The University of Melbourne

The School of Physics
Mission Statement
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Growing Esteem & Future Directions
Governance
Executive Manager’s Report

Academic Staff
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Honorary Staff

Professional Staff

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Research Funding

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www.ph.unimelb.edu.au
The University of Melbourne is a centre of cultural and intellectual life in Australia. Founded in 1853, the university commenced teaching its first students in 1855. Its main campus is located just north of Melbourne’s city centre. It is ranked as one of Australia’s highest research-intensive universities. Reinforcing Melbourne’s position as one of Australia’s leading research universities is our ability to attract Australian Postgraduate Awards (APAs), which are awarded to researchers of great promise. The most recent annual figures saw Melbourne receive 174 APAs – more than any other Australian university. Among those teaching and conducting research at the University of Melbourne are many people of international standing and reputation.

As one of Australia’s oldest universities, the University of Melbourne has a long history of welcoming international students and has a sophisticated understanding of the infrastructure and specialized support where required.

In 2005, the University of Melbourne was ranked #1 study, The International Standing of Australian Universities. This follows the worldwide ranking of the University at #22 by the Times Higher Education Supplement. Internationalisation is essential for the development and growth of the University of Melbourne.

INTERNATIONALLY RECOGNISED FOR ACADEMIC EXCELLENCE

To this end the University has:

- Developed formal international exchanged agreements with over 100 institutions worldwide;
- Established the Eminent Scholars Scheme – an innovative program designed to enhance our teaching and research environment;
- Included distinguished members of the global higher education community in its governing council. The current international member is Professor John Hood, Vice-Chancellor, University of Auckland;
- Helped to create the prestigious Universitas 21 network – an international network of 17 research-intensive universities in ten countries.

The University’s leading role in setting up and supporting Universitas 21 has greatly lifted its reputation in Europe, the United States and Asia. For further information visit http://www.universitas21.com/.

The University has established strong links with industry. The University of Melbourne is a core participant in 21 of 26 Cooperative Research Centres and is a supporting participant in the remaining few. The Government’s Cooperative Research Centre Program, launched in 1990, fosters links between industry, educational institutions and government to encourage world-class research and to offer business an opportunity to collaborate with research institutions on R&D relevant to industry needs. The benefit of such alliances to postgraduate students is that they have access to state-of-the-art facilities and their learning is informed by the latest research conducted by world-class academics.
The University of Melbourne

The Faculty of Science was established in 1903 at the University of Melbourne, under the first Dean, Professor Henry Laurie. 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.

For over 100 years, our Faculty of Science has been recognised internationally for the role in expanding the frontiers of knowledge for the betterment of society.
To advance the knowledge and understanding of physics for the benefit of society, science and the environment by continually achieving excellence in teaching and research. Our aim is to be one of the best Physics Schools in the world.

The School of Physics is one of the oldest and largest in Australia. It houses approximately 200 teaching & research academic staff, research staff, professional staff, postgraduate and 4th year Honours students. The School is justifiably proud of its internationally competitive and comprehensive undergraduate and research programs, particularly with the Honours, Masters and PhD programs.

The major research strengths of the department staff span a diverse range of interests including astrophysics, atom optics, cosmology, condensed matter physics, experimental particle physics, medical physics, nanotechnology and materials science, theoretical particle physics, quantum information science, X-ray and imaging optics. The breadth and depth of interests is reflected in the undergraduate teaching programs.

The School enjoys excellent international reputation in research with its collaborators in CERN (Switzerland), KEK (Japan), Advanced Photon Source (USA), Argonne Lab (USA), Hubble Telescope (USA), NASA, NIST, National Oakridge Laboratory, Lawrence Berkeley Laboratories, and many top universities in Europe, North America and Asia.

In addition, the School locally collaborates with researchers at other Australian facilities such as Anglo-Australian Telescope, APAC, Austin Hospital, Peter MacCallum Cancer Institute, Parkes Telescope, Australian Synchrotron, Walter & Eliza Hall Institute, Howard Florey Institute, CSIRO as well as laboratory facilities within the University of Melbourne Schools and Departments of Biochemical & Microbiology, Chemistry, Computer Science, Medicine, Pathology and Chemical & Biomolecular Engineering.

The School has an outstanding record of achievement in attracting external research funding including grants from the Australian Research Council (ARC), Australian Academy of Science, Victorian Government and USA government bodies.

The School’s research activities are aligned according to 6 research groups:
- Astrophysics (Astro)
- Experimental Particle Physics (EPP)
- Micro-analytical Research Centre (MARC)
- Optics
- Theoretical Condensed Matter Physics (TCMP)
- Theoretical Particle Physics (TPP)

MISSION STATEMENT

"Providing outstanding innovative teaching and learning, research and research training, and knowledge transfer programs"
HEAD’S REPORT

The annual report of the School of Physics is an important communication between the School, the University and the broader community. We are delighted that you are taking the time to consult it.

The work of an academic department takes many forms but teaching and research are at its heart. In the pages of this report you will find a snap-shot of our research and teaching activities in 2005. In doing so, we celebrate the achievements of our students, including those who have won academic prizes and those who have completed degrees. The report also celebrates the achievements of our staff, including the papers they have published and the research grants they have been awarded. We celebrate the diversity of our staff and students, their interests and backgrounds. We are passionate in our commitment to highest standards in teaching and research in physics.

GROWING ESTEEM & FUTURE DIRECTIONS

Guided by the University of Melbourne’s strategy of Growing Esteem, our community of staff and students continue to contribute strongly in each of the three important elements of a world-class university:

Research – Faculty of Science researchers operate at the highest levels internationally across a breadth of disciplines, contributing to the store of human knowledge, finding applications that benefit society and informing teaching programs which position our students for the international marketplace;

Learning and Teaching – attracting the best and brightest from around Australia and internationally, Science at Melbourne offers a broad range of disciplines to prepare scientists and professionals for the challenges of tomorrow;

Knowledge Transfer – by engaging with industry, schools and our community, locally and around the world, our staff, students and alumni are able to define, analyse and help solve complex issues in science and business.
SCHOOL GOVERNANCE

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

Academic Programs
Jeff McCallum (Chair), Andrew Melatos, Lloyd Hollenberg, Ray Volkas, Andy Martin, Ann Roberts, David Jamieson, Elisabetta Barberio, Helen Conley, Colin Entwisle (Executive Officer),

Finance & Facilities
Geoffrey Taylor (Chair), David Jamieson, Chris Chantler, Rachel Webster, Steven Prawer, Robert Scholten, William Belcher, Russel Walsh, Helen Conley, Marcia Damjanovitch-Napoleon (Executive Officer), Paul Spizziri, Chris Witte (ex officio)

Promotions & Marketing
David Jamieson (Chair), Ann Roberts, Rachel Webster, Roger Rassool, Geoffrey Taylor, Bruce McKellar, Michelle Livett, Elisabetta Barberio, Helen Conley, Joanne Kuluveovski, Cilla Gloger (Executive Officer), Brant Gibson, Nick Stavrios (ex officio)

Research & Industry
Ray Volkas (Chair), Stuart Wyithe, Chris Chantler, Les Allen, Rachel Webster, Keith Nugent, Helen Conley, Joanne Kuluveovski, Cilla Gloger (Executive Officer), Shane Huntington, Shannon Orbons (ex officio)

Safety
Rob Scholten (Chair), Wayne Powrie, Paul Spizziri, Phil Lyons, Steven Prawer, Helen Conley, Mary Fernandes (Executive Officer), Marco La Rosa, Matthew Lay (ex officio)

Policy
Geoffrey Taylor (Chair), Ray Volkas, Rachel Webster, David Jamieson, Steven Prawer, Keith Nugent, Bruce McKellar, Les Allen, Helen Conley (Executive Officer), Sasha Ignatiev, Chris Johnson (ex officio)

School Meeting
Geoffrey Taylor (Chair), all staff, Paul Fraser (ex officio), Joanne Kuluveovski (Executive Officer)

EXECUTIVE MANAGER'S REPORT

The Teaching and Research effort of the School has been well supported again this year by excellent professional staff. Joanne Kuluveovski joined the School as Research and Communication Officer to support the School's research efforts. Kristine Philipp was employed as administrative support to the Head while Julie Warden, formerly with Human Resources at the university, moved across to support the finance team within the School.

Within the IT group, we farewelld Tas Dionisakis and Nick Savvides who both moved onto positions within the university. They are replaced by Kathryn Sparks, Simeon Scott and Linh Vu.

Later in the year, Jude Prezens joined Nick Nicola in the undergraduate laboratories, while Michael Gangoiti moved to the administration team primarily to replace Ms Mary Fernandes on reception.

Building works have included the refurbishment of the professorial offices on Level 7, the development of a teleconference room, the installation of a new chiller in the basement and the commencement of a major upgrade of the Geoff Opat Seminar Room. Level 2 offices were also refurbished to create space for the newly funded QCV group. The IT office area was upgraded to accommodate all the staff in one central area. A new office space has also been created in Level 1, utilizing better the space formerly occupied by the sick bay area.
PROFESSORS

**Head of School**

**Geoffrey 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

**Deputy Head of School**

**Raymond 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: Quantum mechanics

**Federation Fellow**

**Keith Nugent**  
BSc(Hons) Adel, PhD ANU, FAA FAIP  
Research Interests: optics, synchrotron science, x-rays, coherence, quantitative phase imaging, biophysics, protein membrane imaging  
Teaching Interests: n/a

**Bruce McKellar**  
BSc(Hons), PhD Syd, DSc Melb, FAA FInstP FAIP FAPS  
Research Interests: B Physics, neutrinos, CP Violation, quantum chromodynamics, early universe, particle phenomenology, general theoretical physics.  
Teaching Interests: Electromagnetism, Subatomic physics, Quantum mechanics

**David 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, Electromagnetic & Special relativity, Further Classical & Quantum Mechanics

**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: Sensors, Condensed Matter Physics
Rachel 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, astrophysics, special relativity,

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, Computational Physics

Les Allen
BSc(Hons), MSc Port Elizabeth, PhD 5th 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 Chantler
BSc(Hons) UWA, DPhil Oxon

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; Quantum Optics

Lloyd Hollenberg
BSc(Hons) PhD Melb, MAIP

Research Interests: theoretical quantum computing and information, qubit system modelling and control, algorithm, single electron transistor, decoherence of gate operations, quantum error correction

