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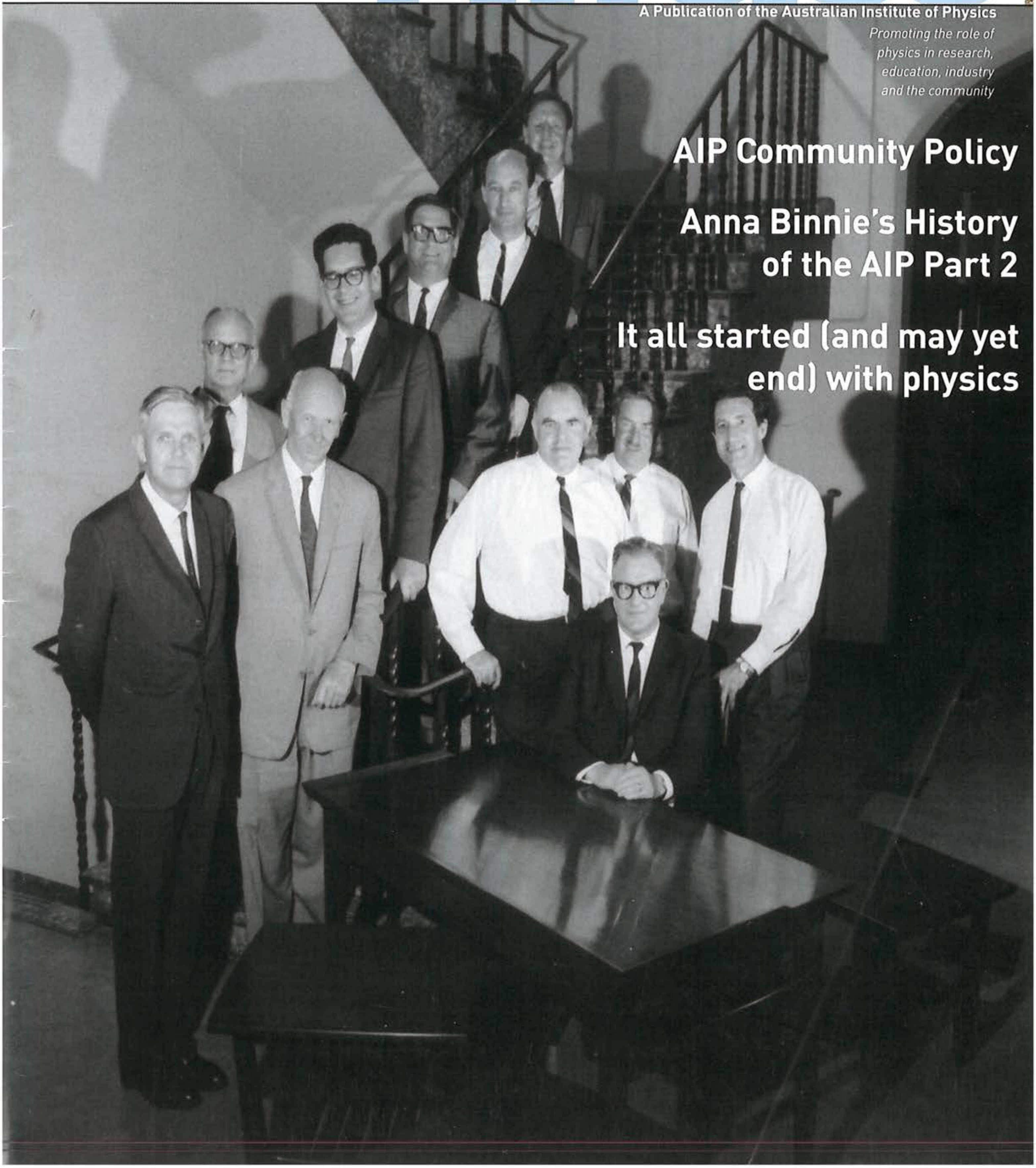

AIP Community Policy

Anna Binnie's History of the AIP Part 2

It all started (and may yet end) with physics

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Australian Physics
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Cover image: Top of stairs going down: Alan Walsh, John Symonds, George Bell, John Carver, unidentified, SE Williams (UWA), unidentified
Around the table: Sitting: Prof Huxley Starting from the right: Stewart Dryden, Alan Harper and Fred Lehany. For more on the history of the AIP see page 128.

The editor encourages corrections and additions to this list. Please send your comments to ap-editor@renegadescience.tv

Image credit: CSIRO Archives

Contributions should be sent to
A/Prof Brian James
Australian Physics
School of Physics, A28
University of Sydney
NSW 2006
Tel: 02 9351 2471
australianphysics@aip.org.au
australianphysics2@gmail.com

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All articles for submission to Australian Physics should be sent in electronic format. Word or rich text format are preferred. Images should not be embedded in the document, but should be sent as high resolution separate attachments in jpeg or tiff.

Authors should also send a short bio of themselves and a recent photo.

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Printing
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91-93 Parraweena Road
Caringbah NSW 2229
Tel: 02 9525 6588
Fax: 02 9524 8712
matthew@clp.com.au

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President's Column - What makes science research good?

President's Column
Dec 2007
No Research Is Wasted

A couple of years ago, I was reading an opinion piece in Nature [1] by well known physicist and cosmologist Steven Weinberg. He listed four golden rules he passes on to young researchers. They are: no one knows everything and you don't have to; choose to research in difficult and messy areas - that is where the breakthroughs will come from; forgive yourself for wasting time - successful research comes mostly from working on problems that will eventually lead you to the right problem to solve; and learn about the history of the science area you are working on as your own work will add to this history.

As few people get to stay in the same research field all of their working lives, I would like to add another golden rule: "No research is wasted". Why do I say this? Often scientists can be working on a project that may not work, or they change jobs, lose funding, or worst of all their research area is terminated. When this happens it is a devastating for the scientist – all of that work and nothing coming from it. Many of us have had this experience at least once. So does this mean we have wasted our effort? Should we only be working on projects we know will succeed? This is the basis of the extra golden rule.

I invented this extra "rule" when reviewing my own research history for a career talk to inspire young women to consider careers in science and engineering. Over 27 years I have been involved with projects on ZnO, GaN and InN thin films, amorphous metals, magnetic materials, superconducting electronics including YBCO thin film growth, Josephson junctions, and devices and applications of superconducting devices. This seemingly disparate list of research projects could be broadly described as condensed matter physics or materials physics from my time at Macquarie University and CSIRO. Concerned that no talk was going to expose "My career goes bung" rather than "My brilliant career" (apologies to Miles Franklin), I discovered some delightful developments resulting from my earlier research.

Doing scientific research is more than just performing an experiment or calculation. Rather, as Newton told us, and Google scholar reminds us, "we stand on the shoulders of giants". The most important step to making science research "science" is that the results are written up and published in scientific journals or technical reports. By becoming part of the history they are read by scientists in the field, and so your own modest science project, once written up, takes on a life of its own.

Take my work on indium nitride thin films. Back in the early eighties, it was a material with little research undertaken on it. I was keen to find a semiconducting material that could be used for visible solid-state lasers, now common but then it was just an idea.

I went about working out how to grow thin films of InN, to characterise their properties, how they respond to light or to electrical currents and magnetic fields, and made some primitive optical detectors by growing a thin film of InN on silicon wafers. I needed to work out how the electrons in the material behaved by calculating the energy bands of the material - where the electrons are relative to the crystal lattice structure. It was a good PhD project for me. I learnt a lot, got my degree and published several scientific journal articles. But then I got a job at CSIRO moving into magnetic and superconducting materials and devices research - I left my semiconducting work behind for others to follow up.

In the time since, my InN work has had a life of its own. InN has an energy band gap (an important parameter to determine how useful it would be as the basis for a visible light device) that when alloyed with GaN provides an ideal semiconductor material for visible light emitting diodes. It is now possible to make my dream device of a solid-state visible laser with blue light. But more importantly, it is possible to make a white light emitting diode that can last for over 50000 hours, requires 92% less energy to operate and will, as prices come down, replace incandescent and fluorescent lights with longer life highly energy efficient lighting. My early work added a little to this development [2].

Another project I worked on was to see if small magnetic particles injected into the blood stream could be positioned around tumours using special drugs, and when exposed to an ac magnetic field could heat up sufficiently (over 60°C) to kill the tumour cells while leaving the rest of the cells in tact. We did this work under contract for the Royal Perth Hospital and Dr Bruce Grey. All these years later we have learnt that he has subsequently developed this idea further via a company called SIRTEX replacing the magnetic particles with radioactive ones with this treatment now being used clinically in Australia with good success [3]. I have found many other examples from colleagues throughout the AIP.

There is another aspect of my new golden rule of "No research is wasted". This is the wisdom you personally develop through the experience of undertaking the science research that teaches you new things and providing knowledge which can then be transferred to (what seems to be) disparate topics by approaching new problems uniquely - possibly in a new way that researchers who have worked exclusively in that field will not have considered.

For example, at my lab we had a long-term research program in plasma physics. As CSIRO moved towards the expectation of stronger commercial and community impacts for the benefit of Australia, CSIRO decided to close down this research area. At that time it was thought there was no clear "pathway to impact"! Since then the plasma team of researchers have scattered in very different directions but it is interesting to see some of the work they have since undertaken. One senior researcher moved into a nanotechnology team using his expertise in thermal plasmas

continued on page 117

Editorial

Our two lead articles in this latest issue concern themselves with the concept of policy: the *AIP Community Policy – Draft for Consultation* and Anna Binnie's *A Short History of the Australian Institute of Physics Part 2*. Both of these articles focus on the policies that lead and direct (or have lead and directed) our organisation. Binnie takes us through a detailed account of how we, the AIP, struggled to find our independence as a national group with its own voice through the tough political times of the post-war era and the early nuclear age. Oddly enough it was the development of, and controversy over policy, which lead to much of the internal strife.

Although the preceding AIP Policy Draft consultation does not cover such contentious issues as nuclear secrecy, it does offer discussion points on the important topics of today, namely the environment and energy (along with perceptions of science and equal opportunity). These discussion points are not offered to you to file away, they are the beginnings of policy development and require your input – your voice. After reading them you can reply to Australian Physics (ap-editor@renegadescience.tv) for publication in upcoming issues, or privately to Judith Pollard at: judith.pollard@adelaide.edu.au

With more and more studies being released focusing on our ageing population of physicists and physics teachers we read yet another obituary of a hard working, pioneering and well rounded contributor to physics. Terry Sabine (1930 – 2006) gets an honest and heart felt goodbye from Anna Binnie.

James Yardley takes us out of our comfort zone in the world of physics and into the high stakes world of finance in It All Started. As mentioned, with more physics students choosing not to pursue a physics career after completing a degree, we see just how important our fundamentals, our learning, our basic principles can apply equally well to fields outside of science. Yardley does leave hope that he, and others like him, may return to physics; and should he return, he will do so with an even greater skills set than when he left.

This final issue of 2007 contains a significantly expanded Reviews section. With 23 books reviewed there is a wealth of reading to keep us all busy over the long summer. Our Reviews Editor Colin Keay begins with his take on Frank Close's More Layers of the Cosmic Onion covering updates and revelations over the twenty years since its first issue. Other reviews run the gamut from off the shelf popular physics and visually pleasing multi-media astronomy books to graduate level texts, numerical analysis, biomechanics, astrobiology and even traveling at the speed thought. Enough to keep even hardened physicists buried in a book during the holiday season.

I have made the first of many changes and updates to Australian Physics. Combining the Press Room and News into one section called News will combine news and press items specific to Australian (and New Zealand) physics. It is hoped that physics departments, institutions, research facilities and government media departments across our two nations will send their items directly to AP instead of the editor searching out items; of course until that happens I will busily comb and sift through web sites for your news. Other changes and directions will appear over the course of the year, and will be itemised for your information in the next issue; these include an increased educational component, a short archival/historical photo section, and over the long term a two page spread debate between competing physics frontiers. Stay tuned.

Until then, read a book, have your say on AIP policy, and enjoy the summer.

John

Deadline for next issue January 25, 2008

President's column - continued from page 115

and heat transfer to gain an understanding of a novel transduction technique called "NanoBANG" [4] where a flash of light initiates a reaction that leads to a small explosion or "pop" like you hear when you pour milk on rice bubbles. This sound volume has been found to be proportional to the amount of material reacting and as a result can be used as a cheap biosensor. The heat transfer calculations and modelling undertaken by this senior researcher explained the explosive sounds showing it was indeed a truly physical effect.

There are many examples of how knowledge gained from one project can be used to transform another research area, initially deemed disconnected. This is happening more and more often as exciting new multidisciplinary research programs are funded.

What is the basis for making sure no research is wasted? Research should be undertaken with the highest integrity and standards possible, and then published with peer review. We need to realize and have the confidence that all knowledge gathered from our research gives us new understanding which then becomes a part of us. If you are to move research fields, an event that is not infrequent in the modern science research "industry", you will bring a new approach to the research problem at hand. Applying and adapting what you know can lead to new undertakings and achieving breakthroughs.

So when we think about "wasted" money on projects or when researchers move fields, leaving that scientific field behind, remember that your work either takes on a life of its own being part of the scientific literature or contributes to the science wisdom that will stay with you leading to outcomes thought impossible or not even contemplated.

