  
Google  
GRA Supply Chain Consultants  
Howard Florey Institute of Experimental Physiology and Medicine  
Iatia Vision Sciences  
Intel  
KPMG  
LEK Consulting  
Macquarie Bank  
Momentum Funds Management  
Note Printing Australia  
PriceCooperWaterhouse  
Victorian Government  
Walter Hall & Eliza Institute

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