Teaching Interests: Advanced Physics; Stars & Galaxies

Girish Joshi
BSc Agra, MSc Allahabad, PhD Delhi

Research Interests: quaternions, octonions, non-commutative geometry, chaotic maps, gauge theoretic model building, particle phenomenology

Teaching Interests: Quantum Mechanics; Quantum Field Theory; General Relativity

ASSOCIATE PROFESSORS & READERS

Christopher Chantler
BSc(Hons) UWA, DPhil Oxon

Research Interests: X-ray optics, synchrotron, X-ray Absorption Fine Structure, powder diffraction, radiation shielding, atomic physics & quantum electro-dynamics, condensed matter physics

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Teaching Interests: Quantum Mechanics; Quantum Field Theory; General Relativity

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, Computational Physics

Ann Roberts
BSc(Hons) PhD Syd, MAIP

Research Interests: optics, photonics, Nanophotonics, Imaging, Microscopy

Teaching Interests: Biomedical Physics, Standard Physics, Optics

Martin Sevior
BSc(Hons) PhD Melb, FAIP

Research Interests: high energy physics, quarks, anti-matter, Higgs particle, Data Grid

Teaching Interests: Quantum Mechanics; Electrodynamics

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Prof Keith Nugent and Assoc Prof Les Allen
### SENIOR LECTURERS

**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: Principles and Applications of Physics, Particle Physics

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

**Andrew Melatos**  
BSc(Hons) PhD Syd  
Research Interests: neutron stars, gravitational waves, plasma physics, superfluids  
Teaching Interests: 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: Advanced Physics, Quantum Mechanics and Thermal Physics

**Roger 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: Advanced Physics, Standard Physics, Instruments for Scientists, Energy & Environment

### LECTURERS

**Andrew 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, Thermal Physics

**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; Stars & Galaxies

### TUTOR

**James Richmond**  
LLB(Hons) BSc(Hons) Melb
RESEARCH STAFF

Senior Research Fellows
Shane Huntington, BSc(Hons) PhD Melb
Harry Quiney, BSc(Hons) MSc Monash, DPhil Oxon
Paul Spizzirri, BAppSc Swinburne, MSc Melb
Steven Trpkovski, BSc(Hons) PhD VUT

Centenary Fellow
Duncan Galloway, BSc(Hons) PhD Tas

Australian Research Fellow
Chanh Tran, BSc(Hons) BE, PhD Melb

Australian Postdoctoral Fellows
Nicoletta Dragomir, BSc Romania PhD VUT MAIP
Adrian Flitney, BSc(Hons) Tas, PhD Adel
Paolo Olivero, MSc PhD Torino
Patrick Reichart, PhD Munich

Research Fellows
Eric Ampem-Lassen, DipEd BSc MPhil Ghana, PhD Melb
David Barnes, BSc PhD Melb
Markus Bischofberger, BSc PGDip PhD Zurich
Bipin Dhal, BSc MSc MPhil PhD India MAIP
Mark Dijkstra, BSc MSc Groningen, PhD Columbia
Scott Findlay, BSc(Hons) PhD Melb
Robert Foot, BSc(Hons) PhD Melb
Brant Gibson, BE PhD LaTrobe
Andrew Greentree, BSc(Hons) Adel, PhD ANU
Justin Kimpton, BSc(Hons) PhD Swinburne
Marco La Rosa, BSc(Hons) PhD Melb
Adrian Mancuso, BSc(Hons) Melb
Katherine Manson, BSc PhD ANU
Glenn Moloney, BSc(Hons) PhD Melb
Matthew O’Dowd, BSc(Hons) PhD Melb
Christopher Pakes, BSc(Hons) PhD Birmingham
Nicholas Parker, MSci PhD Durham
James Rabeau, BSc Waterloo PhD Heriot-Watt
Sergey Rubanov, MSc Russia, PhD NSW
Elizabeth Trajkov, BSc(Hons) PhD Melb
Randall Wayth, BSc BE PGDip PhD Melb
Cameron Wellard, BSc PhD Melb
Garth Williams, BSc Akron, MS PhD Illinois
Jared Winton, BSc Melb
Lyle Winton, BSc(Hons) PhD Melb
Changyi Yang, BSc MSc PhD Sweden
HONORARY STAFF

Professors Emeritus
Herbert Bolotin, BSc CUNY MSc PhD Indiana DSc, FAIP
David Caro, DSc(Hons) MSc LLB(Hons) Tas, PhD Birm OBE AE FACE FAIP
Anthony George Klein, AM BEE PhD DSc Melb FAA HonFAIP
Colin Arnold Ramm, MSc UWA PhD Birm, FinstP FAIP

Professorial Fellows
Allan Clark, BSc Tas, DPhil Oxon., University of Geneva
Jeremy Mould, BSc(Hons) Melb, PhD ANU, University of Arizona
Colin Norman, BE Melb, DPhil Oxon, The John Hopkins University

Miegunyah Fellow
Professor Sankar Das Sarma
Distinguished University Professor & Director of Condensed Matter Theory Center, University of Maryland, USA

Principal Fellows with the title Associate Professor
Ken Amos, BSc PhD Adel DSc Melb, FAIP
Zwi Barnea, BSc MSc PolytechLNY PhD Melb, MAIP
Les Bursill, BSc DipEd Melb, PhD Monash DSc Melb
Norman Frankel, BSc MIT PhD Melb
James Jury, BSc MSc PhD Tor
Fulvio Melia, BSc(Hons) Melb, PhD MIT
Edmund Muirhead, MSc PhD Melb, MAIP
Alan Spargo, BSc PhD WA, MAIP
Maxwell Thompson, MSc PhD Melb DSc FAIP
Stuart Tovey, BA Canterbury, PhD Bristol, MAIP
John Wignall, BA BSc MSc Melb, PhD Cant

Senior Fellows
Brendan Allman, BSc(Hons) PhD Melb, DipEd Monash, MBA LaTrobe
Valery Gurarie, MSc PhD Moscow
Graeme O’Keefe, BSc PhD Melb
Salvy Russo, BSc Melb, PhD RMIT

Fellows
Igor Andrienko, MSc PhD Russia MRACI
David Bardos, BSc PhD Melb
Vivianne Buzzi, BSc(Hons) PhD Melb PGDipMgmt MBS
Alberto Cimmino, BSc Naples MSc Melb PhD Melb
Mukunda Das, MSc PhD India
Michael Drinkwater, BSc Syd PhD Cant
Matthias Eberspaecher, PhD JLU Gieben DipPhys
Moshie Geso, PhD California
Steven Karataglidis, BSc MSc, AssDipMusic PhD Melb
Victor Kowalenko, BSc PhD Melb
Jasmina Lazendic-Galloway, BA Belgrade BSc(Hons) NSW, PhD US
Victoria Millar, BSc(Hons) DipEd MSc Melb
Andrew Peele, BSc LLB PhD Melb
Andrew Rawlinson, BSc PhD Adel
Emma Ryan-Weber, BSc(Hons) PhD Melb
Meryl Waugh, BSc(Hons) Monash DipEd TTC PhD Melb
Professional Staff

ADMINISTRATION

Ms Helen Conley, BSc Deakin DipEd Monash Adv. Dip Gestalt Psychotherapy
Executive Manager

Mr Russell Walsh, Diploma Electronics RMIT
Finance & Resources Manager

Ms Janet Carlon, MARC administrator

Ms Marcia Damjanovich-Napoleon, BA UWA
Finance Officer

Mr Michael Gangoiti, Diploma Electronics
Reception

Ms Cilla Gloger, NHDip Admin Sth Africa
Administrative Officer

Ms Mary Fernandes
Reception (part-time)

Ms Helga Kendy
Reception (part-time)

Ms Kristine Philipp, BA (Hons) LaTrobe
PA to Head & Administrator

Ms Rhiannon Taylor
Project Officer, QCV

Mrs Julie Warden
Administrative Assistant (Finance)

RESEARCH, COMMUNICATIONS & TEACHING

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

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

Ms Kamala Lekange,
Librarian

Apparatus for the measurement of mechanical equivalent heat, with Eric Hercus and Jack Osborne, 1920
**INFORMATION TECHNOLOGY**

Mr William Belcher, **BElecE**  
Manager, IT services

Mr Tas Dionisakos  
IT Support Officer

Mr Timothy Dyce, **BSc**  
Faculty Systems and IT Administrator

Mr Peter Fuggle  
Systems Network Officer

Mr Nick Savvides  
IT Officer CQCT

Mr Simeon Scott  
IT Support Officer

Ms Kathryn Sparks  
IT Support Officer

Mr Linh Vu, **BComSci Melb**  
Web and Database Administrator

---

**UNDERGRADUATE LABORATORIES**

Mr Nick Nicola, **BAppSc RMIT**  
Laboratory Manager

Mr Steven Damen, **BSc Ballarat**  
Technical Officer

Dr David Hoxley, **BSc (Hons) PhD Melb**  
2nd and 3rd Year Laboratory Coordinator

Mr Philip Lyons  
Technical Officer

Mr Jude Prezens, **BAppSc RMIT**  
Undergraduate Laboratory Assistant

---

**TECHNICAL CENTRE**

Mr Roland Szymanski, **PostgradDip 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 Philip Gargano  
Technical Officer

Mr Stephen Gregory, **BAppSc(Hons), BE Melb**  
Technical Officer

Mr Scott Moncrieff  
Technical Officer EPP

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

Mr Sandor Szilagyi  
Senior Electronics Technician

Mr Michael Zammit, **Certificate Fitter & Turner**  
Technical Officer
The School of Physics encourages international exchanges and visitors to the department, including academics of international standing in their field of study.