Steven Weinberg should add this to his tips for young researchers.

Post 2007 Federal Election:

We now have a new government who has promised some significant changes to the science portfolio. Although there are few details, the Rudd Government has promised to double R&D funds over time, introduce 1000 fellowships for mid career scientists, reinvigorate CSIRO and undertake another process rather than the RQF to access universities. The "ten point plan" can be found at the ALP website [5].

It will be interesting to see how the details of the policy develop.

[1] Nature 425 (2003) 389
[2] J. Vac. Sci. Technol. B 19 (1992) 1237
[3] http://www.sirtex.com/
[4] http://www.csiro.au/solutions/ps3a9.html
[5] http://www.alp.org.au/download/now/new_directions_for_innovation__24_april_2007.pdf

AIP QLD Branch

Chair: Dr Brad Carter
Department of Physics,
University of Southern Queensland
Toowoomba QLD 3450
Tel: 07 4631 2801 Fax: 07 4631 2721
Brad.Carter@usq.edu.au

Secretary: Kevin Pimbblet
University of Queensland
Brisbane QLD 4072
pimbblet@physics.uq.edu.au

AIP SA Branch

Chair: Dr Jamie Quinton
Chemistry, Physics and Earth Sciences
Flinders University
GPO Box 2100, Adelaide, SA 5001
Tel: 08 8201 3994 Fax: 08 8201 2905
jamie.quinton@flinders.edu.au

Secretary:
Dr Laurence Campbell
Chemistry, Physics and Earth Sciences
Flinders University
GPO Box 2100 Adelaide, SA 5001
Tel: 08 8201 2093 Fax: 08 8201 2905
laurence.campbell@flinders.edu.au

AIP TAS Branch

Chair: Dr John Humble
Private Bag 21, Hobart, TAS 7001
University of Tasmania
Tel: 03 6226 2396 Fax: 03 6226 2867
John.Humble@utas.edu.au

Secretary:
Dr Elizabeth Chelkowska
Maths and Phys, University of Tasmania
Private Bag 21, Hobart, TAS 7001
Tel: 03 6226 2725 Fax: 03 6226 2867
Elzbieta.Chelkowska@utas.edu.au

AIP VIC Branch

Chair: Dr Andrew Peele,
QEII Research Fellow
Department of Physics
LaTrobe University
Bundoora, VIC 3086,
Tel: 03 9479 2651 Fax: 03 9479 1552
a.peele@latrobe.edu.au

Secretary: Ms. Gaby Bright
PO Box 4355
Parkville Vic 3052,
Tel: 03 8344 3768
gabrielle.bright@versi.edu.au

AIP WA Branch

Chair: Prof. Ian McArthur
Department of Physics
University of W.A.
Stirling Highway
Nedlands, WA 6009
Tel: 08 6488 2737 Fax: 08 6488 1014
mcarthur@physics.uwa.edu.au

Secretary: Dr Ron Burman
School of Physics, The University of Western Australia
Mailing Address: M013 The University of Western Australia Crawley, WA 6009
Tel: 08 6488 2729 Fax: 08 6488 1014
john@physics.uwa.edu.au

Branch News

Queensland report

As of the end of 2007, we have 123 financial members, with the majority based in south-east Queensland. The year 2007 brought a substantially altered branch committee compared to 2006:

1. Brad Carter (USQ) – branch chair
2. John Wilkinson (Forest Lake College) – branch treasurer & teacher
3. Peter Cavallaro (Education Queensland) – teacher (secretary for part of 2007)
4. Kevin Pimbblet (UQ) – secretary for the latter part of 2007
5. Mark Young (Education Queensland) – teacher
6. Simon Critchley (QLD Health) – Industry
7. David Kielpinski (GU) – GU rep
8. Patrick Keleher (CQU) – QLD rep on the AIP Physics Education Group
9. Dick Metcalfe (CQU) – CQU rep
10. Tertia Hogan (St John Fisher College) – teacher

Immediate Past Chair Paul Meredith also served on the Branch Committee until increasing time commitments elsewhere dictated his resignation from the committee late in the year. Thanks go to Paul for his excellent service and wise advice.

The branch strategy for 2007 has been to preserve (within budgetary limitations) the successful formula of physics outreach developed by Paul Meredith and his committee. This philosophy is one of engagement with an audience that includes teachers, their students and the general public. To this end, substantive physics teacher representation on the branch committee has been maintained. Specific aims for 2007 were to:

1. Engage with the secondary education establishments in Queensland through Education Queensland, the Science Teachers Association Queensland and the Queensland Studies Authority.

2. Recognise the professional development obtained by teachers attending AIP events through the use of certificates.

3. Support key high-profile events that engage a wider community than is reached by more traditional monthly seminars.

Some pictures from the Mt Isa venue of the 2007 Youth Lecture tour. Courtesy Chris Pocock and Stephen Hughes.

4. Maintain an expanded Youth Lecture tour that emphasises rural and regional venues across much the state
5. Continue to combine the AGM with a postgraduate seminar evening and convivial gathering of AIP branch members

Overview of 2007 branch activities
The calendar of events involved a series of presentations. Some highlights follow:

• Research seminars Research seminars were presented to showcase and inform teachers and their students about some of the physics research being done at Queensland universities. Talks included Nathan Downs on "Solar UV" (USQ, Sep); Andrew White on "Computing with Light" (UQ, Oct); Geoff Pryde on "Quantum enhancement precision measurement" (Griffith Uni, Nov).

• Physics education in schools The new Queensland Senior Physics Syllabus had been presented by the Queensland Studies Authority's Dr. Beth Brook to the branch. Discussion of this syllabus is ongoing as is input to the Queensland Government's decadal plan for Science, Technology, Engineering and Mathematics (STEM) education and skills.

• Youth Lecture The Youth Lecture tour held during the lead up to, and during, Science Week in August was provided by Dr Stephen Hughes from QUT. Stephen spoke on the application of medical imaging techniques to non-destructively visualise inside a wrapped ancient Egyptian mummy to reveal some of the secrets of her life and times. Stephen's talk was well received, with regional audiences especially enthusiastic. It was reported by Stephen that:

"The lecture was given in seven locations – Toowoomba, Mt. Isa, Rockhampton, Sunshine Coast, Gold Coast, Townsville and Brisbane. The talk Jeni – A Tale of Modern Medicine and Ancient Egypt appeared to be well received based on comments students made to their teachers. In Townsville, teaching staff went to the trouble of downloading and printing supplementary information off the QUT website about the project for school students. The talk emphasised the interdisciplinary nature of physics – this project is an example of the application of medical physics to archaeology. When speaking to their classes, teachers picked up strongly on this aspect of the project and reiterated to their students the multidisciplinary nature of physics. Teachers in Mt. Isa emphasised how grateful they were to be included in the tour and mentioned how rare it was to have 'high profile' visitors from Brisbane."

• Co-sponsorships The branch joined forces with other organisations to co-sponsor and co-promote physics events, to cost effectively maintain and raise the profile of the AIP:

- The 2007 Youth Lecture tour was co-sponsored by the Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM). This allowed the number and range of venues included to be the largest to date.

- Internationally recognised astrophysicist Professor Joe Silk from Oxford University spoke at the Brisbane Planetarium in August. This booked-out event was co-hosted by the UQ, USQ and the AIP and USQ.

- Astronomer, author and media personality Fred Watson presented an astronomy talk entitled "Dark Secrets" at South Bank in August in

Branch News

Some images from the Physics Demo Troupe Northern Territory tour. Courtesy Joel Gilmore

aid of National Science Week. Fred's visit to Queensland was supported by the Science Teachers Association of Queensland, the Queensland Museum South Bank, QUT Faculty of Science and the AIP.

- The branch has assisted with the marketing of BrisScience and other events using its website and by emailing the branch membership.

- The branch contributed to the running of a small Physics Teachers workshop help at USQ Toowoomba in July; this workshop may prove to be the forerunner of more substantial workshops held in Brisbane.

- The branch provided some modest funding to defray the cost of videotaping some of the "Tools of Science" lectures organised for 2007 by UQ's Dr Norman Heckenberg. Some lectures have been produced as a DVD and will be placed on the web to benefit members and teachers.

- The branch also lent its support to the one nomination from Queensland for the Bragg medal. The winner has yet to be announced.

- The excellent Physics Demo Troupe founded by Joel Gilmore and Jenny Riesz completed a Northern Territory tour between Alice Springs and Darwin in September, thanks in part to AIP funding. It was reported by Joel that:

"Joel Gimore, Jenny Riesz and Andrew Stephenson, members of the University of Queensland's Physics Demo Troupe, recently embarked on their largest project to date - a three week tour of the Northern Territory. Presenting shows and workshops on topics such as "The Power of Air", the science of music, and nanotechnology and nanomaterials (including walking on water!). They visited 14 of the most remote schools in Australia as they travelled over 2000 kilometres from Alice Springs to Darwin. The feedback from students and teachers was fantastic, and notes and resources were left with teachers so that these activities can continue long after the Troupe moves on!"

This trip was jointly funded by the University of Queensland, the Australian Institute of Physics, the Australian Academy of Technological Science and Engineering, and the Australian Research Council's Nanotechnology Network. Joel and Jenny would like to thank all of their sponsors for their continued support of science outreach around Australia.

• Scholarships and bursaries:

- Secondary School Achievements in Physics Certificates: Certificates were awarded to students in Centenary State High School, St Aiden's Anglican Grammar School, St Edmund's College and Forest Lake College, in recognition of their outstanding performance in Year 12 Physics.

- Undergraduate prizes: Once again this year, undergraduate awards (book tokens) were given to a number of students at Queensland Universities for the top performers in their programs.

I'm pleased to thank the branch committee for their help during 2007. Information about the branch can be found on our website at

http://qld.aip.org.au

South Australia

On 2nd July Prof. Tanya Monro addressed a joint meeting of the AIP and the Institution of Electrical and Electronics Engineers on "New optical fibres for applications beyond data transmission". Prof. Monro is Chair of Photonics and the Director of the DSTO Centre of Expertise in Photonics within the School of Chemistry and Physics at the University of Adelaide. She explained that classes of optical fibres are rapidly emerging that allow fibres to be used well beyond their established role in data transmission. These developments have been enabled by research in a diverse range of areas including physics, materials science, process engineering and fluid mechanics. Recent progress in a range of areas including new transmission fibres, highly nonlinear fibres, chemical and biological sensing with new fibres and novel fibre lasers were reviewed. Some highlights included fibres with world-record nonlinearity and the first fluorescence-based in-fibre biosensors.

There was then a gap in lectures, but our hard-working education subcommittee provided other activities. The annual "Excellence in Physics Teaching" medal was presented by the Chair, Dr Jamie Quinton, to Ian Faulkner at the launch breakfastof National Science Week on August 15th. The annual Super Science quiz for high school students was held on August 24th. Approximately 90 students attended and the winning school, in a very close finish, was St Peter's. We thank National Science Week for supporting the Quiz with a grant.

On 15th October Prof. Fred Watson, Astronomer-in-Charge at the Anglo Australian Observatory, spoke on "What's happening to gravity?". Although this was intended to be a members' lecture, an invitation for interested visitors resulted in an unexpected, generally non-physicist, audience of about 200 people. Prof. Watson gave an entertaining and fully illustrated talk, identifying gravity as the single most important force in shaping the Universe. He said our understanding of gravity has gone through two quantum leaps, with Newton's Principia in 1687, and Einstein's General Theory of Relativity in 1915. But today there is another revolution taking place. Physicists all over the world are probing gravity at the quantum level, while astronomers are recognising that there is something more than just irresistible attraction going on out there in the Universe.

On November 7th we had our official joint meeting with the Astronomical Society of South Australia. Dr David Malin, Adjunct Professor of Scientific Photography, Dept. of Applied Physics, RMIT University, Melbourne, spoke on "Darkroom to Digital" - how imaging techniques developed for astronomical photography evolved into the digital processes used in modern CCD imaging. He described how a background in chemistry and microscopy and a curiosity about the world led to a position at the Anglo Australian Telescope. He showed how he developed the techniques of making true-colour astronomical images from black and white negatives, keeping the diverse audience enthralled with stunning pictures and referring frequently to the Physics principles involved. Finally he reviewed his recent work in using digital processes to produce even better renditions and analysis of the archive of astronomical photographs.

SA branch chair, Dr Jamie Quinton, with Dr David Malin (right) at supper following the joint meeting with the Astronomical Society of SA.

Recent AIP Public Lectures in Hobart

The first of three successful public lectures organised by the Branch was held on 27th September, when Professor John Dickey, Head of the Discipline of Physics at the University of Tasmania, provocatively asked Why do we need Cosmology?

He started his answer at a sociological level, quoting the opening verses of the Gospel According to St John to show the deep felt need at the time to give meaning to the world. An earlier fragment of a Chinese manuscript brought forth similar ideas, though in very different language. These and similar historical documents from other societies all demonstrate the deep innate desire of humans of all beliefs to know how and why they are here. Modern Cosmology seeks to satisfy similar needs.

John gave an overview right across modern developments in modern cosmology, starting with Edwin Hubble's 1929 distance/velocity plot for extra-galactic nebulae and continuing through to the most recent observations by the Hubble telescope and the Wilkinson Microwave Anisotropy Probe. Observations of the cosmic microwave background by the WMAP satellite (launched in 2001 and in orbit around the Langrangian L2 point) have revealed unprecedented accuracy about the nature and age of the universe. We now believe that baryons comprise ~4% of the universe, cold dark matter ~23% and dark energy ~73%. Importantly, Ω_0, the constant that describes the curvature of the universe, has been measured to be unity within 2%, thus implying that the universe is flat. But, with all that cold dark matter and dark energy, it is clear that we still have much to discover to fulfil the basic human need implied in the lecture's title.

On 6th October, Prof Tanya Munro, of the Centre of Expertise in Photonics at the University of Adelaide, gave the annual Women in Physics lecture, entitled New optical fibres for applications beyond data transmission. Whilst in Tasmania she also presented a slightly simplified version of the material to Year 11/12 students in Hobart and Launceston. The thrust of her talk concerned the details of optical fibre construction.

The holy grail of optical fibres is loss reduction. Optimum performance can, in principle, be obtained by using glasses of different refractive index in the core and cladding of the fibre; however the use of softer glasses introduces problems with low softening and melting points. There are also difficulties when glasses of different viscosity are used in the production of fibres. Consequently the vast majority of currently available commercial fibres are produced from silicon glass.

An interesting technique to reduce losses while maintaining single glass construction introduces air holes into the fibre. These run the length of the fibre and can be of varying sizes, provided that the core of the tube remains solid. Such fibres can be made from a single optical material, provide versatile cladding configurations and provide a very broad range of possible optical properties, some of which have been produced at the Adelaide Centre's labs. Capable of providing new transmission windows they can be used in a range of applications, such as aircraft counter measures, surgery and dentistry, real-time water quality monitoring, all-optical data processing and receiver protection.

The branch held its AGM on November 1st. The meeting was attended by the National President of the AIP, Dr Cathy Foley, newly arrived in Hobart after giving talks to Year 11/12 students in Burnie, Devonport and Launceston.

Following the traditional branch annual

Branch News

dinner Cathy presented her lecture Superconductivity: Has it changed or touched your life? Many in the audience were surprised at the extent to which it has at least touched them in ways they may not have been aware.

Like John Dickey several weeks earlier, Cathy opened her talk with an apparently quite unrelated slide – of Woodstock, New York, 15-17 August 1969. Her point was that that event, intentionally or otherwise, became a turning point in western culture. Her next slide showed her reasoning, the New York Times of 18 March 1987 reporting the first public news of high (relatively!) temperature superconductivity, then newly presented at an APS meeting.

The event came to be known as "The Woodstock of Physics". The field has developed considerably, with materials superconducting up to at least 125K. Probably the usage which the largest number of people will encounter, albeit unknowingly, is MRI (magnetic resonance imaging) in which superconducting magnets are used to maintain sufficiently large magnetic fields.

Magnetic fields cannot penetrate superconductors. Small devices can be constructed to measure the fields. Cathy went on to discuss some of the applications of such devices, in particular SQUIDs (Superconducting QUantum Interference Devices), which her lab has developed. These include various types of surveying magnetometers, both for land and underwater surveys. Examples include geophysical exploration for ore bodies and underwater searches for wrecks and submarines. Mapping the sea-bed for oil was also mentioned.

John Humble

Western Australia

The Western Australia Branch has held the following events:

Quiz Night
Wednesday 17th October at the UWA Tavern

Physics in Industry Evening
Wednesday 24th October at the UWA Physics building

AGM and Dinner
Wednesday 5th December at The University Club, UWA
After dinner speaker - Justice Robert French of the Federal Court of Australia

More details of the events can be found at: *http://wa.aip.org.au*

Executive News

SUMMARY OF EXECUTIVE MEETING E270

Meeting held Monday October 15

Education
The executive appreciates there is concern about the state of physics education in high schools, and is actively pursuing means of expressing these concerns to education ministers in State and Federal government. The president has met with the Minister for Education in NSW and had a positive discussion. It is planned to continue this dialogue because of the importance of having physics presented effectively in high schools.

Archiving
It is important to have a system of archiving AIP material, including Australian Physics. Means of setting up an effective system are being investigated.

University Restructuring
There are constant changes taking place in the administrative systems of universities, usually referred to as restructuring. Many of these changes have threatened the identity of physics departments. The AIP is taking an active role supporting departments that come under threat.

Australian Physics
A new editor of Australian Physics has been appointed. The editorial responsibilities are in the process of being handed over and next year publication should come back to schedule. It has been resolved that the role of chief editor of Australian Physics will be an ongoing function of the vice-President. The main aspect of this role will be the reviewing of the content of articles.

Influential Australians
The president has been placed on the list of the 100 most influential people in Sydney. No doubt members will be pleased that physics has such a high profile.

AIP membership
It will be difficult to maintain the level of current activities without recruiting more members. Considering the central role of physics in society, it is important for the AIP to maintain a high profile. Work is being done towards attracting physics graduates to join and participate in AIP activities.

DSTO Scholarships
Nominations for the DSTO scholarships are now being considered and the winners will be announced shortly.

History of the AIP
Work on the writing of the history of the AIP is proceeding. At this stage, the interviewing of foundation members is a high priority item. It is possible that a history group could be formed.

Branch Annual General Meetings
It has not been easy to keep track of the branch executive members. Branches are asked to advise changes in their executive following the annual general meeting. Branches should note that this would be necessary for the organisation of the Council meeting.

Council Meeting
The most suitable time for the Council meeting appears to be the second week of February. Dates will be advised as soon as they are decided.

Membership database
Problems are being experienced with the membership database. Work on rectifying these problems is proceeding.

Budget
Accounts are running on budget this year. It is projected that following the increase in membership fees, next year will also run on budget.
Next meeting E271 scheduled for December 11.
Ian Bailey,
Hon secretary.

The 45th Annual General Meeting of the AIP is to be held at the University of Melbourne at 1800 on Monday 11th February 2008.

Agenda

1. Apologies, recording of proxies
2. Minutes of 44th Annual General Meeting
3. Business arising from the minutes
4. President's report
5. Treasurer's report
6. Appointment of auditor.
7. Any other business.

School of Physics Conference Room (level 7) for the Council meeting and the Laby theatre 6-8 for the AGM

Ian Bailey
Hon. Secretary

Interested in helping the AIP improve its membership database and website?

The AIP Executive is seeking an AIP member volunteer to join the national Executive in 2008 as a special projects officer for the specific task of helping develop guidelines for improving our membership database and our website. An objective of the project is to make greater use of the website for the benefit of members. The person would be expected to seek relevant information, provide advice, attend 6 executive meetings during the year (held in various capital cities - travel expenses will be covered), and take part in occasional phone conferences. The project does not include implementing proposed changes, for which an IT professional would be engaged.

If you are interest, please contact the President, Dr Cathy Foley (cathy.foley@csiro.au)

News

From molecules to the Milky Way: dealing with the data deluge

Most people have a few gigabytes of files on their PC. In the next decade, astronomers expect to be processing 10 million gigabytes of data every hour from the Square Kilometre Array telescope.

And with DNA sequencing getting cheaper, scientists will be data mining possibly hundreds of thousands of personal human genome databases, each of 50 gigabytes.

CSIRO has a new research program aimed at helping science and business cope with masses of data from areas like astronomy, gene sequencing, surveillance, image analysis and climate modelling.

The research program, which began this year, is called 'Terabyte Science' and is named for the data sets that start at terabytes (thousands of gigabytes) in size, which are now commonplace.

"CSIRO recognises that, for its science to be internationally competitive, the organisation needs to be able to analyse large volumes of complex, even intermittently available, data from a broad range of scientific fields," says program leader, Dr John Taylor, from CSIRO Mathematical and Information Sciences.

One aspect of the problem is that methods that work with small data sets do not necessarily work with large ones.

An aim of the program is to develop completely new mathematical approaches and processes for scientists in a range of disciplines to further their research and boost Australia's position as a world science leader.

"Large and complex data is emerging almost everywhere in science and industry and it will hold back Australian research and business if it isn't dealt with in a timely way," Dr Taylor says.

Countries like the US also recognise the challenges, as Dr Taylor has seen first hand in his ten years' working in laboratories there.

"This will need major developments in computer infrastructure and computational tools. It involves IT people, mathematicians and statisticians, image technologists, and other specialists from across CSIRO all working together in a very focussed way," he says.

After a workshop in September, specific research areas have been identified and projects are progressing in advanced manufacturing, high throughput image analysis, modelling ocean biogeochemical cycles, situation analysis and environmental modelling.

CSIRO Mathematical & Information Sciences

Chief Scientist to open inaugural Scientists in Schools symposium

Over one hundred teachers and scientists gathered at the CSIRO Energy Centre in Newcastle on 24 October for the inaugural Scientists in Schools symposium on Energy and Climate Change.

The symposium is part of the national Scientists in Schools programme that links scientists with schools across Australia.

Dr Hugh Dove with student in the Crop Adaptation lab of CSIRO Plant Industry, Black Mountain, ACT. CSIRO Photograper Carl Davies

The programme is funded by the Australian Government Department of Education, Science and Training and managed by CSIRO Education.

Australia's Chief Scientist, Dr Jim Peacock, the programme's champion, delivered the opening address at the symposium.

"I'm delighted that we've been able to bring 50 of the teacher-scientist pairs from our Scientists in Schools programme together at this event," he said.

"Since Scientists in Schools commenced in late July, over 300 scientists have been partnered with teachers and the number is growing daily."

Highlights of the symposium included:

- a presentation on the energy-climate change nexus by CSIRO Energy Technology Chief, Dr David Brockway
- a chance to witness some of the pioneering technology showcased at the award winning CSIRO Energy Centre
- an interactive panel on low emissions electricity options including solar, clean coal and nuclear.

CSIRO

CEO maintains strong stance on confidentiality

"To attract applications from the best researchers available, the Australian Research Council (ARC) must be able to offer a guarantee that their privacy and intellectual property will be respected," the ARC's Chief Executive Officer, Professor Margaret Sheil, said.

"The ARC is committed to its best practice peer review processes for assessing research proposals, ensuring that we support Australia's most promising and competitive research and researchers.

"To maintain the integrity of our processes and uphold the confidentiality obligations we enter into with applicants and assessors, the ARC does not, as a matter of policy, discuss details of funding applications or researchers, other than those that have been successful."

Professor Sheil said it was a matter of public record that the ARC is the respondent in a matter before the Administrative Appeals Tribunal (AAT) in relation to an application for access to documents under the Freedom of Information Act 1982 (FOI Act).

The FOI request relates to 2004 and 2005 National Competitive Grants Program funding decisions.

News

The ARC has complied with the requirements of the FOI Act by writing to persons and organisations whose business, financial, professional or personal affairs information is contained within documents that are the subject of the FOI matter.

A number of the individuals who have received notification letters have sought, and received, additional advice from the ARC regarding the nature of the information involved in the FOI request.

The (former) Minister for Education, Science and Training, the Hon. Julie Bishop MP, has accepted all ARC funding recommendations since taking up her position.

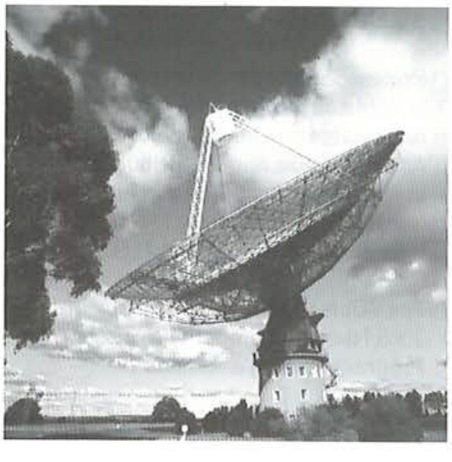
The previous Minister, in deciding to not approve proposals, was exercising his right under the Australian Research Council Act 2001 to make final funding decisions.

Australian Research Council (ARC)

In a shock finding, astronomers using CSIRO's Parkes telescope have detected a huge burst of radio energy from the distant universe that could open up a new field in astrophysics. The research team, led by Assistant Professor Duncan Lorimer of West Virginia University, reports its discovery in the online journal Science Express.

The radio burst appears to have originated at least one-and-a-half billion light-years (500 Mpc) away but was startlingly strong.

"Normally the kind of cosmic activity we're looking for at this distance would be very faint but this was so bright that it saturated the equipment," said Professor Matthew Bailes of Swinburne University in Melbourne.



The burst was so bright that it was dismissed as man-made radio interference. It put out a huge amount of power (10exp33 Joules), equivalent to a large (2000MW) power station running for two billion billion years.

"The burst may have been produced by an exotic event such as the collision of two neutron stars or be the last gasp of a black hole as it evaporates completely," Professor Lorimer said. The burst lasted just five milliseconds.

It was found by David Narkevik, an undergraduate at West Virginia University, when he re-analysed data taken with the Parkes telescope six years ago.

Although they've found only one burst, the astronomers can estimate how often they occur.

"We'd expect to see a few bursts over the whole sky every day," said Dr John Reynolds, Officer in Charge at CSIRO's Parkes Observatory.

"A new telescope being built in Western Australia will be ideal for finding more of these rare, transient events.