**Dr Jenni Adams, BSc(Hons) DPhil Oxon**  
Senior Lecturer, Department of Physics and Astronomy, University of Canterbury, New Zealand

**Mr Andrew Alves, BSc RMIT**  
PhD, School of Applied Science, RMIT, Australia

**Dr David Belton, BSc(Hons) JCU PhD Melb**  
CSIRO Exploration and Mining, School of Geosciences, Monash University, Australia

**Mr Adam Boag**  
PhD, School of Applied Science, RMIT, Australia

**Professor Sankar Das Sarma**  
Distinguished University Professor & Director of Condensed Matter Theory Center, University of Maryland, USA

**Dr Michael Brown, BSc(Hons) MSc PhD Melb**  
Research Associate, Astrophysical Sciences, Princeton University, USA

**Professor Sudhendu Choudhury, BSc MSc PhD Dehli**  
Department of Physics & Astrophysics, University of Delhi

**Mr Jules Cluitmans**  
PhD candidate, Department of Applied Physics, Technical University of Eindhoven
<table>
<thead>
<tr>
<th>Name</th>
<th>Degree(s)</th>
<th>Institution</th>
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<tbody>
<tr>
<td>Mr Martin Draganski</td>
<td>BSc RMIT</td>
<td>PhD, School of Applied Science, RMIT, Australia</td>
</tr>
<tr>
<td>Dr Vladimir Gudkov</td>
<td>MSc PhD Russia</td>
<td>Associate Professor, Department of Physics and Astronomy, University of South Carolina, Columbia</td>
</tr>
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<td>Professor Xiao-Gang He</td>
<td>BSc China MSc PhD Hawaii</td>
<td>Department of Physics, National Taiwan University, Taipei, Taiwan</td>
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<td>Professor Phillip Hemmer</td>
<td>BSc Dayton PhD MIT</td>
<td>Faculty of Electrical and Computer Engineering, Texas A &amp; M University, Texas, USA</td>
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<td>Associate Professor Yanping Huang</td>
<td>BSc MSc PhD China</td>
<td>Physics Department, East China Normal University, Shanghai, China</td>
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<tr>
<td>Professor Rafi Kalish</td>
<td>MSc PhD Israel</td>
<td>Institute of Solid State Physics, Technion, Israel</td>
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<td>Dr Alexander Kalloniatis</td>
<td>BSc(Hons) Tas, PhD Adel</td>
<td>Australian Research Fellow, CSSM, University of Dortmund, Germany</td>
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<td>Professor Yong Kim</td>
<td>BSc MSc PhD Korea</td>
<td>Department of Physics, College of Natural Sciences, Cheju National University, Republic of Korea</td>
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<tr>
<td>Dr Weihua Liu</td>
<td>BEG MEG China PhD Monash</td>
<td>CSIRO Exploration and Mining, School of Geosciences, Monash University, Australia</td>
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<tr>
<td>Dr Gerard Monnom</td>
<td>HDR PhD France</td>
<td>Laboratoire de Physique de la Matiere Condensee, Centre National de la Recherche Scientifique, Univesite de nice-Sohia Antipolis, Nice, France</td>
</tr>
<tr>
<td>Miss Bridget Murphy</td>
<td>BSc(Hons) Monash</td>
<td>PhD candidate, Victorian College of Pharmacy, Monash University, Australia</td>
</tr>
<tr>
<td>Mr Silvio Petrichoni</td>
<td></td>
<td>PhD candidate, Faculty of Physics and Geosciences, Institute for Experimental Physic II, Department of Nuclear Solid State Physics, University of Leipzig, Germany</td>
</tr>
<tr>
<td>Professor Lisa Randall</td>
<td>BA PhD Harvard</td>
<td>Department of Physics, Harvard University, Cambridge, USA</td>
</tr>
<tr>
<td>Dr Werner Richter</td>
<td>BSc(Hons) South Africa, MSc Kansas, PhD South Africa</td>
<td>Physics Department, University of Stellenbosch, Matieland, South Africa</td>
</tr>
<tr>
<td>Professor Joseph Salzman</td>
<td>BSc MSc PhD Israel</td>
<td>School of Electrical Engineering, Technion, Haifa, Israel</td>
</tr>
</tbody>
</table>
Dr Bart Smeets, BSc Belgium, MSc PhD Netherlands
Department of Applied Physics, Eindhoven University of Technology, The Netherlands

Professor Gerard Stephenson Jr, BSc PhD Massachusetts
Department of Physics and Astronomy, University of New Mexico, Albuquerque, USA

Dr Juris Svenne, BSc Canada PhD Massachusetts
Department of Physics and Astronomy, University of Manitoba, Winnipeg, Canada

Dr Jian Yin Sze, BE Singapore
Ion Beam Processing Laboratory, Nanyang Technological University, Singapore

Dr Charles Tahan, BSc Virginia PhD Wisconsin
Cavendish Laboratory, Cambridge, UK

Mr Michael Taylor, BSc RMIT
PhD, School of Applied Science, RMIT, Australia

Mr Rick Van Bijnen, BSc The Netherlands
PhD, Department of Applied Physics, Eindhoven University of Technology, The Netherlands

Dr Zbigniew Was, MSc PhD Poland
The Henryk Niewodniczanski Institute of Nuclear Physics, Krakow, Poland
The School of Physics is proud of its success in competitive research grants gained predominately from the Australian Research Council. The list below represents new and current research funding awarded to the University of Melbourne in 2005 only, unless indicated otherwise.

**AUSTRALIAN ACADEMY OF SCIENCE**

Dr Elisabetta Barberio  
Travel Visit to Europe  
$5000

**AUSTRALIAN INSTITUTE OF NUCLEAR SCIENCE AND ENGINEERING**

Dr Paolo Olivero  
Study of Deuterium Incorporation in Diamond Nanocrystals Embedded in a Fused Quartz Matrix by Means of Secondary Ion Mass Spectroscopy  
$6,208.00

**AUSTRALIAN NUCLEAR SCIENCE & TECHNOLOGY ORGANISATION**

Dr Chanh Tran  
Correlations in a Synchrotron Beam Measured Using Phase Space Tomography  
$10,410.00

**AUSTRALIAN RESEARCH COUNCIL**

Dr Bipin Dhal  
Coherent X-ray Diffraction Imaging of Malaria Affected Blood Cells  
$3,325.00

Dr Garth Williams  
Coherent Diffractive Imaging of Nanostructured Arrays  
$10,410.00

Associate Professor Christopher Chantler  
Associate Professor Les Allen, Dr Chanh Tran, Dr Harry Quiney, Assoc Prof Zwi Barnea  
Synchrotron Developments of New Techniques in X-ray Interactions With Matter, Resolving Major Discrepancies in Quantum Physics and Chemistry  
$146,285

Professor David Jamieson et al  
Foundation Studies of Ion-beam Nanotechnology  
$96,264
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<th>Name</th>
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<td>Professor David Jamieson et al</td>
<td>ARC Centre of Excellence for Quantum Computer Technology (Melbourne node)</td>
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<td>Dr Adrian Flitney</td>
<td>Quantum Decoherence: A Game - Theoretic Perspective</td>
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<td>Dr Shane Huntington</td>
<td>Nano-Engineering of Optical Fibre Fresnel Lenses</td>
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<td>Professor Bruce McKellar</td>
<td>Neutrino Physics: A Window on Physics Beyond the Standard Model</td>
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<td>Dr Andrew Martin</td>
<td>Dynamics of Interacting Bose Gases/Fluids in Atomic and Condensed Matter Systems</td>
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<td>Professor Keith Nugent et al</td>
<td>Advanced X-ray Optical Systems: From Innovative Idea to Intelligent Implementation</td>
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<td>Professor Keith Nugent</td>
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<td>Associate Professor Robert Scholten</td>
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<td>Development in Optical Sciences - Federation Fellowship</td>
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<td>Professor Steven Prawer et al</td>
<td>Diamond Quantum Dots Fabricated by Ion Implantation</td>
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<td>Dr James Rabeau</td>
<td>Diamond Single Photon Source</td>
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<td>Associate Professor Ann Roberts</td>
<td>Innovation in Photonic Device Imaging: The Keystone for Future Technologies</td>
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<td>Micro-characterisation of Rare-Earth-doped Optical Fibres</td>
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<td>Quantum and Classical Imaging With Light and Atoms</td>
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<td>Associate Professor Martin Sevier</td>
<td>The Development of Data Grids For High Energy Physics</td>
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<td>Professor Geoffrey Taylor</td>
<td>High Precision Silicon Pixel Detectors for High Energy Physics, Synchrotron and Medical Imaging Applications</td>
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<td>Professor Raymond Volkas</td>
<td>Particle Physics and Cosmology of Neutrinos</td>
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<td>Associate Professor Lloyd Hollenberg</td>
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<td>Associate Professor Girish Joshi</td>
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<td>In and Beyond the Standard Model of Particle Physics</td>
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<td>Formation and Evolution in the Extragalactic Universe</td>
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<td>Gravitational Lensing Probes of Quasar Structure</td>
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<td>Dr Stuart Wyithe</td>
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<td>The First Objects in the Universe</td>
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<td>The End of the Dark Ages of the Universe</td>
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<td>Dr Chanh Tran</td>
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<td>Associate Professor Christopher Chantler</td>
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<td>Associate Max Thompson</td>
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<td>Dr Roger Rasool</td>
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<td>Outreach Programme</td>
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**DEPARTMENT OF EDUCATION & TRAINING**

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<td>Department of Education &amp; Training - Phase Imaging of Cold Atoms</td>
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**DEPARTMENT OF INNOVATION INDUSTRY & REGIONAL DEVELOPMENT**

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<td>Department of Innovation Industry &amp; Regional Development - Sponsoring Research Higher Degree Stipend - Optics Characterisation Using Quantitative Phase Imaging</td>
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**UNIVERSITY OF MELBOURNE**

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<td>$25,000</td>
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<td>Melbourne Research Grant Scheme</td>
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Associate Professor Chris Chantler
Melbourne Research Grant Scheme
Critical Tests of Quantum Electro-dynamics in Medium-Z-Systems
$25,000

Dr Elisabetta Barberio
Early Career Researchers’ Grant
Understanding the Matter-Antimatter Asymmetry in the Universe
$26,000

Dr Andrew Martin
Early Career Researchers’ Grant
Scattering of Dilute Gas Bose-Einstein Condensates
$19,500

US ARMY RESEARCH OFFICE
Professor Steven Prawer
Quantum Computing in Diamond
$164,041

VIC PARTNERSHIP FOR ADVANCED COMPUTING LTD
Professor Rachel Webster
Australian e-Astronomy and Astrophysics
$75,015

Dr Glenn Moloney
Australian Data Grid for Experimental & Theoretical High Energy Physics
$75,015
School of Physics Colloquia