"The Australian SKA Pathfinder, which is going to be built by 2012, will have a very wide field of view—be able to see a very large piece of sky—which is exactly what you want for this kind of work," he said.

"The burst may have been produced by an exotic event such as the collision of two neutron stars."

The discovery of the radio burst is similar to the discovery of gamma-ray bursts in the 1970s, when military satellites revealed flashes of gamma-rays appearing all over the sky. One kind—the so-called long-period bursts—was eventually identified as the explosion (supernova) of a massive star with the associated formation of a black hole.
For animations, go to: *http://astronomy.swin.edu.au/~ajameson/swinmedia/*

CSIRO

Stars well-endowed with gold have fewer companions

The chequered destinies of Australian Idol winners underscores what astronomers have known for a long time - star formation is complicated. A new astronomical study adds an unexpected twist to the complications: stars well-endowed with gold and other heavy elements have fewer stellar companions. Researchers from The Australian National University (ANU) and the University of New South Wales (UNSW) believe their discovery could help track down Earth-like planets outside of our solar system.

"Ten years ago researchers found that stars with a large amount of heavy elements were more likely to be orbited by planets," said report co-author Dr Charley Lineweaver from ANU's Planetary Science Institute. "We still don't understand why, but that's the way it is. Our goal was to find out if such high-metallicity stars might also be more likely to be orbited by other stars."

The Sun is a typical star in that about one per cent of its mass is made of heavy elements like oxygen, iron and gold. However, there are many stars with as little as one third of a percent of their mass in heavy elements, while other stars have tens times that much. The amount of heavy elements plays an important role in the types of object that form around a star.

Dr Lineweaver and Dr Daniel Grether from UNSW put together the most complete census of nearby stars. They were surprised when they found the opposite - stars with the highest content of heavy elements were less likely, not more likely, to have companions.

"Our counterintuitive result does not yet have a good theoretical explanation, but we think that stars that form in different regions of our galaxy probably followed different paths to stardom," Dr Grether said.

Detecting Earth-like planets has become a hot field. Dr Lineweaver and Dr Grether believe that further research on the relationship between the amount of heavy elements in stars and the types of stellar and planetary companions orbiting them could assist in the search for worlds like our own. The study is published in the latest edition of the Astrophysical Journal: *http://www.journals.uchicago.edu/ApJ/journal/contents/ApJ/v669n2.html*

The Australian National University (ANU)

ARC Centre of Excellence for Quantum-Atom Optics Prof. Peter Drummond awarded the Moyal Medal and Lecturer

Professor Peter Drummond has been awarded the Moyal Medal and Lecturer for 2007 for his distinguished contributions to physics. Macquarie University has established a Medal and a Lecture Series in honour of Professor Joe Moyal. The lectures are given annually at Macquarie University by the Medallist.

Macquarie University

The Sigma Energy Solutions Science & Technology Award and Young Achiever of the Year: Jennifer Riesz

Jennifer, from the University of Queensland, is a Bachelor of Science graduate with first Class Honours. This young physicist is making significant headway towards understanding melanin pigment and the role that it plays in the formation of melanoma skin cancer. Jennifer has received many awards, international scholarships including attending a workshop by world renowned biophysicist Klaus Schulten and study in London in a world class nuclear facility.

Jennifer still finds the time to put back into the community by promoting her love of science to regional school students.

Awards Australia Frank Kraft, Sigma Energy Solutions and Jennifer Riesz, winner

University of Queensland

Swinburne astrophysicist receives international cosmology prize

Three Australian astrophysicists including Swinburne's Professor Warrick Couch are part of two international teams of scientists that will receive the prestigious 2007 Gruber Cosmology Prize.

The two teams simultaneously came to the same conclusion that most of the universe is Dark Energy. As a result, it is now known that the universe is likely to just keep expanding, faster and faster.

Although the discovery was an international effort, Warrick was one of the pioneers of the project, playing a lead role in the Supernova Cosmology Project with observations that began at the Anglo-Australian Telescope almost 20 years ago.

"When we began the observations, detecting supernovae at such vast 'cosmological' distances was extremely challenging, so the radical findings are a great triumph for telescope and detector technology development," Warrick said.

Swinburne University

Australian Materials Research Excellence Acknowledged by the International Union of Materials Research Societies

The International Union of Materials Research Societies (IUMRS) is a global union of technical groups and societies dedicated to promoting interdisciplinary materials research and education worldwide. The IUMRS has adhering bodies and institutional affiliations around the world. Australia is an adhering body of IUMRS through the Australian Materials Research Society (AMRS). AMRS is an umbrella organisation that endeavours to provide the connection with IUMRS for materials practitioners across a number of societies in Australia with a strong interest in Materials.

The establishment of the ARC Research Networks, notably the Australian Research Network for Advanced Materials (ARNAM) and the ARC Nanotechnology Network (ARCNN), has given a boost to the co-ordination of materials research events and activities across Australia. The networks have played an effective role in promoting the strength of materials research and interdisciplinary activities not only in Australia but internationally.

IUMRS supports two prime multidisciplinary materials conferences around the world, the International Conference on Advanced Materials (ICAM) and the International Conference on Electronic Materials (ICEM). It is a requirement that such meetings run a minimum of 15 topical symposia in areas where the host country has particular strengths but covering the broadest possible spectrum of interdisciplinary materials areas. Furthermore, there must also be a symposium on Materials Education. Attendance is expected to be more than 1500. AMRS was successful in bidding for the ICEM08. (see Conferences)

ICEM08 is the first major international conference covering a broad range of interdisciplinary materials topics to be held in Australia. It will consist of 19 topical symposia (including a materials education symposium) and one network meeting within the thematic areas, and will be of particular interest to materials researchers and students where the research outcome has electrical/electronic, optical, energy and environmental applications.

The format of the conference will include: plenary lectures from Nobel Laureates and internationally renowned scientists, about 150 invited oral presentations from international experts in the topic areas covered by individual symposia in parallel sessions, as well as contributed oral and poster sessions. Many symposia intend to publish papers in high impact international journals or symposium proceedings.

Further details can be can be found on the conference website: http://www.aumrs.com.au/ICEM08

Jim Williams, Director Research School of Physical Sciences and Engineering, ANU and Chairman ICEM08.

AIP Community Policy – Draft for Consultation

Introduction

The AIP has a range of policies[1] related to its purpose of 'promoting the role of physics in research, education, industry and the community'. The first of these policies to be reviewed in the current cycle is the Community Policy, comprising elements of the current Environment and Public policies. In September 2007, the draft policy was circulated to AIP branches for comment. In response to a suggestion from Dr Laurence Campbell, Flinders University of South Australia, an additional policy supporting a carbon tax has been included.

Members of the AIP are invited to provide comments on the content of the policy, either as a Letter to the Editor (ap-editor@renegadescience.tv) or as a private comment to the Science Policy Convener, Dr Judith Pollard, School of Chemistry and Physics, The University of Adelaide, SA 5005, email: judith.pollard@adelaide.edu.au

Draft Community Policy

Introduction: The AIP is the leading advocacy group for Physics in Australia, with a vital interest in promoting Physics in the general community, and providing expertise to guide national policy.

1 Perceptions of Science

1.1 Policy: The AIP supports initiatives to enhance interest and excitement in Science, and to demonstrate that there are rewarding, challenging and creative careers for scientists
Reason: There is a growing gap between the supply of scientists and mathematicians in essential areas and the demand.

1.2 Policy: The AIP supports the idea of a national campaign (similar to advertising for the armed forces) showing the many varied and interesting careers available in Science and Mathematics.
Reason: There is a serious disparity between the public reliance on science and technology and community perceptions of employment prospects in this area. A national campaign will produce additional material for careers advisers.

1.3 Policy: The AIP promotes a strong Physics, Chemistry and Mathematics culture in Australia with support from Government and Industry, to promote the image of enabling sciences nationally.
Reason: The aim is to highlight the role of the enabling sciences.

2 The Environment

Introduction: Protection of the environment is of utmost importance for the well being of all forms of life on Earth, not least in Australia with its unique flora and fauna. The Physics Community is in a strong position to have a dominant and positive impact on these issues. Physicists have the skills to understand complex systems, and already make significant contributions in the fields of climate modelling, biospheric modelling, ground water modelling and ocean modelling. These skills are also contributing to the understanding of the functioning of complex biophysical systems that form the foundation of how the planet will change in the future.

2.1 Policy: The AIP supports scientifically sound discussion leading to the development of environmental strategies based on sound scientific principles and evidence.
Reason: Policy decisions should be informed by scientific evidence. The AIP has the authority to contribute to public education in many aspects of environmental science.

2.2 Policy: The AIP promotes the development and implementation of technologies that preserve the environment.
Reason: Environmental issues are becoming increasingly important and will present new business opportunities in methods and technologies that help preserve or remediate the environment.

2.3 Policy: The AIP promotes research into the effects of greenhouse gas emissions on the environment, and their relationship to regional and global climate change.
Reason: There is growing awareness of the potential for rapid large-scale climate changes, some of which are already evident. These include rises in sea levels associated with melting of the polar ice caps, combined with thermal expansion; acidification of the oceans due to increased gas concentrations; and increased rates of extreme weather events. Scientific research into these changes is vital for the formulation of appropriate policy.

3 Energy

3.1 Policy: The AIP supports the development of a range of energy sources and energy storage systems.
Reason: New sources of energy and methods of transportation involving greatly reduced emission of greenhouse gases are vital to Australia and the world. Improved energy storage systems will

allow more effective use of renewable energy sources, including solar and wind. The Physics Community is in a strong position to contribute to the development of these technologies.

3.2 Policy: The AIP supports the development of policies and practices which improve energy efficiency.
Reason: Generation and use of energy depletes the Earth's resources. These effects can be reduced by improving energy efficiency.

3.3 Policy: The AIP supports the development of a public education campaign to promote the efficient use of energy in everyday life.
Reason: Demand for additional energy sources will be reduced if more people implement simple and inexpensive changes to improve the efficiency of energy use in the home and private transport.

3.4 Policy: A tax should be applied to carbon as it is produced. The rate of tax should be increased with the concentration of CO_2 in the atmosphere (e.g. as the fourth power of the concentration). Other taxes should be reduced so that the change is revenue-neutral.
Reason: There is unlikely to be any serious development of zero-CO_2 sources of energy while coal-based energy remains cheap. A tax on carbon, increasing in a predictable manner as total CO_2 concentration in the atmosphere increases, would encourage the development of zero-emission energy sources, energy efficiency and lifestyle changes.
The tax is more likely to be acceptable if it is off-set by reductions in other taxes.

4 Equal opportunity

4.1 Policy: The AIP advocates an inclusive equal opportunity policy for all, and encourages such policy in the Physics employment, education and social communities.
Reason: Successful science requires input and participation from as broad a cross-section of the population as possible (regardless of gender, age, race and ethnoreligious affiliation, marital status, disability, political or religious belief, sexual orientation, transgender, family or carer's responsibility) so that it can address a range of problems that affect all people.

1. AIP Science Policy available at http://www.aip.org.au/about.php#policy.

A Short History of the Australian Institute of Physics Part 2

From the Formation of the Australian Branch of the Institute of Physics to the Establishment of the Australian Institute of Physics

Anna Binnie
a.binnie@mail.aip.org.au

Introduction

We concluded the previous episode with the local members agreeing to a Constitution for the Australian Branch of the Institute of Physics. This agreement occurred on 2nd June 1944. This second instalment will examine the part played by Physicists in Australia during the Second World War and the role of the Australian Branch during this period. This paper will also examine the activities of the Australian Branch and the factors that lead to the establishment of an independent Australian Institute of Physics. The period in question spans the years from the late 1930s to the early 1960s. The final instalment will examine the role and activities of the Australian Institute of Physics from its inception to the present. This final section will appear in early 2008.

Physicists and the Second World War

1939 was also a crucial year in world politics, the clouds of war had been on the horizon and finally in September when Germany invaded Poland, Western Europe and Britain declared war on Germany. As a British ally Australia was also at war. 'Towards the end of 1938 the Minister of defence requested co-operation of the Australian Branch in the preparation of a register of physicists for use in the event of a national emergency'[1]. In response, a register of all physicists working in Australia was made. A copy of this register is located in the AIP Archive but time did not permit me to investigate this further. In the Annual Report of the Australian Branch, dated 26th February 1941, it was noted that 'on the outbreak of war copies of the Register of Australian Physicists, prepared by the Branch, were made available to the Prime Minister's Department, the Defence Forces and the Supply and Development Departments. We were informed that this register has been found of great value by the Commonwealth Government'[2]. The 1939 conference for Physicists held in Melbourne in August saw one session devoted to a discussion of ways in which Australia's physicists might best contribute to the nation's effort in the war that was obviously coming.[3] In fact, this session was a Special Meeting of the Branch, held on 24th August 1939 to discuss ways in which the branch could co-operate with the Government in such a way that Physicists could assist 'the particular needs of the nation in time of emergency'[4].

During the war years certain professions were deemed 'protected' and individuals in these professions were seen as serving the 'war effort' by continuing in their professional life. Physics and physicists may well have been placed in this category; this is not to say that physicists were any less willing to serve the nation in combat. It should also be noted that many married women trained in mathematics and physics saw the war years working as teachers only to return to the home after the end of the war. Until the late 1960s married women could not be employed in the public service and many other professions as permanent employees, in fact women were expected to resign from their employment as soon as they married.

The CSIR had by 1939 established two physics based divisions, the

Fig. 1 Fredrick White CSIRO Archives

National Standards Laboratory, which was located at the University of Sydney, and the Division of Aeronautics, both of these divisions would see increased employment of physicists during the war years[5]. Unknown to many physicists was the establishment of the Radiophysics Division under the direction of David F. Martyn (1906-1970). The purpose of this new secret Division was to work on a secret project, radar, that was being developed in both Britain and Australia in the lead up to the war. Unfortunately Martyn was to remain at this post for only a short time before being effectively moved out by both Professor John Madsen and Fredrick White[6] (see Fig. 1). Later in the war, CSIR established the Lubricants and Bearings Section at Melbourne University under Philip Bowden who was an expert on surface physics.[7]

As I've stated in Part 1, the Branch was officially established in 1939 and the Constitution adopted in

A Short History of the Australian Institute of Physics Part 2

1944. The period between these years saw Thomas Laby as the first Chairman (1940-41) followed by Kerr Grant (1942-43) and A.D. Ross (1944-45). A.D. Ross was the Honorary Secretary from 1939-1943 and in 1944 he was followed by George Briggs who was Honorary Secretary from 1944 -1949. Ross as Secretary and later as the Chairman of the Branch regularly wrote to the Government during the war. His letters were not so much concerned with the war effort per se but with what would happen after the war.

As a method of preventing large scale unemployment and the subsequent recession that was caused by the massed demobilisation of serving troops after the First World War, the Australian Government, initially under Menzies but later enhanced and developed further by Curtin and Chiefly, had established the Department of Post War Reconstruction. It was concerning the issues of Post War reconstruction that A.D. Ross wrote to both, John Curtin, the Prime Minister and 'Nugget' Coombs, the Secretary of the Department of Post War Reconstruction, starting in 1943.

Ross wanted a Physics representative on the Committee working to determine what would be the national requirements after the war. Ross was unsuccessful in getting the type of representation he requested but one of his letters articulates many of the concerns that he and the physics community had at this time. The letter, dated 18th October 1944, was addressed to The Prime Minister, John Curtin, states

'... we are concerned regarding the large number of radio technicians who will suddenly be set free and who have little or no training to equip them for future employment ...

The shortage of science teachers has become very acute, and State Governments do not seem to contemplate steps adequate to meet requirements. It is unlikely that many demobilised men will take up school teaching of science unless conditions are made more attractive.

A large number of Australian scientists are now employed in research work in connection with branches of the Service, munitions making, and the like. The period of demobilisation would be ideal for development of research departments to assist Australia's Post-war industrial expansion.'[8]

Many of these concerns have remained with the physics community, there is still a shortage of suitably qualified physics and mathematics teachers, there are limited industrial research positions open to physicists and there is still a shortage of technically trained individuals.

Ross makes a further point in this letter which requires further debate, this point states in full;

'Australia should now be investigating some of the fundamental problems of science which may revolutionise industry in the future. I have in mind the construction of at least one cyclotron in Australia. Control of atomic energy would completely alter the whole question of man's use of power, and there is no reason why Australia should not be at the forefront of this. It would involve the provision of considerable funds and staff and there is no possibility of the work being commenced at the disposal of the Universities, the CSIR or other Government Departments'[9].

In 1943 atomic energy was placed under extreme military secrecy both in the UK and the US. The question begs to be asked how did Ross know about it and be familiar enough with it to write to the Prime Minister as a concern of the Australian Branch? The answer most probably lies in one man, Marcus Oliphant. Oliphant had been involved with establishing the MAUD Committee and had some involvement in the British Tube Alloys project and by 1943 had been attached to the Manhattan Project and was responsible for insuring that at least one Australian (Burhop) was seconded to the project in Berkeley. Oliphant had also sent a summary of the MAUD Committee report to Australia's Minister in Washington, Richard Casey. One copy of this summary was sent to (then) Prime Minister, Robert Menzies, but another copy found its way to David Rivett at the CSIR. Oliphant had addressed a Council meeting of the CSIR; the meeting was held in camera and no record remains, but the topic was 'uranium'. Finally, Oliphant had spent a few days as Ross' guest in the Physics Department at the University of Western Australia in 1943[10].

Development of the Australian Branch

When the Australian Branch was formally established, most of the population of members was located in two states, New South Wales and Victoria. These two states formed the first Divisions with the new branch. In 1944, the South Australian Division was formed and in 1947 the Queensland Division was formed. The Western Australian Division was in existence by 1945, but its formation date is uncertain, it may well have been a Division from 1943 since A.D. Ross would have seen to it that Western Australia would not have been left out. The ACT Division did not come into existence until 1960 when the ANU had become an established university and an employer of a significant number of physicists who, together with members for the Mt Stromlo Observatory, formed the nucleus of this Division. Tasmania, despite having an established University with an

A Short History of the Australian Institute of Physics Part 2

active physics department, did not become a Branch until 1965, after the Australian Branch had become an independent Institute.

In 1945, for example the administrative committee structure of the Australian Branch was made of:

- President who remained in office for a two year period,
- Vice-President who would become the next President and was in office for a period of two years,
- Honorary Secretary-Treasurer who took the office for an 'extended' period. This position was split into two separate positions (Honorary Secretary and Honorary treasurer) in 1950.
- A Committee made up of 8 members; three from NSW, two from Victoria and one each from South Australia, Western Australia and Queensland. This ratio reflected the membership distribution.

This structure would remain, with minor variations for the life of the Australian Branch. Each Division was run by a local committee and had a Divisional Chairman. Most activities were organised by this local committee. Despite the war, there appears to be evidence of some lectures and meetings taking place in both Melbourne and Sydney during the war years. One of the first representations made by the new Branch seems trivial in retrospect, but reflected the modern views of the members of the Branch. The University of Melbourne had established its Physics Department in the Victorian era when Physics was still called Natural Philosophy. The name remained until 1943, when at the General Meeting on 13th February 1943 the Branch approached the University of Melbourne to change the name from Natural Philosophy Department to the Physics Department. The University agreed (possibly because there had been other representations from within the department over a period of years) and the name change took effect from 1st January 1944.

Atomic Energy

After the war, the issue of secrecy with respect to physics research became important, with the secrecy surrounding atomic energy being of primary concern. As previously mentioned atomic energy was developed under secrecy during the war, but in peace time the technology of atomic energy was seen in a different light. The NSW Division, in 1946, wanted the Institute of Physics to clearly state that atomic energy should not remain a military secret and that this technology should be made available for peaceful purposes. John Lewis in his history of the IOP 'Promoting Physics and Supporting Physicists' refers to this particular issue under the sub-heading 'Ethical issues'. It is worthwhile to explore these discussions in full.

The episode began when the IOP published in its "Notes and News' dated April 1946 the following;

'During the past months, suggestions have been received by the Board from members at home and overseas that it should express the Corporate view of the Institute regarding the use of Atomic Energy and how far the scientific and technical information connected with recent developments should be published. The Board is of the opinion that no useful purpose could be served by the issue of such a statement. ... It desires members to know that it is in full agreement with the views expressed by the President of the Royal Society.'[11]

It is unknown whether the members of the NSW Division knew what The President of the Royal Society had said, but for completeness, Sir Henry Dale the (then) President of the Royal Society had said;

'If, by submitting for a while to secrecy, we could help to save that freedom and establish it for ever we could not hesitate; but we must be watchful now against any assumption that submission will be continued into peace. ... It is surely our duty as men of science to help the world with our knowledge to make that decision, and to make clear our own views and intentions. ... I think that we, as scientists, should make it clear to the world that, if national military science were allowed thus progressively to encroach upon the freedom of science, even if civilisation should yet for a while escape the danger of final destruction, a terrible, possibly a mortal wound would have been inflicted on the free spirit of science itself.'[12]

On 9th July 1946 the NSW Division passed and circulated the following resolution to all the other divisions in the Australian Branch;

'1) In the light of our present knowledge and in the belief that the members of the Institute are virtually unanimous in their support for international control of those aspects of atomic energy capable of being used to destructive ends, this meeting considers the Board should publically(sic) support the recommendations made in the report on the International Control of Atomic Energy prepared for the US Secretary of State's Committee on Atomic Energy, which ... is being submitted to the United Nations Atomic Energy Commission, or If, in its fuller knowledge, the Board does not support the above recommendations as representing the views of the Institute, it should publically(sic) state the alternatives to which it subscribes.

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2) This meeting considers the Board should have prepared from time to time factual analyses of the scientific information likely to be of importance in determining future lines of action in connection with atomic energy considerations and that these should be made available to members and, possibly in a modified form, published for general distribution.

Fig. 2 Joe Pawsey CSIRO Archives

3) This meeting considers the Institute should endeavour to collaborate with other bodies of scientists throughout the world in measures designed to prevent war and to promote the application of science to the well-being of humanity and that the Institute should promote by all means within its power the free exchange of all scientific information between scientists of all countries.'[13]

A.D. Ross responded to the NSW Division's resolution, by writing to Esserman who was one of the NSW representatives on the Australian Branch Committee, on 5th August stating that, 'I do agree that the Board of the Institute might take a rather more active part at this important juncture in the history of Physics. Our Institute is a professional association, and the Board of the Institute should be expected to give members advice on the stand which they might take with regard to questions which have a direct bearing on the profession.'[14] The Victorian and South Australian Divisions expressed support for the NSW resolution. It appeared that all the Divisions within the Australian Branch were supporting the view that the Institute should have a policy position on the issue of atomic energy and secrecy.

The NSW Division resolution was further discussed at the 13th General Meeting of the Australian Branch on 22nd August, from the minutes of that meeting under 'other business' Joe Pawsey (see Fig. 2) asked 'what action ... the Board proposed to take on the use and control of atomic energy?' The President of the Branch responded that he had 'discussed this matter with the Secretary of the Institute who informed him that the Board had given serious consideration to the matter and had decided that for the time being it would take no action. The Board preferred that any action by physicists, if taken, should be without the official support of the Institute'. The issue of control of atomic energy was one of the most important issues of this period. The UN had established an Atomic Energy Commission, the US had produced and published the Smyth Report and the Australian Commonwealth Parliament had discussed and passed the 'Atomic Energy (Control of Materials) Act'. The Institute was reluctant to take a public stance.

The Institute Board drafted a response to the NSW Division resolution on 2nd January 1947. The Board had rejected all three parts of the resolution and reiterated its previous response stating that atomic energy should be used for peaceful purposes that required an international agreement[15].

The Board's response was sent out to all the Australian Branch Divisions. A copy was also sent to the Secretary of the Branch George Briggs who was still in New York forming part of Australia's delegation to the UN Atomic Energy Commission. Briggs had left Australia before the NSW Division had passed its resolution. He wrote Sir John Madsen, the President of the Australian Branch on 1st April 1947, stating

'from my experience as scientific adviser to the Australian representative on the Atomic Energy Commission I came to realise more fully than I would have otherwise that there are eminent scientists who hold views contrary to the majority in regard to the methods and procedure for the control of atomic energy'.[16]

Fig. 3 Hugh Webster
Courtesy of the University of Queensland, UQAS909

Briggs' letter was also forwarded to all the Divisions. Letters in response to these were received within a week. Leslie Martin from Victoria, Kerr Grant from South Australia and A.D. Ross from Western Australia stated that they agreed with the Board. Hugh Webster (see Fig. 3) from Queensland totally disagreed with Briggs and stated in his response dated 9th April, '... appears to me

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that the Board are endeavouring to side –step their responsibilities in the matter which is one which greatly affects the Profession, and therefore quite properly comes within the scope of the Institute ... the views of the Institute should carry particular weight in that it includes physicists of all political opinions. The fact that the minority might include eminent physicists should not be allowed to overrule the wishes of the majority'. He further suggested a postal ballot to find the views of all members.[17] The last response came on 16th April, from Alan Harper (see Fig. 4) from the NSW Division who felt that the draft response from the Board was essentially 'sitting on the fence'.

Fig. 3 Alan Harper

Physicists in Post-War Australia

The Commonwealth had decided, as part of its Post War Reconstruction, to establish a university in Canberra. The structure of this new institution would be based on an American model, which comprised a small undergraduate teaching university as one small section and the other main part would be a grouping of research institutions engaged in research and the training of postgraduate students. This University became the Australian National University. The Australian Branch of the Institute of Physics had its part to play in the establishment of this university.

At the 23rd August 1946 Meeting of the Branch it was noted that the President (J. Madsen), Honorary Secretary-Treasurer (G. Briggs) and other members of the Institute 'served on the Committee to advise on the Institute of Physical Sciences'[18]. It is not stated what work this committee did, however from other sources it appears that part of the advice would have been to nominate the Director of the Institute of Physical Sciences. Two names were considered, the first choice was Harrie Massey who had been approached by 'Nugget' Coombs during a break at the Prime Ministers' Conference in London in May 1946. Massey who was at University College London at the time, was not very interested in going back to Australia. He suggested that Marcus Oliphant mignt be interested.[19] It was Marcus Oliphant who finally became the first Director of the research School of Physical sciences at the ANU.