Prof Sankar Das Sarma, University of Maryland
*Tidbits about qubits: Spin quantum computation in semiconductor nanostructures* (Jan 27)

Joachim Ullrich, Max-Planck-Institut für Kernphysik, Heidelberg, Germany
*The Attosecond Heisenberg-Microscope* (Jan 28)

Prof Helen Quinn, Stanford University
*What is the difference between matter and antimatter in the laws of Physics?* (Feb 28)

Prof Keith Nugent, School of Physics, University of Melbourne
*The Centre of Excellence in Coherent X-ray Science* (Mar 2)

Prof Rafi Kalish, Technion, Haifa, Israel
*Diamond: a new high-tech semiconductor with outstanding properties* (Mar 16)

Dr Michelle Livett, School of Physics, University of Melbourne on behalf of AUTC Physics project
*Key Findings from the National Physics Project on Learning and Teaching* (Apr 6)

Dr Nicole Bell, Kellogg Radiation laboratory, Caltech, USA
*Topics in Particle Physics and Cosmology* (Apr 8)

Dr Damien Easson, Syracuse University, USA
*Cosmology, String Theory and Why We Live in a Three Dimensional Universe* (Apr 8)

Prof Brad Gibson, Swinburne University
*Building a Universe Byte-by-Byte* (Apr 13)
Assoc Prof TC Ralph, ARC CQCT, University of Queensland
Quantum Teleportation: What is it? What is it good for? (May 4)

Prof Dick Manchester, ARC Federation Fellow, Australia Telescope National Facility, CSIRO
Pulsars and Gravity 9 (May 11)

Dr Roland Crocker, Harvard-Smithsonian Center for Astrophysics
Neutrons and Neutrinos from the Center of the Galaxy (May 18)

Prof Robert A Vincent, University of Adelaide
Atmospheric Waves and their impact on the Atmosphere and Climate (May 25)

Prof Rod Tucker, Dept of Electrical and Electronic Engineering, University of Melbourne
Slow Light Optical Buffers for Data Storage (Jul 20)

Prof George Ellis, University of Cape Town, South Africa
Cosmology: Critical View of Cosmology Today (Jul 22)

Prof Klaus H. Ploog, Paul Drude Inst for Solid State Electronics, Germany
Ferromagnet-Semiconductor Nanostructures for Spintronics (Jul 25)

Assoc Prof Vladimir Gudkov, University of South Carolina
Fundamental Neutron Physics at the Spallation Neutron Source (Jul 27)

Dr Brenton Hall, ARC Centre of Excellence for Quantum-Atom Optics, Centre for Atom Optics and Ultrafast Spectroscopy, Swinburne University of Technology
Bose Einstein Condensates in A Permanent Magnetic Film Atom Chip (Aug 3)

Prof Pip Pattison and Dr Garry Robins, Department of Psychology, University of Melbourne
Exponential random graph models for social networks (Aug 10)

Prof Lisa Randall, Harvard University, USA
Localized Gravity (Aug 17)

Dr Leo Brewin, School of Mathematical Sciences, Monash University
Black holes and Numerical General Relativity (Aug 24)

Dr Robert H Frater, VP for Innovation, ResMed Ltd
A journey from industry to industry (Aug 31)

Dr Jenni Adams
Department of Physics and Astronomy, The University of Canterbury, New Zealand
Opening a New Window on the Universe with the IceCube Neutrino Observatory (Sep 7)
Dr Andrew Melatos, School of Physics, University of Melbourne
Superfluids in Neutron Stars (Sept 14)

Prof Bruce McKellar, School of Physics, University of Melbourne
Ethics in research and teaching (Oct 5)

Prof Robert Elliman, Department of Electronic Materials Engineering, RSPhysSE ANU
Light from Silicon – size does matter! (Oct 12)

Dr George Dracoulis , RSPhysSE, Australian National University
Metastable States and Nuclear Spectroscopy (Oct 19)

Prof Howard Wiseman, ARC Centre for Quantum Computer Technology, Griffith University
Einstein and the Prehistory of Quantum Computing (Oct 26)

Prof Michelle Simmons , Federation Fellow, University of New South Wales
Scanning Probe Microscopy for Atomic-scale Device Fabrication (Nov 2)

Prof Ed Hinds, Centre for Cold Matter, Imperial College, London
Atom chips: a vision for quantum information processing (Nov 23)

Seminars - Theory

Dr Shui Yin Lo
Onsager relations, water clusters and infrared imaging system (Feb 18)

Prof Jim Jury, Trent University
2-quark photo-production, on a 9-quark system (Mar 2)

Prof Bruce Barrett, University of Arizona, USA
The Ab Initio No-Core Shell Model And Its Applications (Jul 26)

Assoc Prof Vladimir Gudkov, University of South Carolina
Neutron beta-decay: radiative and recoil corrections and sensitivity to new physics (Aug 2)

Dr Jenni Adams, University of Canterbury, New Zealand
From Gamma Ray Bursts to Light in Ice (Sept 6)

Leanne Duffy, Department of Physics, University of Florida, USA
Yukawa scalar self-mass on a conformally flat background (Dec 16)

Seminars - Optics

Dr Klaus-Dieter Liss, Bragg Institute, ANSTO, Lucas Heights Science and Technology Centre, NSW
High-Energy Synchrotron Radiation: A Unique Tool For Bulk Investigations Of Crystalline Materials (Feb 18)
Mr Thijs Meijer, University of Melbourne, and Eindhoven University, The Netherlands
Electromagnetically induced transparency (EIT) and lasing without population inversion (Apr 27)

Dr Matthew Sellars, Laser Physics Centre, RSPhysSE, ANU
Quantum computing with rare-earth ions (Jun 2)

Dr Arturo Lezama, Institute of Physics, Universidad de la República, Uruguay
Coherence effects in “slow” and “fast” light atomic media (Jun 17)

Dr Bart Smeets, Eindhoven University of Technology, The Netherlands
Atom lithography of Fe (22-Jun)

Ruben Dilanian, Department of Physics, Monash University
Image reconstruction from X-Ray diffraction data (Oct 19)

Prof Wolfgang Treimer, Technische Fachhochschule, - Berlin, University of Applied Sciences, Germany
Advances in Neutron Tomography (Dec 14)

Seminars - Astrophysics

Dr Paul Francis, Australian Gemini Project Scientist, Australia National University
Gemini Telescopes Update (Mar 9)

Dr Matthew Baring, Rice University
Gamma-Ray Bursts and Cosmic Rays: Implications from Shock Acceleration Theory (Mar 16)

Dr Jamie Stevens, School of Physics, University of Melbourne
What do loose groups tell us about galaxy formation? (Apr 5)

Dr Scott Croom, Anglo-Australian Observatory
The Evolution of Super-Massive Black Holes (Jun 2)

Dr Doug Johnstone, Herzberg Institute of Astrophysics, Canada (Jul 22)

Dr Chris Tinney, Anglo-Australian Observatory & ARC College of Experts
Proposal Writing for Fun and Profit ...and a Career (Aug 19)

Prof Jeremy Mould, National Optical Astronomy Observatory, USA
The distance to the radiogalaxy Centaurus A and the Thirty Meter Telescope (Sep 5)

Dr Andre Fletcher, Shanghai Astronomical Observatory
Radio-loud AGN Surveys, Black Hole Magnetosphere Theories, and Sgr A* Variability (Oct 24)

Seminars – Experimental Particle Physics

Dr Zbigniew Was, Institute of Nuclear Physics PAN Krakow, Poland
Photos as a pocket Parton Shower - and recent developments (Jul 7)
DOCTOR OF PHILOSOPHY

Ang, Joo Chew
Quantum computing

Aruldoss, Celine K
Novel methods for the determination of the coherence properties of classical fields

Atkinson, Tom ME
Studies in high energy physics at the Atlas experiment.

Bellair, Catherine J
Quantitative phase microscopy: performing measurements of the refractive index and volume of cells

Carson, Ben J
The phenomenology of higher dimensional physics.

Cole, Jared H
Theoretical and computational investigation of a type-II quantum computer

Colton, Imogen
Propagation-based phase imaging of Bose-Einstein condensates

Conrad, Vincent
Readout for solid state quantum computer

Coulthurst, Andrew
The phenomenology of the physics of extra dimensions

Crosby, Sean C
New directions in ghost imaging

Dalseno, Jeremy P
Using $B^+D^{*+}D^{*}K_s$ to measure $\cos 2\varphi$

Demaria, Alison
Extensions of standard model

Devitt, Simon J
Quantum algorithm development

Doukas, Jason A
Higher dimensional physics

Dusza, Andrew
Physics of higher dimension

Filewood, Gregory
A theoretical study of the dark sector of nature
Gassull, Daniel
Materials issues in quantum computing

Flewett, Samuel
Experimental investigations in wavefield recovery

Fraser, Paul R
A multi-channel algebraic scattering theory and predictions of low energy nucleon-nucleus reaction cross sections

George, Damien P
Higher dimensional membrane world models

Hopf, Toby F
Single ion implantation for construction of a quantum computer

Kandasamy, Gajendran
Quantum computation

Kazi, Sandor I
Studies in high energy physics.

Kil, Il Joong
Studies in high energy physics

Kinnane, Mark N
Fundamental and applied investigations in X-ray optics.

Greig-Lau, Deborah
Raman analysis of artists’ pigments and media

Law, Sandy SC
Particle physics and cosmology in the brane world

Lay, Matthew
Defect studies of ion implanted silicon and silicon-dioxide for next-generation electronic devices

Low, Catherine I
Lepton family symmetries and the Quartification grand unified theory

Lydon, Jennifer M
Monte Carlo characterisation of narrow photon fields for intensity modulated radiotherapy

McFadden, Rebecca A
Advanced algorithms for the detection of the EOR signal

Melchiori, Adrian G
A low frequency imaging telescope

McDonald, Kristian L
Neutrino Mass Matrices

Orbons, Shannon M
Fabrication of photonic structures using ion implantation

Peralta, Carlos
Superfluidity in neutron stars

Rae, Nicholas
Absolute measurement of XAFS and atomic form factors

Scott, Rebecca J
Precise half-life measurement of the fermi superallowed $B^+$ decay of $^{26}$m $^{11}$A

Sidiroglou, Fotios
Microscopic characterisation of high power fibre laser

Smale, Lucas F
X-ray absorption fine structure

Sobott, Bryn A
An innovative pixel detector for x-rays

Srbinovsky, Jhan A
Ionized bubbles at the end of cosmic reionization

Stavrias, Nikolas
Measurement of wavefunction overlap of phosphorous donors in silicon

Starling, Timothy R
Solid state quantum computing

Takau, Viliami T
A measurement of the near-threshold cross section on proton
Testolin, Matthew J
Quantum computation and device modelling

Phillip Urquijo
Semileptonic decays in Belle

Villis, Byron J
A defect study of MOS devices

Vigelius, Matthias
Compact objects as sources and detectors of gravity waves

Wong, Ivy O
Neutral hydrogen in galaxy cluster environment

Wedd, Robin H
Investigation of B meson decay

Witte, Chris
Atomic resolution imaging and spectroscopy

MASTERS DEGREE BY RESEARCH

Cosgriff, EC
Theory and computations of atomic-cluster wave functions for x-ray absorption near-edge structure

Henderson, Clare A
Unique phase recovery from light fields carrying screw dislocations

Johnston, Chris
Quasar stromgen spheres

Kidwani, Nader M
Breaking of CP and CPT symmetries

Martini, Berin
The effect of surface reconstruction on the growth of aluminium nitride by Pulsed Laser Depositions

Mastrano, Alpha
Superfluid instabilities and pulsar glitches

Meehan, Alistair J
Optic characterisation using quantitative phase imaging

Pyke, Daniel J
Phase separation of hydrogen in amorphous silicon

Stenborg, Travis N
Planetary lagrange point dynamics

Singh, Swati
The faint quasar luminosity function

Tse, Yun Fai
Search for direct CP violation in B-PII delays
We congratulate the following students who completed theses.

**POSTGRADUATE THESES**

**Culpepper, Joanne**
*A PET detector module using silicon photodiode arrays*
Masters Degree by Research, 17 August 2005

**Dowd, Rohan T**
*Search for $B \rightarrow \rho \rho$ and $B \rightarrow K^* \rho$ decays at Belle*
Doctor of Philosophy, 5 September 2005

**Findlay, Scott D**
*Theoretical aspects of scanning transmission electron microscopy*
Doctor of Philosophy, 26 August 2005

**Fowler, Austin G**
*Towards large-scale quantum computation*
Doctor of Philosophy, 17 May 2005

**Karick, Arna M**
*Galaxy formation and destruction in the fornax cluster*
Doctor of Philosophy, 2 November 2005

**Lin, John Jia An**
*Spatial coherence measurement of undulator radiation using uniformly redundant arrays.*
Doctor of Philosophy, 18 April 2005

**McCaw, James M**
*Quantum chaos: spectral analysis of floquet operators*
Doctor of Philosophy, 22 April 2005

**Michna, Magda L**
*Novel imaging techniques using the transport of intensity equation*
Doctor of Philosophy, 23 August 2005

**Payne, Donald JB**
*Magnetic field evolution in accreting neutron stars*
Doctor of Philosophy, 14 June 2005

**Stevens, Jamie B**
*Neutral hydrogen in nearby galaxy groups*
Doctor of Philosophy, 23 June 2005

**Trott, Cathy M**
*Structure of dark matter in galaxies*
Doctor of Philosophy, 6 June 2005
Turner, Lincoln D

Holographic imaging of cold atoms

Doctor of Philosophy, 1 March 2005

Wayth, Randall B

The structure of galaxies and AGN using gravitational lensing

Doctor of Philosophy, 6 June 2005

De Jonge, Martin D

High-accuracy measurements of the x-ray mass attenuation coefficients of molybdenum and tin: testing theories of photoabsorption

Doctor of Philosophy, 3 October 2005

O’Leary, Nicole L

Structure retrieval at atomic resolution using electrons

Doctor of Philosophy, 14 November 2005

Otsuka, Paul H

Analysis of thermal shock and implantation-induced processes in ceramic crystals

Doctor of Philosophy, 26 October 2005

Pace, Peter

Characterisation of optical fibres based on high resolution imaging

Masters Degree by Research, 22 June 2005

HONOURS PROJECTS

Moritz Backes

Semianalytical approach for electromagnetic showers in sampling calorimeters

Supervisor: Dr Elisabetta Barberio

Nicholas Bate

Microimaging quasars

Supervisor: Professor Rachel Webster

Simon Bell

Four-wave mixing in a rubidium vapour cell

Supervisor: Associate Professor Robert Scholten

Jay Bourke

Finite difference method calculations of x-ray absorption fine structure

Supervisor: Associate Professor Chris Chantler

Christine Chung

Time dependent accretion in compact objects

Supervisor: Professor Rachel Webster

David Curtin

Fermion confinement in brane world models with SO(10) unification

Supervisor: Professor Ray Volkas

Nadia Davidson

Looking for SUSY dark matter with ATLAS

Supervisor: Dr Elisabetta Barberio

Zac Evans

Analysis of \( B \to K \Pi \) and \( B \to \Pi \Pi \) decays with flavour SU(3) symmetry

Supervisor: Professor Bruce McKellar

Jack Glover

Experimental and theoretical investigation of the S-ray mass attenuation coefficient of gold: testing theories of photoabsorption, XAFS & XANES

Supervisor: Associate Professor Chris Chantler

Xiao Ming Goh

Tomographic reconstruction of asymmetrical optical fibres and microspheres

Supervisor: Associate Professor Ann Roberts
<table>
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<tr>
<th>Name</th>
<th>Title</th>
<th>Supervisor</th>
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<tbody>
<tr>
<td>Christoph Hofmann</td>
<td>Diffraction contrast imaging of Ultra cold 85Rb atoms</td>
<td>Associate Professor Robert Scholten</td>
</tr>
<tr>
<td>Sally Langford</td>
<td>Earth: a prototype extra-solar planet</td>
<td>Dr Stuart Wyithe</td>
</tr>
<tr>
<td>Jiufu Lim</td>
<td>Diffraction of TNC-based explosives detection</td>
<td>Dr Roger Rassool</td>
</tr>
<tr>
<td>Nils Lippock</td>
<td>Investigation of MOS-devices using deep-level-transient-spectroscopy</td>
<td>Dr Jeff McCallum</td>
</tr>
<tr>
<td>Anthony Morley</td>
<td>Capacitive coupling fault identification and reduction in ATLAS silicon detectors</td>
<td>Professor Geoffrey Taylor</td>
</tr>
<tr>
<td>Andre Petersen</td>
<td>A generalisation of the nonlinear many body dynamics of a double delta-kicked quantum rotator using Bose-Einstein condensation</td>
<td>Dr Andrew Martin</td>
</tr>
<tr>
<td>Nitin Rughoonauth</td>
<td>Constraining cosmic reionisation at Z ~ 6</td>
<td>Dr Stuart Wyithe</td>
</tr>
<tr>
<td>Ashley Stephens</td>
<td>Threshold and crossover in the implementation of quantum error correction</td>
<td>Assoc Prof Lloyd Hollenberg</td>
</tr>
<tr>
<td>Andre Trosky</td>
<td>Pulsar glitches and self-organised criticality</td>
<td>Dr Andrew Melatos</td>
</tr>
<tr>
<td>Lachlan Whitehead</td>
<td>Optical phase imaging from a single far-field intensity measurement</td>
<td>Professor Keith Nugent</td>
</tr>
</tbody>
</table>
The Astrophysics group has continued its strong research program and its commitment to a successful research training program.

Dr Stuart Wyithe was appointed to the new faculty position in the group in 2004. He has continued his research collaboration with Professor Avi Loeb at Harvard, working on the Epoch of Reionisation and the formation and evolution of supermassive black holes. During 2005, Stuart has started supervising his first PhD student, Jhan Srbinovsky, working on the Epoch of Reionisation.

Dr Andrew Melatos has further developed his models of gravitational radiation from accreting neutron stars, with promising predictions for the possibilities of detecting this radiation with the current generation of long baseline interferometers such as LIGO. In addition, Dr Melatos published the results of his Gemini observations of the Crab pulsar wind nebula. His collaboration with PhD student Peralta and Dr Andrew Ooi’s group in Mechanical Engineering at Melbourne yielded new results in superfluid hydrodynamics, with laboratory applications.

Dr David Barnes resigned to follow his passion of photography. Dr Barnes has made a substantial contribution to the development of the Australian Virtual Observatory, www.ausvo.org, and also to the ongoing analysis of the HIPASS dataset.

Professor Rachel Webster continued her work on the microlensing of lensed quasars, a project which will develop new techniques to measure the sizes of quasar emission regions. This program was supported by a large allocation of Gemini time. Professor Webster was the inaugural Caroline Herschel Distinguished Lecturer at the Space telescope Science Institute in June 2005.

During 2005, the Melbourne group worked with collaborators at MIT and Harvard to deploy 3 tiles at Mileura Station in WA. This project was managed by David Barnes, who was assisted by Jamie Stevens, Randall Wayth and Chris Johnston. The deployment was spectacularly successful, with at least two publishable results from the first datasets.

Five PhDs were awarded in the group in 2005: Drs Donald Payne, Cathy Trott, Randall Wayth, Arna Karick and Jamie Stevens. In addition, PhD student Ivy Wong spent a year working at Johns Hopkins University in Baltimore, with Dr Gerhardt Meurer, and PhD student Matthias Vigelius spent two months at Harvard, working with Prof Bryan Gaensler. Research Fellows Neil Killeen and Mark Dijkstra also joined the Astro group.
Publications for 2005 include:


In 2005 Roger Rassool became the 4th academic member of the EPP group, following the closure of the Photonuclear Group within the School. We’ve benefited greatly from Roger’s contributions in the areas of detector physics and his links with external organizations such as the Australian Synchrotron and the Austin Hospital. In addition 2005 saw Markus Bischofberger (Atlas analysis) and Marco La Rosa (grid development) join us as postdoctoral fellows and Jared Winton was hired as an engineer for Silicon Detector development.