Secrecy in Post War Science

There were accusations as early as 1947 that communist scientists were being employed by CSIR[20]. Oliphant summarised this attitude when he wrote 'The presence of men from CSIR, which has specifically rejected secrecy, in the Atomic Energy Establishment at Harwell and the fact that at least one Australian who served with the British team on this project in America has turned out to be a member of the Communist Party, add to their worries'[21]. The different attitudes to security between the CSIR and both Britain and the Defence Department in Australia led to great pressure being placed on CSIR. At this time, the Chairman of the CSIR was David Rivett who had been appointed to this position in February 1946 after a long and distinguished career in the CSIR. Rivett objected to any secret scientific work being carried out in the CSIR, but he accepted that in time of war this was reasonable[22].

Rivett addressed the issue of secrecy in science when he spoke at the University College in Canberra in March 1947 stating: 'The CSIR and the universities must maintain in Australia the spirit of science, which can live only in an atmosphere of freedom. If a government wishes to prepare secretly for the destruction of other sovereignties they should not conduct it in research institutions which respect their traditional freedoms of science'[23]. Rivett was an idealist who was looking to re-establishing the public nature of scientific research in Australia. Harold Breen (1893-1966), a senior Public Servant, commented about Rivett: 'He believed with all his being the duty of the scientist was to explore and publish his findings. He regarded any deviation from this as a betrayal of principle and disruption of the purpose for which CSIR was founded'[24].

Despite Rivett's idealism, in September 1948, he was attacked in Parliament by the conservative Opposition, and it was suggested 'that secret information to which CSIR officers had access was not adequately protected'[25]. Of primary concern was the nuclear work. This accusation was echoing the concerns of the US and Britain as to Australia's lack of security in nuclear matters. Despite the support from his Minister, John Dedman, and the Prime Minister, Ben Chifley, Rivett's accusers would not be silenced. It appeared that the CSIR was full of individuals who could be potential spies and hence threaten Australia's national security.

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The government was now forced to reconsider the structure of the CSIR and bring it under the control of the Public Service Board. This control would ensure that all applicants to the organisation were to be screened by an independent authority, and further, that the organisation as a whole would be more accountable for all its financial transactions. The Dunk-Coombs Act passed on 18th May 1949 reconstituted the CSIR as a new organisation, the CSIRO. Rivett retired from CSIR on 2nd April 1949[26].

The Australian Branch was concerned with this debate on scientific secrecy in peace time as well. The General Meeting of the Branch, 14th January 1949 held in Hobart passed the following motion concerning the vetting of scientists who were to work for CSIRO, 'This meeting expresses its concern at the recent Commonwealth legislation concerning CSIR and directs the Branch Committee, as a matter of urgency to examine the statement on this matter sent to the Government by the ANRC and, as it deems fit, endorse or amplify that statement in a letter to the ANRC or to the Commonwealth Government'[27]. Needless to say CSIRO became part of the Public Service and all seeking employment are vetted by ASIO. Further, in 1953 when the Australian Atomic Energy Commission was established, staff members of this organisation were also vetted. The universities are the only 'public' employers who do not vet their staff.

The Branch Grows and Develops

The Branch was now considering its membership and representation. One of the side benefits of the war was the improvement in transport between the states and improvements in telecommunication. The General meeting held in Sydney at the National Standards Laboratory on 19th July 1949 considered two issues: the inclusion of the increasing numbers of students and young graduates in physics; and the increased work load of the Secretary-Treasurer. The meeting considered that the 'Standing Order Amended to allow an increase in size of the Branch Committee and for representations from all states and territories' and 'minimum ages for election to Associateship and Fellowship are raised to 25 and 30 years respectively'[28]. The meeting also suggested that the position of Honorary Secretary-Treasured be turned into two separate positions, Honorary Secretary and Treasurer and the committee be expanded from 8 to 9 ordinary members.

This meeting also proposed that a new grade be created, that of 'Graduate' and that the 'qualifications for graduate shall be a pass degree in physics without research experience. The grade will serve as a step between Student and Associate. The Secretary is awaiting information as to whether this grade will be open to persons, such as teachers, who hold pass degrees but have not the additional qualifications necessary for Associateship'[29]. The past membership requirements had effectively excluded all pass physics graduates many of whom were teachers. The Branch was now attempting to reach out to all physicists and include them into the professional organisation. The under representation of teachers in the Branch would continue throughout the 20th Century and into the 21st Century. Teachers with physics qualifications were usually members of Science Teachers Associations within their own states and their respective teacher unions and many felt little need or desire to join yet another organisation which catered largely to the research and university community.

Soon after the war the branch returned to organising conferences. It should be remembered that ANZAAS Conferences still had a physics and mathematics section in their biennial congresses but the Australian Branch returned to hosting conferences for physicists. These post war conferences began as specialist conferences, which were in part educative in nature and partly a sharing of recently completed research. The first of these specialist conferences was organised in 1948 and was entitled 'The Heat Transfer Conference'. It was held in Sydney, 25-27 August. This was followed by the X-Rays in Industry Conference held in Melbourne held 9-11 November 1949.

Other specialist conferences followed regularly, an indication of the manner in which physics was developing in the immediate post war period:

- 1950 Photometry and its Applications held 7-10 November in Sydney
- 1952 Radio Science in Sydney
- 1956 Scientific Manpower in Melbourne and Contemporary Optics in Sydney
- 1958 Atomic Energy Symposium in Sydney
- 1959 Solid State Physics and Contemporary Optics in Melbourne
- 1960 Theoretical Physics
- 1961 Ionospheric Physics in Brisbane

The Australian Branch had functioned utilising State Divisions to organise local lectures and activities. In the late 1950s another need arose amongst physicists, that of communicating and sharing ideas of a specialist nature. The 1958 report from the Branch it was noted that 'Under the Chairmanship of Dr J.S. Dryden, the NSW Division formed a "Solid State Physics Group". This is the

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first specialist group formed in Australia'.[30] Other groups would follow, some would be wound up and others are still going, these will be discussed in Part 3 of this history.

The Beginnings of Independence

When A.D. Ross reflected on the History of the Institute, he reminisced 'From time to time senior officers of the Branch have raised the question as to whether we should be more affective as an Australian Institute than as a Branch of a London organisation. Dr Briggs pressed this matter strongly when he was President of the Branch in 1951'[31]. From February 1951 George Briggs started to campaign for an Australian Institute. On 1st February he wrote to Webster and McAulay stating his wish to establish an Australian organisation. He then went to Adelaide and met with the Divisional Committee and had similar meetings in Sydney and Melbourne[32]. At the General Meeting of 24th May 1951 held in Brisbane, there were proposals to establish an Independent Australian Institute of Physics. The Branch committee had communicated with London and had received a favourable reception for it.[33]

The next step was taken at the General Meeting 22nd August 1952 held in Sydney. There was a proposition that there should be formed an Australian Institute of Physics 'At the request of the Chairman, Dr Briggs outlined the present position in relation to the proposal to form an Australian Institute of Physics. He stated that support had been expressed at meetings at most Divisions except Victoria where there was a strong body of opposition to the proposal'. This meeting also approved the change in standing orders that allowed the Chairmen of Divisions within the Branch to be ex-officio members of the Branch Committee'.[34] There was, also, a motion to send a questionnaire to all members seeking their responses on an independent body and whether it should be an Institute of Physics or a Physical Society. Unfortunately this landmark General Meeting only managed to change the standing orders. By August Briggs reported to Oliphant that four Divisions had approved the move. However, it would take another 10 years and much more discussion before an Australian Institute would be formed. According to Alan Harper's unpublished memoirs, the real problem seemed to be that many of the physicists had come from Britain, wishing to retain their membership in the IOP, were unwilling to desert it in favour of an Australian Institution. The early 1950s also experienced the election of the shortest serving President of the Branch.

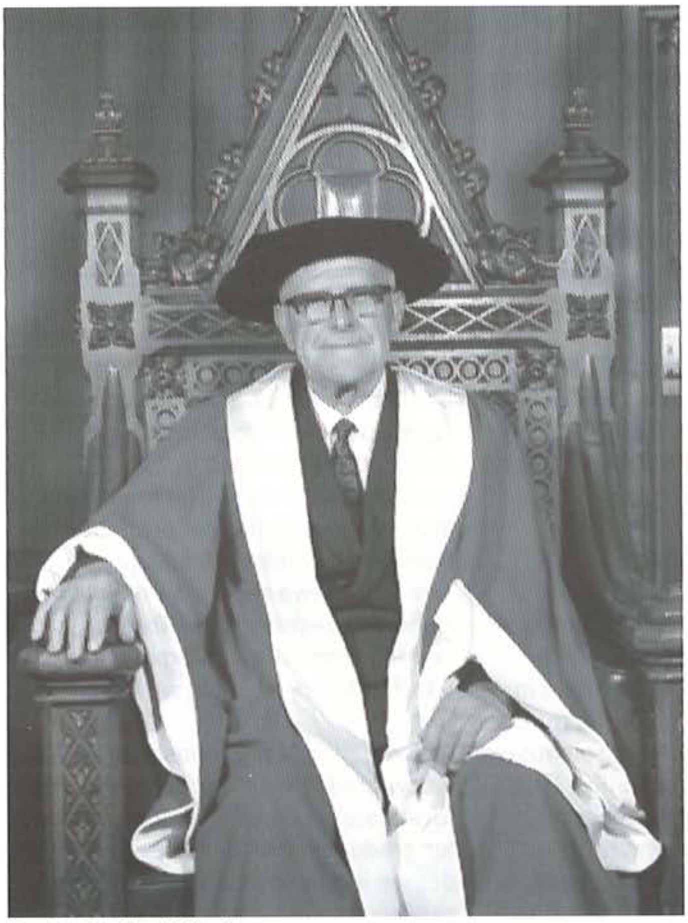

Fig. 5 Leslie Harold Martin
Photographer Norman Wodetzki
University of Melbourne Archives
Image UMA/2238

In early March 1953 Leslie Martin (see Fig. 5) approached Marcus Oliphant and invited him to be the next Vice President of the Branch. Oliphant initially declined on 25th March 1953 but then after what appears to be some lobbying by telephone he accepted on 31st March 1953 and categorically emphasised that he did not want to organise meetings[35]. All seemed to be going well, Oliphant is duly elected President of the Branch; but at his first General meeting on 16th January 1954 as Chair the meeting, he resigned. 'Professor Oliphant said that, since accepting nomination, he had undertaken additional responsibilities as President of the National Academy of Science and that he thought it would not be wise to occupy both posts of responsibility since the Academy and the Institute might not always agree on matters of policy. He asked, therefore, that he might be relieved of the Presidency of the Branch'[36]. The Branch was now in turmoil and finally on March 25th 1954 the Branch Committee elected Leonard Huxley as President for 1954-55[37].

Fredrick White who was President of the Branch wrote to his Vice President Hugh Webster on 16th September 1957 complaining that

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Harry Messel had criticised the Institute for not 'being sufficiently active in organising interstate meetings' and 'another feature of the Institute which always seems to me to militate against such things is the lack of harmony amongst the different groups'. Webster suggested that perhaps the Institute get Messel more involved but it appeared that Messel wanted to establish his own organisation, a Physical Society[38]. The notion of an Australian Institute of Physics had never completely disappeared and by the late 1950s plans were well advanced to bring this about.

In 1959 there was again some discussion as to who should be nominated as Vice President, Messel or Huxley. Hugh Webster had revived the issue of a separate Australian Institute and had worked well with Joe Pawsey to this end. The issue in this case was who would best work with Joe Pawsey to bring about the inauguration of the Australian Institute of Physics. This person was also likely to be the first President of the Australian Institute of Physics. After some consideration Huxley (see Fig. 6) is given the nomination[39]. The Australian Branch would consider very carefully any nomination of a high profile physicist such as Messel. In the end Harry Messel never served as president of the Australian Branch or of the Australian Institute of Physics when it was finally established; nor did Messel ever establish a Physical Society in Australia.

Fig. 6 Fred Huxley
Photo courtesy of University of Adelaide Archives

The Australian Institute of Physics

The First Annual Report of the Australian Institute of Physics provided little of the immediate history to the events of 1962,

'The AIP is the logical out growth of the Australian Branch of the IPPS which was initiated largely through the work of the first secretary Prof A.D. Ross in 1924 ... the proposal first received general consideration by the members of the Branch in 1951, when under the Presidency of G.H. Briggs members were asked to vote on the proposal to form such a body. The majority decision was that the time was not then appropriate for such a move ... In 1959 under the Presidency of Prof H.C. Webster the proposal was revived and on the instigation of the Branch Committee the Executive of the Branch, under the leadership of the late Dr J. Pawsey, President of the Branch for 1960, went into the matter. ...A meeting of the inaugural Council of the new body was held in November 1962 ... The first meeting of Council and inaugural General meeting of the Institute were each held in Sydney on 14th May 1963.[40]

The process by which the AIP was established was indeed laborious. All the State Divisions were consulted, discussions in each of the states occurred and members consulted. Alan Harper who was then Secretary of the Branch was in regular contact with the Secretary of the Institute of Physics. The Institute was supportive of the establishment of an Australian Institute of Physics. According to Harper's unpublished memoirs,
'as a gesture of support the Council of the British Institute had proposed some very favourable arrangements whereby members of the branch could retain membership of the British body at a greatly reduced subscription if they joined the Australian Institute'
Further, the Council of the Institute had decided to transfer the funds of the Australian Branch to the Australian Institute. Thus when the Australian Institute was finally formed it would be an independent and financially viable body.

It was Harper's job to prepare an analysis of the proposal to form an Australian Institute, send it to members requesting comments and analyse these. Harper and Frank Nichols then drafted a Constitution for the new Institute and circulated this to the membership. Eventually it was decided to hold a plebiscite of all members. This occurred in the days when communication was done mainly by postal mail. The papers were prepared, and sent to all members of the Institute of Physics resident in Australia.

Members were asked whether this independent body should be an Institute of Physics or a Physical

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Fig. 7 Frederick John. Lehany CSIRO Archives

Society. An Institute of Physics would be a professional body while a Physical Society would be non-professional and would act as an interest group. The response was overwhelmingly for an Australian Institute of Physics. Finally a plebiscite was arranged, all the respondents had to return their ballots by a predetermined date.

The final meeting of the Australian Branch of the Institute of Physics was held on 21st August 1962 at the University of Sydney. Leonard Huxley who was then President and Chair of the meeting called on J.S. Dryden to announce the results of the plebiscite of all members:

536 ballots were sent out and 304 were returned. Of the returned ballots there were 2 abstentions (both elderly members), 16 were against and 286 for the formation of a separate entity, the Australian Institute of Physics.

In addition a further 31 Ballots were received after the close of balloting with 2 against and 29 in favour.[41] Thus with an overwhelming vote for the independent body from the 57% of the members who bothered to return their ballots, the Australian Institute of Physics was about to be born.

After the ballot was announced, the President, Leonard Huxley, moved the following resolution, which was seconded by A.D. Ross,

'The opinion of a strong majority of Members of the Branch, as expressed through the recent plebiscite, having been in favour of the proposal that an Australian Institute of Physics be formed to take the place of the Australian Branch of the Institute and Society ... this meeting hereby recommends to the Council of the Institute of Physics and Society that as soon as is convenient following the formation of the proposed Australian Institute of Physics the Australian Branch of the Institute and Society be dissolved'.

The resolution was carried unanimously. A second resolution expressing gratitude to the Institute of Physics and an agreement for continual co-operation was also carried unanimously. The third and final resolution was moved by the President and seconded by the Vice President, F. Lehany (see Fig. 7), was carried unanimously. This third resolution gave birth to the Australian Institute of Physics and stated simply,

'That at the conclusion of this Meeting a meeting of those desirous of forming an Australian Institute of Physics be held for that purpose'.[42]

The Australian Institute of Physics finally came into existence. Many who worked so tirelessly to this end were there to savour this moment. Ross was probably the most proud. The organisation, which he worked so hard to establish had developed into an independent body incorporating the majority of working physicists. Joe Pawsey unfortunately was not present to witness this 'coming of age', he was hospitalised at this time and died a few months later.

Part 3 of this history will examine the activities of the Australian Institute of Physics from 1962 to the present.

(Endnotes)

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[34] ibid

[35] Box 5 AIP Archives

[36] Box 6 AIP Archives

[37] Box 5 AIP Archives

[38] Box 1 AIP Archives

[39] Box 5 AIP Archives

[40] AIP First Annual Report 1963

[41] Box 6 AIP Archives

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Terence "Terry" Murray Sabine 1930 - 2006

Terrence 'Terry' Murray Sabine
12th December 1930- 30th October 2006
by Anna Binnie

Terry Sabine should be regarded as Mr Neutron Diffraction in Australia. He was responsible for bringing this relatively new technique to Australia and educating Australian scientists in its use and potential uses.

Terry was educated at De la Salle College, Malvern where he was Dux of his year. In 1948 he commenced studies at the University of Melbourne from where he graduated with a B.Sc. in 1953, majoring in Physics and Theoretical physics. In 1955 he graduated again from the University of Melbourne with an M.Sc. in Physical Metallurgy, with a thesis entitled 'The Nucleation of Intergranular Cavitation'. He was awarded an M.Sc. Exhibition in 1956, for this work from the University of Melbourne.

Shortly after graduating he was recruited by the Australian Atomic Energy Commission and sent to Harwell to train in neutron diffraction techniques. As part of his training he also learned to design apparatus for use in the newly commissioned Australian research reactor, HIFAR. When he returned to Australia in 1958 Terry was put in charge of the Neutron Diffraction Group at Lucas Heights. At this time Terry had a small staff of 2 research scientists, 1 Experimental Officer and 3 Technicians. Within a year, Terry was running training schools through AINSE, instructing university academics in neutron diffraction techniques.

The first two papers employing this technique appeared in 'Nature' in 1961, just over 2 years after HIFAR became critical; Terry co-authored both papers. What is significant is that both papers lead to further honours. The first appeared on 30th September 1961 and was entitled 'Scattering of Long Wavelength Neutrons by irradiated Beryllium Oxide'. The authors were three employees of the Australian Atomic Energy Commission (AAEC), T. Sabine, A. Pryor and B.S. Hickman. The three authors would, in 1964, share the Syme prize together with Terry Walker for work on beryllium oxide. Two weeks later, on 14th October, the other paper appeared in 'Nature' entitled 'X-ray and Neutron Diffraction Examination of p-Diphenylbenzene'. The authors of this paper were Professor Birkett-Clews, Dr E. Maslen, Mr H. Rietveld and T. Sabine. All, except Sabine were researchers from the University of Western Australia. (The H. Rietveld is the Hugo Rietvelt of the 'Rietvelt Method' fame.) The development of this method, while published after Rietvelt returned to the Netherlands, was started while Rietvelt was a student working under direction, and with, Terry's Neutron Diffraction Group at the AAEC.

In 1967 Terry was awarded a Senior Fulbright Travel Grant and spent a year at the Brookhaven National Laboratory in the U.S. He always talked of the generosity of the AAEC who not only paid him his usual salary but paid him a travel allowance as well.

In 1971 Terry was awarded a Doctor of Science by the University of Melbourne, in recognition of his contributions to material science through the use of neutron diffraction. This degree was awarded on the merit of his collected publications under the title 'Research in Neutron crystallography and Irradiation Damage'. Then in 1972 Terry left the AAEC to take up an academic role as Head of the School of Physics and Materials at the NSW Institute of Technology (now the University of Technology, Sydney UTS). It should be noted that Terry maintained his ties with the AAEC and ANSTO and was a regular visitor at Lucas Heights until his death. Terry remained at UTS until retirement where he was conferred the title, Emeritus Professor. He maintained an office and ties with the Applied Physics department and was still giving an occasional lecture to first year students as recently as 2005. In 1988 the University conferred the title of Professor on him. Terry maintained his enthusiasm for neutron diffraction encouraging members of his department to apply for AINSE grants.

Terry was also very active in a number of professional societies. Terry was a great supporter of the AIP and served the Institute in many capacities including: NSW Branch Committee 1966 and 1970, Branch Secretary 1971-1972, Deputy Chair 1972 and Chair 1973-74.

Terence "Terry" Murray Sabine 1930 - 2006

He also served as Vice President of the AIP 1975-76 and President of the AIP 1977-78; held the position of President of the Society of Crystallographers in Australia 1983-85; was a member of the original Australian Neutron Beam Users Group (ANBUG) established in April 1979; and became the second ANBUG President in April 1980 and again September 1982.

In 1972 he was elected a member of the Neutron Diffraction Commission of the International Union of crystallography and re-elected in 1975 and 1978. In 1986 he was appointed to the Scientific Advisory Committee, ISIS Spallation Neutron Source, UK. In 1996 he was elected a member of the Small Angle Scattering Commission of the International Union of Crystallography and re-elected in 1999. Despite these honours and a huge number of publications, Terry was unsuccessful in becoming a Fellow of the Australian Academy of Science.

In his personal life, Terry could best be described as a larrikin. He had the reputation of being a sports lover (cricket and golf) and enjoyed beer and red wine. He was a keen golfer playing regularly at his beloved Blackheath. His interests in areas outside physics were many and varied. He was a member of the Sceptics Society, coming down to Sydney for their monthly meetings, and he was a member of the Blackheath Historical Society.

As a colleague and friend Terry was always good fun. I first met him through Arthur Pryor, my PhD Supervisor. Terry provided me with information concerning the history of neutron diffraction in Australia. Later I met Terry in Melbourne where we enjoyed a meal and a day in the museum. Most recently when I was working at UTS, Terry was a frequent visitor. I enjoyed our lunches together. I had asked Terry to participate in the AIP History project and he was to be the first AIP President that I was to tape. Unfortunately, he cancelled our meeting since his cancer had returned and he was to under go surgery the next day. That was the last time I spoke to him.

Terry's enthusiasm for his work had a cost, that of family life. His first marriage to Margaret ended in divorce, as did his second marriage to Katrin. In his latter years Terry attempted to re-establish his relationship with his surviving children and grandchildren, (Terry and Margaret's eldest son William is deceased). Terry is buried in his beloved Blackheath, his grave is guarded by a huge flowering Waratah. He is survived by Margaret and two of their children and their families; Anne, husband David, children Simon and Oliver, James, wife Julie and children Andrew and Stephanie, by Catherine and their son, Nicholas and by Elizabeth.

Vale Terry, you are missed!

Finally I should like to thank the following for their assistance: Arthur Pryor, Suzanne Hogg and James Sabine.

It started (and may yet end with) physics

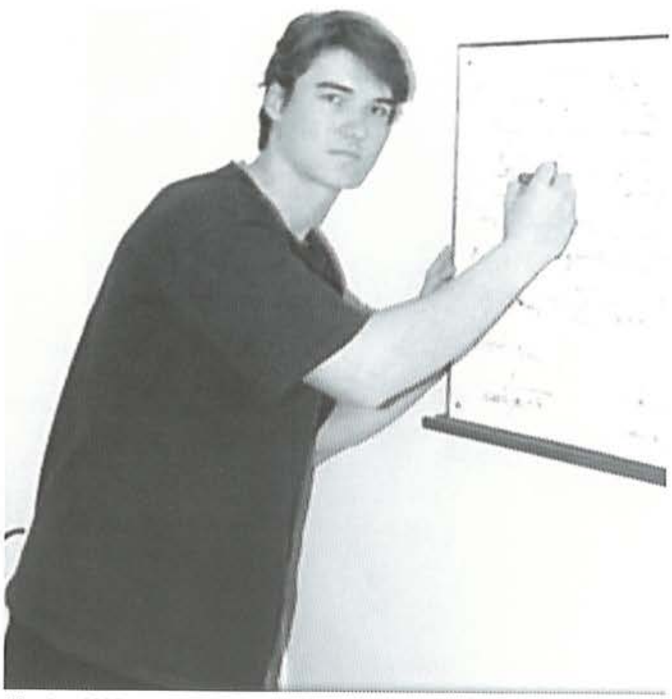
by James Yardley

It started (and may yet end) with physics

Actually it started with dismantled toys, pyromania and the deaths of many, many insects; but this is possibly going too far back and is almost certainly not unusual among budding scientists in any case. More relevantly, having become interested in maths and physics (in particular) towards the end of high school, I almost got it right and enrolled in Electrical Engineering at Sydney University in 1992. Fortunately, by the end of my first year this concession to 'common sense' had been abandoned. I continued on to do honours (1995) and then a PhD (2001) in Theoretical Physics/Electromagnetism at Sydney with Prof. Ross McPhedran as my principal supervisor.

The writing on the wall

Although I greatly enjoyed physics and mathematics and had been convinced that I wanted an academic career, during my honours degree (4th year) it had begun to dawn on me that a career in theoretical physics was going to be quite a different experience to physics coursework. It was absolutely not going to be a case of daily insights and non-stop elegant results – at least for the majority (?) of researchers there was going to be considerable time spent chipping away at a fairly small patch of the coal face. It seemed that this was partly a result of the way success in academic work is measured and also due to the simple fact that a lot has already been done. Even though this narrowness would be mitigated by the healthy interaction of workers discussing their respective patches and of course teaching, it was still a blow to my hopes. Equally significant, was the likelihood that continuing in physics research would involve competing with very able people for very short contracts that didn't pay well in countries I might not want to live in.



Physics 1995

Moving into finance

Early on in my university career I'd also developed an interest in the mathematics of gambling[1] and from this, the realisation that there was much more to mathematical finance than book-keeping. Also, the stories of mathematicians and physicists (in particular) moving into Wall Street firms had begun to filter down - or at least I started noticing them. Most importantly of all, I had some friends from university who were already working as quantitative analysts and through this link I got some part time work at St George Bank doing mostly risk modelling. This was at about the half way point in my PhD and meant that the most difficult part of selling out - landing that first job - was in my case quite straightforward.