The group’s activities focused mostly on the Belle experiment currently collecting data at the KEK laboratory in Japan and the ATLAS experiment, under construction at the CERN lab in Geneva, Switzerland. We continued to lead the Australian deployment of computational GRID technology within Australia and initiated the collaboration with the PSI lab in Switzerland for the development of pixel detectors for Synchrotron radiation science.

At Belle we study CP violation (the difference between matter and anti-matter), rare decays sensitive to Physics beyond the Standard Model, and make precision measurements of the CKM parameters Vcb and Vub. For the ATLAS experiment we have constructed detector modules for the Silicon Central Tracker (SCT), developed power supplies for the SCT, and have designed and constructed 4200 in-line filter and voltage limited systems. These have been mounted in 13 large electronics racks directly beside the ATLAS detector in the main cavern. In addition to these hardware contributions we are developing software to significantly speedup detector simulation and have designed algorithms for the reconstruction of electrons which have a complex trajectory in the ATLAS detector.

When ATLAS begins operation in 2007 it will produce roughly 15 million gigabytes of data per year, equivalent to 3 million DVDs or 1% of the total global digital information output. The Worldwide LHC Computing grid (WLCG) is a massive, distributed, international computing infrastructure designed to enable analysis of this enormous data set. It coordinates and shares processing power, data, applications and network resources from many thousands of linked computers. The EPP group has played a leading role in the development of grid and has deployed a grid infrastructure across 300 computers at 5 facilities in Sydney, Canberra, Melbourne and Adelaide. In 2005 this grid was used to simulate complex particle collisions in the Belle experiment and to participate in ATLAS data challenges.

We are looking forward with eagerness to the commencement of ATLAS data taking scheduled for late 2007. We have worked for many years to build up the hardware, software and data analysis skills needed to explore the data obtained at this frontier experiment. The ATLAS experiment will explore the nature of Electroweak Symmetry Breaking at an energy regime almost guaranteed to discover new physics.

Publications for 2005 include:


Xie QL, .. Sevior ME, ..Urquijo P, ..Barberio LME..,”Observation of B → J/ψΣ0 and B0 → J/ψρ0 decays” *Physical Review D* 72(5):11051-11056 (2005)

Abe K, .. Sevior ME.,”Improved measurement of CP-violation parameters sin 2ϕ1 and /l/, B meson lifetimes, and B0 - antiB0 mixing parameters” *Physical Review D* 71(7):20031-200312 (2005)
Chang M-C, .. Moloney GR, .. Sevior ME, .. Taylor GN, .. Urquijo P., “Search for $B^0 \rightarrow \rho \rho$, $B^0 \rightarrow \Lambda \Lambda$, and $B^+ \rightarrow \rho \Lambda$ at Belle” Physical Review D 71(7):20071-20075 (2005)


Saigo M, .. Sevior ME, .. “Study of the suppressed decays $B^- \rightarrow [K^+ \pi^-]D\pi^-$ and $B^- \rightarrow [K^+ \pi^-]D\pi^-$” Physical Review Letters 94(9):16011-16016 (2005)

Wang CC, .. Sevior ME, .. Taylor GN., “$B^0 \rightarrow \rho$ nullplusmn $\pi$ plusmn time-dependent CP violation at Belle” Physical Review Letters 94(12):18011-18016 (2005)


Li J, .. Sevior ME, .. Taylor GN., “Search for $D^0$-anti $D^0$ mixing in $D^0 \rightarrow K^+\pi^-$ decays and measurement of the doubly-cabibbo-suppressed decay rate” Physical Review Letters 94(7):18011-18015 (2005)


Over the past twelve months the Melbourne node has been deeply involved in the production of counted atom devices, especially the routine production of two atom devices for the charge qubit experiments. With the advent of exciting experimental data on some of these devices, the device modelling program has also been deeply involved in the interpretation of this data. All this work has proceeded in close collaboration with the other nodes of the Centre.

The production of counted atom devices depends on ion implantation using on-chip integrated detectors. This process underwent further optimization in 2005 to improve reproducibility and reliability. A particular challenge was to make the integrated detector structure compatible with subsequent fabrication of increasingly sophisticated and complex nanocircuitry for control and readout of the charge configuration of the device. We developed a strategy using buried heavily doped wells set back more than six microns from the implant sites leading to electrical contacts that are more than 500 microns further back. This keeps the construction site free from metal contamination. In 2005, more than 25 devices were fabricated with the new detector structures and some of these were employed in completed devices that went through to measurement. The highlights of these measurements are presented in the report from the New South Wales node. Given the very promising data being obtained on these devices we anticipate further developments within the Ion Beam Program, in close collaboration with the Integrated Quantum Computer Device Program, of the single ion implantation system with the view to perform the implantation at lower energies in conjunction with a thinner surface oxide to improve the lateral precision.

The issue of how phosphorus implanted into silicon at the very low concentrations needed for quantum computer devices was addressed in detail by the Materials Program. In collaboration with Dr Wayne Hutchinson of ADFA, electrically detected magnetic resonance was observed for the first time in an ion implanted device. This allowed us to check that the implanted phosphorus was electrically active and this work was complemented with our in-house deep level transient spectroscopy system that allowed us to measure the density of electron traps at the interface between the gate oxide and the silicon substrate. This is a critical issue for Si:P architectures. The problem of dopant activation was addressed in the Atomic Level Manipulation and Imaging Program where highly sensitive Scanning Kelvin Microscopy images were taken of the buried charge created by both P and Si implanted silicon. The Si control implants yielded signals below the noise level which itself approximates to the signal that would arise from an array of charge traps spaced by approximately 70 nm, which exceeds the typical inter-qubit spacing utilised in qubit test devices showing implantation damage has been repaired. The issue of the activation of extremely low concentrations of implanted phosphorus ions remains open but we hope to resolve this issue in 2006 once a suitably sensitive alternative analysis method is developed. However the Hybrid Optical Solid-State Program provided extraordinarily sensitive measurement on ensembles of as few as 104 single P donors and pairs of P donors. These measurements provide information on the Heisenberg exchange constant, J, which is an indication of the wavefunction overlap between donor pairs.

The exciting results from the Quantum Measurement Program showing controlled single charge quantum transfer has spurred the more detailed modelling of the charge transfer process which has greatly assisted with data interpretation. A particular challenge has been the modelling of charge transfer in a counted four atom device. The results from the modelling are consistent with all four atoms being active as donors and that microwave induced charge transfer events were possible under a narrow set of configurations of the device – consistent with the experimental data. The Device Modelling Program team also reached several important milestones with the development of architectures for the transport of single electrons in a process described as Coherent Transport by Adiabatic Passage (CTAP). This allows separation of qubit interaction zones from readout zones in a two dimensional multi-qubit device. The Device Modelling Program also keeps watch on developments in quantum computing schemes that complement the Si:P system. Some schemes, such as those that involve N-V centres in diamond, have the potential to provide single photon sources or strongly coupled light-matter...
interactions when fabricated into quasi periodic photonic band gap cavities which may be useful in the readout of Si:P qubits. Much of the work in the Device Modeling Program was given a tremendous boost from the two visits of Prof Sankar Das Sarma, University of Maryland, in February and October of 2005. Prof Das Sarma also gave a major public lecture during his October visit which attracted over 400 people to hear about his vision of quantum mechanics in future technology.

Staff, postdocs and students were in high demand in 2005 for lectures at scientific conferences but were also keen participants in the vast range of activities that took place in 2005 to mark the UN-declared International Year of Physics. We were involved in more than 30 events which often featured the work of the Centre presented to large and enthusiastic audiences of the general public. For 2006 we look forward with keen anticipation to the realization of Si:P qubits.

Publications for 2005 include:


McCamery DR, Francis M, McCallum JC, Hamilton AR, Greentree AD & Clark RG, “Donor activation and damage in Si-SiO2 from low-dose, low-energy ion implantation studied via electrical transport in MOSFETs” Semiconductor Science and Technology 20:363-368 (2005)


United States of America: SPIE - The International Society for Optical Engineering (2005)


Lay M, Pakes CI & McCallum JC, “Kelvin-probe force microscopy defect study of ion implanted thermal oxide thin films on silicon” In AD Rakic & YT Yeow (eds), 2004 Conference on Optoelectronic and microelectronic materials and devices. 405-408. Piscataway, United States of America: IEEE - Institute of Electrical and Electronic Engineers (2005)


Research Highlights

In an often-crowded and vibrant atom optics lab, Assoc Prof Robert Scholten and his team continued their work on novel approaches to imaging cold atoms, developing a minimally destructive, quantitative, yet experimentally practical method. The insight of PhD student Lincoln Turner led to an elegant approach, in which the diffraction pattern of cold atoms illuminated by an off-resonant laser beam is computationally inverted to provide an image of the atoms. The technique offers great promise as an easy yet precise method of phase imaging, for both cold atoms and for some applications of x-ray imaging. Lincoln left the group mid-year, with a Fulbright Fellowship to work with Nobel Laureate Bill Phillips at NIST, Washington DC.

The lab also demonstrated a blue laser based on establishment of a coherent quantum superposition of atomic states. Energy was converted with unprecedented efficiency, to generate a coherent blue beam – like a laser, but without mirrors. The work was published on the front cover of the Australian Optical Society News in March, and in Optics Letters.

The coherent x-ray group published a total of 12 refereed papers, including some work on a new approach to coherent imaging, and two papers on the work of Benedicta Ahartari on phase-contrast radiography. In particular, its work on diffractive imaging with curved wavefields is grabbing international attention.

In October A/Prof Roberts presented a paper on one aspect of this research at the Optical Society of America Annual Meeting in Tucson. She also visited Singapore and, with PhD student Nicole Tse, obtained the first in-situ Electronic Speckle Pattern Interferometry images of canvas paintings in the Singapore Art Museum. While in Singapore, she gave seminars at the National Heritage Centre and the National University of Singapore and also visited the Singapore Synchrotron Light Source and the Centre for Ion Beam Applications.

The precision x-ray optics team continues its work on pinning down physical constants to unprecedented resolution and published a number of very high quality publications in this area. The group was heavily involved in the international X-ray and Inner Shell Processes Conference held in Melbourne (X05, 4-8 July 2005). Assoc Prof Chris Chantler was Scientific Chair and Editor of the refereed proceedings. Group members continue to be invited to present at conferences around the world.

Grants

A collaboration led by Keith Nugent was successful in being awarded ARC, University and Victorian State Government funding to establish the Centre of Excellence for Coherent X-ray Science. The Centre is a major coup for the School of Physics, bringing together outstanding research groups from the Schools of Physics and of Chemistry, the Australian Synchrotron, CSIRO, Latrobe, Monash and Swinburne Universities, and a number of prestigious international partners.

Robert Scholten and Ann Roberts were successful in receiving an ARC Discovery Project grant, ‘Quantum and classical imaging with light and atoms’ to extend our innovative research in physical optics to quantum optics.

Students and Visitors

In 2005, the atom optics group enjoyed the year-long sabbatical of A/Prof Jamie White from Juniata College in the USA, and long stays by several visiting PhD students from The Netherlands including Thijs Meiijer, Kenian Domen, and Bart Smeets, through our collaboration with the quantum-atom-optics group at Eindhoven University.

Martin de Jonge completed his PhD ‘with distinction’ (top 5% of all PhDs) according to the examiner, who wrote ‘these careful measurements will continue to serve as THE yardstick for measuring the performance of future theories for a long time.’ Well done, Martin.

Adrian Mancuso completed his PhD and commenced work with Quantum Communications Victoria, housed within the School. Former student, Magda Michna, now at McGill University in Canada, was awarded her PhD in December and Peter Pace (now at Victoria University) received his MSc in August.
Publications for 2005 include:


Research carried out within the TCMP group in 2005 can be classified into two general areas: Imaging of condensed matter systems and the dynamics of dilute gas BECs. The research carried out has resulted in a total of nine publications (three in the prestigious Physical Review Letters, the flagship journal of the American Physical Society and one in Applied Physics Letters). The academic staff in the group, Assoc Prof Les Allen and Dr Andy Martin each delivered three invited contributions at international conferences. The software IWFR, used for phase imaging at atomic resolution in electron microscopy, developed in the Allen subgroup, was successfully commercialized in conjunction with the Japanese company HREM Inc.

The group was funded by two Australian Research Council (ARC) Discovery Project (DP) grants and one Melbourne Early Career Researcher (ECR) grant, worth $164,500 in 2005. The DP grants have enabled the appointment of two postdoctoral research fellows in the group, namely Dr Scott Findlay and Dr Nicholas Parker. The ECR grant has established computer facilities and provided travel money for Dr A M Martin's subgroup.

Strong international collaborations have been a feature of the research done. Link are in place with the Oak Ridge National Laboratory, The SuperSTEM Facility at Daresbury, Trinity College Dublin, Nottingham University, Imperial College London, The University of Otago, The Massachusetts Institute of Technology (with the group of Nobel Prize winner Prof W Ketterle) and the University of Durham.

Publications for 2005 include:


- Canton L, Pisent G, Svenne JP, Van Der Knijff DJJ, Amos KA & Karataglidis S, “Role of the


Theoretical particle physics group continues to thrive as it manages generational change of its permanent academic staff.

After almost thirty-five years of dedicated service to the School of Physics, Dr Girish Joshi retired from teaching and administration at the end of 2005. He remains active in research, continues to supervise PhD students and holds a joint ARC Discovery Project grant for 2006-2008 with Bruce McKellar and Ray Volkas. It is appropriate to reflect on Girish's long career, which has seen him publish almost 200 papers and supervise more than a dozen PhD students. Research Fellow, Dr Alexandre Ignatiev also left the group. We welcome Dr Adrian Flitney who was awarded Australian Postdoctoral Fellow. Dr Nicole Bell will join us on 1 January 2007 as a new continuing Lecturer in theoretical particle physics. After completing her PhD at Melbourne with Ray Volkas, she was a postdoc at the influential theoretical astrophysics group at Fermilab for three years, and is presently a Sherman Fairchild Scholar at Caltech. She has won numerous awards, and has written several very influential papers in particle cosmology and astrophysics as well as in straight theoretical particle physics.

The Head of the TPP group, Professor Bruce McKellar, shall effectively retire from teaching and administration at the end of 2006. During 2006, we shall run a search for a second continuing lectureship to fill his shoes (very large shoes to fill!). So, from 2007 we anticipate having a new-look group under the leadership of Ray Volkas, with Bruce and Girish continuing to be very active in research as honorary staff.

In 2005, the TPP group had 13 PhD and Masters students active in theoretical particle physics research, and two research fellows. The currently active research fields cover physics beyond the standard model, including brane-worlds, extra-dimensions and gravity, as well as particle cosmology and high-energy astrophysics. Particle physics worldwide has for some time been broadening into a cross-disciplinary effort involving our friends the astrophysicists and cosmologists, and the TPP group's research efforts exemplify this trend. We are also keenly awaiting the Large Hadron Collider, and looking to enhance our already strong links with the experimental particle physics group.

Group member Associate Professor Lloyd Hollenberg continues to lead Melbourne's theory effort within the ARC Centre of Excellence for Quantum Computing Technology, supervising a large number of research students and two postdocs. Good progress has been made in their efforts to construct a solid state quantum computer, a project to be described in more detail elsewhere in this annual report.

Selected publications for 2005 include:


Low CI, “Abelian family symmetries and the simplest models that give $\Phi_{13} = 0$ in the neutrino mixing matrix” *Physical Review D* 71(7):30071-300713 (2005)


QCV was established within the School of Physics in July 2005. QCV is funded by a State Government of Victoria Science, Technology and Innovation (STI) grant in addition to support from the Faculty of Science. QCV is an Unincorporated Joint Venture between The University of Melbourne, MagiQ Technologies (New York and Boston), Qucor Pty Ltd and Silicon Graphics Inc. The program has three major milestones to meet over the course of the next three years:

* Development of a prototype single photon source based on diamond
* Enhance the communications abilities of our research staff and offer similar services to external clients
* Engage industry to determine their interest in Quantum Communications and their possible involvement

The first 6 months of the program have been dedicated to corporate branding and establishing the QCV team, including new staff Dr Elizabeth Trajkov, Materials Engineer; Dr Steven Trpkovski, Photonics Prototype Development Engineer; and Mr Hugh Wilson, Research Fellow, all arriving in 2005.

To date this process has been highly successful with the establishment of the QCV office on Level 2. The majority of the staff positions for the program have now been filled with a variety of research, commercial and administrative staff. The team has also successfully submitted to Government the Commercial, Marketing, Technical, and Industry Engagement Plans for the next 3 years.

Initial discussions for the formation of a QCV corporate entity have also been initiated in order to capitalise on investor interest in the program. This strategic plan will enable the continuation of the QCV program well beyond the end of the State Government funding period.

The QCV is directed by an Executive Board consisting of members from each of the Joint Venture Partner organisations. In addition, a prestigious Industry Advisory Group has been established to provide expert advice on a range of commercial topics.

A key challenge for a commercially driven program such as the QCV is to demonstrate value to the School of Physics with regards to the traditional areas of teaching and research. To this end the program is proud to support numerous research programs through the acquisition of equipment, staff resources, collaborations, and the provision of student scholarships. Members of the QCV have been encouraged to engage in teaching and have strong involvement in the school’s outreach programs.

The QCV program is providing an opportunity for a crossover between a variety of sectors. Collectively, the team represents all of the sectors involved in commercialisation. It is my strong feeling that the existence of this program within the school will greatly benefit our traditional research and teaching programs in addition to meeting the new demands for knowledge transfer being placed upon us all.
Publications for 2005 include:


Dower PM, Farrell PM & Gibson BC, “A numerical optimal control approach to the design of an optical fibre-based evanescent field” In P Horacek & M Simandl (eds), *16th IFAC World Congress 2005*. 1-6. Laxemburg, Austria: International Federation of Automatic Control
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.

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 School's 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 organises a focus day for senior postgraduate students to assist with the transition out of postgraduate study. The School also 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.

Each of the above activities was undertaken during 2005. In 2006, we have already had our induction day, attended by more than 20 new postgraduates. Additionally we will continue to run the Senior Focus day and Research exhibitions. As a new initiative in 2006, the School will expand the postgraduate seminar series to include a full colloquium by final year students, describing the work presented in their thesis. This final colloquium will provide the opportunity for the School to celebrate the achievements of postgraduate students.
PAUL FRASER (PPSS President)

The Postgraduate Physics Student Society (PPSS) is an association of which each postgraduate degree student is automatically a member. It is affiliated with the University of Melbourne Postgraduate Association, which formally provides funding for the range of activities the PPSS undertakes, though the School of Physics significantly supports the PPSS both financially and logistically.

The purposes of the PPSS are to enhance the academic and professional life of its members, encourage social interaction of students within the School, to co-ordinate representation of School of Physics Postgraduate students on School committees and to represent School of Physics Postgraduate Students to the Science Faculty and University.

In 2005, these goals were achieved by running traditionally well received social events such as barbecues and a trivia night, as well as the new addition of a pool competition. On the more formal side, student attendance at the various School committee meetings was high, indicating the enthusiasm of postgraduate students to participate in the running of School and the business of the University that affects the School. Additionally, the PPSS creates leadership positions for its members, enhancing skills prior to entering formal employment.

In 2006 the PPSS aim to continue fulfilling these duties, and with the enthusiastic group of volunteers in office bearer roles and on committees, the coming years should be quite productive.

For more information, visit the PPSS website at http://www.ph.unimelb.edu.au/pgss/
Prizes & Awards

**UNDERGRADUATE**

**Bryan Scholarship in Natural Science**
Selection Criteria: Awarded to a student who has completed their BSc degree and is undertaking Honours in a branch of the Natural Sciences, on recommendation by Faculty of Science.
Value: $2,350
Recipient: Chun-Hsu Su

**Dwight Prize**
Selection Criteria: Awarded to the student achieving the highest results in First year advanced level, on recommendation by the Head
Value: $700
Recipient: Douglas Brumley

**E M and J F Ward Prize for Experimental Physics**
Selection Criteria: Awarded to the most outstanding student in experimental physics in the final year of the BSc degree with a major in physics.
Value: $600
Recipient: Alastair Stacey

**Ramm Prize in Experimental Physics**
Selection Criteria: Prize is awarded to a student enrolling in either Honours or postgraduate degree by research in Experimental Physics who has demonstrated excellent research potential.
Value: $1000
Recipient: Nadia Davidson

**T F Ryan (Roentgen) Prize**
Selection Criteria: Prize is awarded to the student with the highest aggregate score in 640-151 and 640-152 Physics for Biomedical Science at First Year.
Value: $600
Recipient: Grace Liu

**William Sutherland Prize**
Selection Criteria: Awarded to the student achieving the highest results in Second Year Physics who is proceeding to study I Physics at the Third Year level.
Value: Book vouchers worth $200
Recipient: Jayne Thompson

**Wyselaskie Scholarship in Natural Science**
Selection Criteria: Awarded on academic merit to a student proceeding to the Honours Year in a branch of the Natural Sciences.
Value: $2,100
Recipient: Paul Geil
POSTGRADUATE

Fulbright Scholarship
Selection Criteria: Applicants must have a record of achievement in their chosen field, such as academic record, professional recognition, publications, exhibitions, performances or presentations and must relay their ability to promote mutual understanding between Australia and the United States.
Host Institution: National Institute of Standards and Technology
Project: Seeking to measure the Abraham force and thus developments in precision measurement.
Recipient: Dr Lincoln Turner

Puzey Scholarship by Faculty of Science
Selection Criteria: Be offered a place in a relevant Postgraduate Program and availability of appropriate supervisors
Value: $25,000 up to 4 years
Recipient: Damien George

Professor Kernot Research Scholarship in Physics
Selection Criteria: Awarded on recommendation of the Head on the basis of Honours results. Holders are required to conduct research in Physics at postgraduate level.
Value: $2,525
Recipient: Nadia Davidson

Dixson Research Scholarship in Physics
Selection Criteria: Awarded on the basis of Honours results in Physics. The holder is required to conduct research in Physics at the University at postgraduate level
Value: $2000
Recipient: John Paul Goldby

STAFF

Assoc Prof Les Allen
John Sanders Medal for “Excellence in Developing or Applying Electron Microscope Techniques”, provided by the Australian Microscopy and Microanalysis Society

Assoc Prof Lloyd Hollenberg
Dean’s Award for Excellence in Teaching, provided by Faculty of Science
Subjects Offered

**FIRST YEAR SUBJECTS**
- 640-121/2  Physics (Advanced)
- 640-141/2  Physics
- 640-151/2  Physics Biomedical A/B
- 640-161/2  Principles & Applications
- 640-176    Solar System & Cosmos
- 640-177    Stars & Galaxies

**SECOND YEAR SUBJECTS**
- 640-223    Quantum Mechanics & Thermal Phys (Adv)
- 640-225    Electromagnetism & 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
- 640-261    Energy & Environment

**THIRD YEAR SUBJECTS**
- 640-321    Quantum Mechanics (Advanced)
- 640-322    Thermal Physics (Advanced)
- 640-323    Electrodynamics (Advanced)
- 640-341    Quantum Mechanics
- 640-342    Thermal Physics
- 640-343    Electrodynamics
- 640-351    Astrophysics & Optics 3
- 640-353    Atomic, Molecular & Solid State Phys
- 640-354    Subatomic Physics
- 640-356    Theoretical Methods for Physics
- 640-364    Computational Physics
- 640-381    Principles & Applications of Sensors
- 640-385    Modelling, Visualisation and Analysis

**HONOURS**
The Honours year comprises course work and research project. The content of course work may vary from year to year but typically include subjects chosen from:

- Atom Optics & Photonics
- Extragalaxies, Astro & Cosmology
- General Relativity
- Particle Physics 1
- Particle Physics 2
- Quantum Mechanics A
- Quantum Mechanics B
- Quantum Structures
- Quantum Field Theory
- Scattering & Imaging
- Statistical Mechanics
JULY LECTURES

This very popular series of free public lectures has a long and enviable history in the school. They are aimed at giving an insight into fundamental questions in physics, and advances in current research. They are given by researchers from this school, and delivered in a format that is accessible to the interested lay person. This year’s theme was ‘Einstein Explained’

Professor Raymond Volkas, School of Physics
The light quantum: from the humble photoelectric effect to the strange world of modern physics (1 July)

Professor David Jamieson, School of Physics
Einstein’s theory of Special Relativity: light, time and space (8 July)

Professor Bruce McKellar, School of Physics
How the mass movement of trillions of atoms changed the world (15 July)

Professor George Ellis, Professor of Applied Mathematics and General Relativity at the University of Cape Town, Templeton prize winner (2004)
Curved Space and Compassion: Is there a link between Einstein’s General Theory of relativity and our Humanity? (22 July)

Dr Elisabetta Barberio, School of Physics
E=mc²: Energy and matter entwined (29 July)

PHYSICS GYMNASIUM

This series of monthly lectures is specifically designed to provide enrichment and encouragement for senior high-school students who are studying physics. The meetings are held monthly during the school year at 5:15 pm.

Assoc Prof Lloyd Hollenberg, School of Physics
The frontiers of physics and the limits of knowledge (23 February)

Dr Stuart Wyithe, School of Physics
Structure of the Universe (20 April)

Prof Geoffrey Taylor, School of Physics
ATLAS: map for the beginning of the Universe (18 May)

Dr Norman Frankel, School of Physics
Queer Universe (15 June)

Dr Maurizio Toscano, Melbourne Girls Grammar School
Physics and Thinking (20 July)

Professor David Jamieson, School of Physics
Einstein’s theory of relativity: outrageous but true! (10 August)
PHYSICS IN SERVICE DAY

This professional development day consists of 5 sessions relevant to teachers of VCE Physics. It is designed to keep teachers aware of developments in physics, expand their horizons, and assist them in keeping up to date with the current high schools physics syllabus.

Dr Roger Rassool (School of Physics)
Alternative energy sources: the answer?

Professor Keith Nugent, School of Physics
The Australian Synchrotron: a meeting place for physics and biomedical science

School of Physics Alumni
Gabriella Bright, James McCaw and Jessie Carlsson
Where to from here? Careers after a Physics degree

Associate Professor Peter Farrell, Dept of Electrical and Electronic Engineering
How to build an optical communication system

Dr Shane Huntington, School of Physics
Physics for fun and profit!

MUPPETS

MUPPETS stands for Melbourne University Physics Promotion, Education & Teaching Services

Bendigo February Tour
Setting up base at the Bendigo Science Discovery Centre, the Muppets team, led by Dr Roger Rassool, put on 2-4 shows over 5 days in which nearly every primary school in Bendigo attended. The final show was hugely successful which was open for parents and the general public.

Outback Roadshow
Presented as part of the Einstein International Year of Physics, the roadshow was the biggest and most ambitious yet for MUPPETS. The vehicle convoy, carrying two tonnes of equipment, covered more than 2400 kilometres on its two-week outback itinerary. Led by Physics academics Dr Roger Rassool and Associate Professor Max Thompson, the MUPPETS team of Physics staff and graduate students presented major public shows and workshops in Mildura, Broken Hill and Cobar and visited more than 30 schools along the way. As well as drawing full-house audiences, the roadshow also attracted significant media attention. The images in this feature were taken by Mildura's Sunraysia Daily newspaper.

Other MUPPETS Programs
In excess of 3,500 primary and secondary students parents, teachers and careers teachers in Australia and overseas benefited directly from MUPPETS programs this year. Summer schools attracted 490 high achieving students, some of whom will undoubtedly be students of the future for us.

Melbourne Physics Forum at the Melbourne Town Hall
With ABC's Bernie Hobbs as the master of ceremonies, this was a fun day of physics for 1500 Year 10-12 school students. The day event was designed to introduced Einstein's four big ideas from 1905 and the ghost of Melbourne's own physicist, William Sutherland, who actually beat Einstein to one of these ideas.

The show comprised 4 mini-lectures with demonstrations:
E=mc² and cosmology presented by Prof Rachel Webster
Brownian motion presented by Dr David Hoxley
Photo-electric effect presented by Dr Roger Rassool
Special Relativity presented by Prof David Jamieson

In addition, alumni were on hand to help out in a discussion panel on physics careers, the role of physicists and the really “big science” questions.
The School of Physics renewed its focus with alumni and friends with the development of the Alumni Physics Newsletters. These have been well received, especially by the physics community who now live overseas, as a way of keeping in touch.

In February, we hosted a Cocktail party reunion which proved to be a great success. Young and old took up the opportunity to reconnect with familiar faces. It was especially pleasing to see graduates from the 1940s at the party. We were also privileged to have guest speaker and alumnus, theoretician Professor Helen Quinn AO join us for the event. She completed her undergraduate degree at Melbourne before moving to Stanford.

DONATIONS and SUPPORT

The School greatly acknowledges the support of the Mr Andrew Brooks of the Colonial Foundation. They have generously provided $360,000 over 3 years to expand Dr Roger Rassool’s Outreach activities.

The School continues to value the donations to the University made by Misses Betty and Jean Laby whose late father, Professor Thomas Laby, was the Professor of Natural Philosophy (Physics) from 1915-1944.

The School of Physics also acknowledges the support of the Pierce Bequest, set up by philanthropist Arthur Albert Howard Pierce. The annual funds worth $30,000 have been invested in computer equipment destined for teaching undergraduate and postgraduate purposes.

In 1984, Emeritus Professor JF Ward of Townsville, set up a trust in memory of his great-aunt Edith Ward, who in 1896 was among the first 55 women to graduate at The University of Melbourne. Such support also commemorates the association over a span of four generations of the Ward Family with the School of Physics.

Colin A Ramm was appointed a ‘Professor of the University’ in 1972, with a Personal Chair in the Department of Physics 1982 - 1986. In 1987 he became an Honorary Professor, and Professor Emeritus in 1999. We value the contributions of the Ramm family in support of the scholarship prizes in their name.

Vic Millar, Helen Conley and Prof Steven Prawer
In addition to many universities and schools, organisations that have recruited our graduates include:

ANSTO
Austin Hospital
Australian Synchrotron
Australian Government
Australian Strategic Policy Institute
Bureau of Meteorology
Boston Consulting Group
Commonwealth Scientific and Industrial Research Organisation (CSIRO)
Department of Human Services
Defence Science Technology Organisation (DSTO)
Ernst & Young
GBC Scientific Equipment
Google
Howard Florey Institute of Experimental Physiology and Medicine
LEK Consulting
Momentum Funds Management
Walter Hall & Eliza Institute
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