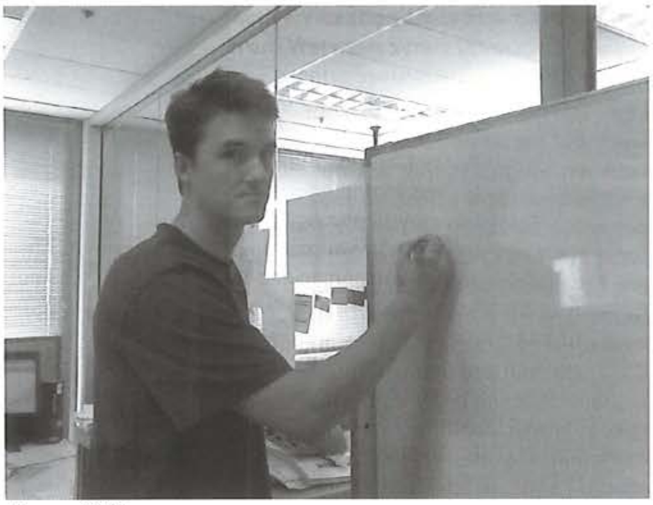
At this point I had only done half a course in the theory of option pricing and no formal statistics courses but with the typical range of physics, mathematics and computing completed by the half way point in a theoretical physics PhD, an enlightened employer might/did trust that the requisite finance could be learned on the job. This belief is justified by a long list of relevant skills a physicist might bring with them: a pragmatic approach to problem solving; the ability to reason about mathematical models in a non-mathematical way[2]; the ability to understand and patch models when they fail; the ability to think heuristically; experience with real data; some programming skills; and hopefully the ability to communicate with both technical and non-technical people.

This (albeit incomplete) list of relevant skills comprise reasons why physicists should make good quantitative analysts, but just possessing these skills does not obviate the need to actually learn some mathematical finance. Now that more courses are actually offered in mathematical finance it seems that employers are less likely to accept totally raw hard-science recruits with a view to teaching them the finance as it is needed. Worse still, even with a higher degree in physics and some mathematical finance courses under the belt there is a long-standing and partly legitimate fear among employers that such an academic person will be too aloof or otherwise unable to do anything relevant (i.e. profitable) to the business they are trying to run. To be absolutely clear: there are no jobs in finance where former physicists or mathematicians sit in the lotus position while dirty faced underlings bring forth DE's to be solved. This is not to say that jobs in mathematical finance don't contain a significant academic component, but rather that an emphasis on quick and practical solutions is usually required.

Moving further

In 2002 I took a position in the Sydney office of an American firm (Susquehanna) where my role is primarily to use quantitative techniques to identify trading opportunities. As opposed to the quantitative methods involved in risk management[3], the development of trading strategies often draws on a much wider range of mathematical techniques (eg time series analysis, signal processing, information theory etc) – not to mention numerous ad-hoc models intended to exploit a specific market inefficiency. Although still relatively scarce in Australia, the number of people in this type of role has grown on the back of the recent explosion in the number of hedge funds. Anyway, perhaps unexpectedly my exposure to the sadistic world of special functions during my PhD would prove helpful in this space. Firstly by providing a tool chest of functional forms with which to try and model any given effect, and secondly in helping me optimise these representations. Indeed, it is increasingly becoming the case in modern trading that being fast is almost as important as being smart.

Finally, to explain the qualification in the title, it is not uncommon for people who've come from various science backgrounds and have worked in mathematical finance to at least entertain the hope of one day returning to their scientific roots. Part of leaving physics in the first place meant accepting physics as an interest, not a profession and as such a successful career in finance can be a very good thing in terms of allowing people to pursue other interests later on.



Finance 2007

A couple of random references:

1/ http://en.wikipedia.org/wiki/Econophysics - people who are determined to show that mathematical finance completely reduces to solved problems in physics.

2/ "My Life as a Quant: Reflections on Physics and Finance", Emanuel Derman.

(Footnotes)

[1] The team room at one point becoming a den of trainee card counters.

[2] Mathematicians don't necessarily understand diffusion just because they can solve the diffusion equation.

[3] Although I can't attribute it, I recently heard mathematical finance (as applied to risk management) described as being like a safety net under a tight-rope that's only there when you're not falling.

Light snakes across tiny gaps
http://physicsworld.com/cws/article/news/31541

Light usually travels in a straight line – but not when it crosses a gap between two plates that are less than a wavelength apart. This strange behaviour has been known for some time, but it has proven very difficult to predict exactly what path the light will follow (Fig. 1). Researchers in the US have created a computer model that does just that, and it could be a boon to those trying to harness the unique optical properties of tiny gaps to make more sensitive microscopes and more efficient photovoltaic cells (Appl. Phys. Lett. 91 153101).

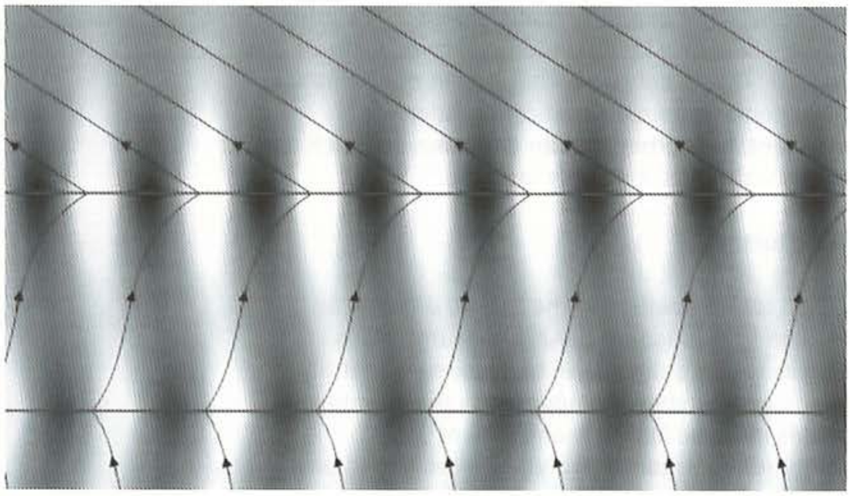


Fig. 1 Infrared light moves from a hot surface (bottom), across a 100-nm gap to a cold surface: the lines are Poynting vectors, which show the direction of energy flow between the plates. (Courtesy: Georgia Institute of Technology)

Sticky walls slow mixing
http://physicsworld.com/cws/article/news/31199

Anyone who has mixed paint, cake batter or any other viscous fluid knows that the sides of the container must be scraped occasionally because unmixed fluid tends to stick there. Although the effect of sticky walls on mixing is difficult to quantify, physicists in France and the UK have now done experiments and calculations that reveal how mixing is inhibited by the walls of a vessel. The authors admit that engineers already have a good practical understanding of mixing, industry could benefit from having a deeper knowledge of the physical processes involved. The results could lead to a better understanding of mixing in a wide range of disciplines from geophysics to microfluidics (Phys. Rev. Lett. 99 114501).

Electron microscope breaks half-Angstrom barrier
http://physicsworld.com/cws/article/news/31142

The first electron microscope to resolve features as small as half an Angstrom (0.05 nm) has been developed in the US. Known as a transmission electron aberration-corrected microscope, or TEAM, the instrument is the result of a collaboration between the US firm FEI, Corrected Electron Optical Systems (CEOS) of Germany and Lawrence Berkeley National Laboratory in California.

TEAM, which is a transmission electron microscope (TEM) and a scanning transmission electron microscope (STEM) rolled into one, could allow scientists to gain a better understanding of structure and dynamics of matter at the atomic scale.

Unravelling the mysteries of coiling ropes (and pasta)
http://physicsworld.com/cws/article/news/31564

If you carefully lower a rope onto the floor it will probably form a neat coil. While most people wouldn't give this a second thought, an international team of physicists has done a series of experiments and numerical simulations to work out why. Their new insights into coiling could shed light on the behaviour of an important class of materials called "elastic ropes", which includes DNA molecules and structural reinforcing rods in buildings (Phys. Rev. Lett. 99 154302).

"This is an exciting paper, which details the many different coiling patterns in an elastic rope," says Herbert Huppert, a geophysicist at the University of Cambridge. "The agreement [between experiment and numerical model] gives confidence to the detailed and complex nature of this sub-field of highly nonlinear dynamical systems, in contrast to many other situations for which the description is at best qualitative. Many a physicist is going to enjoy playing with his pasta after reading this paper."

Capacitance sheds light on complex flows
http://physicsworld.com/cws/article/news/31487

Engineers could soon have a much better idea of what is going on inside pipelines thanks to a new flow sensor developed by scientists in Germany. The device can distinguish between different substances in a flowing mixture and it could help solve tricky flow problems such as how to move unruly mixtures of oil, gas and water from deep undersea wells to the surface.

Current techniques for measuring "multiphase" flows have limited efficacy. However, Uwe Hampel and colleagues at the Forschungszentrum Dresden-Rossendorf (FZD) in Dresden, Germany, have come up with a sensor that promises to change all this. The sensor consists of two planes of parallel wire electrodes stretched across a pipe flange. The planes are perpendicular to each other and separated slightly to form a mesh. An oscillating voltage is applied to wires in one plane and the resulting electrical fields are detected at the electrodes in the second plane. This allows sensors to measure the capacitance of materials in the regions where two wires cross.

Different materials have different capacitances, which allow the sensor to differentiate between different phases in the flow. According to Hampel, the measurement can be done very rapidly. The flow in a typical pipe cross-section can be scanned up to 10,000 times/s at a spatial resolution of 0.5 mm.

Neutrinos could probe Earth's structure

http://physicsworld.com/cws/article/news/32035

In the absence of a 6,000 km-deep hole to conduct observations, scientists hoping to learn about the internal structure of the Earth presently have few options but to monitor seismic waves. However, this technique, which relies on models of how waves are affected by rock properties, is indirect and potentially unreliable. A truly direct method, suggest researchers from Spain, Japan and the US, might be to monitor the proportion of atmospheric neutrinos that are absorbed while passing through the Earth.

This isn't the first time that atmospheric neutrinos have been proposed to probe the Earth's structure. Although these chargeless, almost massless particles pass straight through the Earth unimpeded when they have low energy, at energies above 10 TeV they are occasionally absorbed.

Since this absorption depends on the density of the neutrino's travelling medium, a neutrino travelling through a slice of the Earth close to the surface, for example, would be less likely to be absorbed than a neutrino travelling straight through the dense core. So by counting how many neutrinos come through different slices, it should be possible to see where the transition between the core and the inner mantle occurs, or between other structural layers.

Scientists widely dismissed the idea of using atmospheric neutrinos to probe the Earth's structure, however, because they mostly occur at lower energies.

Now, Concepcion Gonzalez-Garcia from the University of Barcelona in Spain and colleagues say that atmospheric neutrinos may have been dismissed too hastily (arXiv:0711.0745). "It would be better to have a localized beam rather than a disperse one, but the point is that there is no such localized beam in nature that is intense enough," said Gonzalez-Garcia .

Not any neutrino detector is up to the job, though. The researchers think that sufficient numbers of atmospheric neutrinos could only be detected with AMANDA's successor, known as IceCube — a network of about 70 light sensors on strings that are currently being buried two-kilometres deep into the Antarctic ice.

The researchers estimate that about 1000 neutrinos would have to be detected to observe the density transition from the Earth's core to its mantle with 99% accuracy. Given that IceCube will not be completed before 2010, this observation could take from four years to a decade.

Although this seems like a long time, Gonzalez-Garcia's group point out in their paper that such measurements rely too heavily on models that have not been verified by independent methods. "The case for direct observations using an alternative method is compelling," they say.

Venus flytrap inspires adaptive optics

http://physicsworld.com/cws/article/news/32071

It may be best known for ensnaring flies, but now the Venus flytrap has captured the attention of some materials physicists in the US. Alfred Crosby and colleagues at the University of Massachusetts at Amherst have been inspired by the carnivorous plant's unusual jaw structure to create a new material that can rapidly change its shape when stimulated by pressure, heat or electrical current.

In a Venus flytrap this lethal flipping from convex to concave occurs when a fly crawls between the open jaws and touches one of many tiny hairs located inside, although botanists are divided on exactly how the hair triggers the signal. "This plant can change the shape of its lobes from concave to convex at very high speeds — around 100 ms," said Crosby.

Crosby's group sought to create a structure that could exhibit this behaviour on small scales throughout. They began by moulding an array of circular protrusions onto a 1-mm-thick silicone layer. They then stretched the layer, and bonded another layer of unmoulded silicone underneath to create pockets or air. It is these air pockets combined with the rubbery nature of the material that gives way to the snap-buckling instability, so that

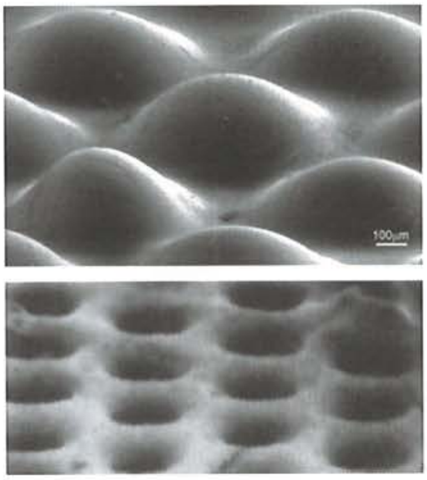


Fig. 2 The researcher's material can flip from having convex (top) to concave (bottom) protrusions simply by changing the heat, pressure or electrical current. (Credit: A Crosby et al.)

all the protrusions can be triggered between the convex or concave state (Adv. Mater. 19 3589).

Unlike the jaws of the Venus flytrap, the Massachusetts group's material can be triggered by pressure, heat or an electrical current. When the individual protrusions — which are like tiny lenses — change from convex to concave, the entire surface is modified in its reflectivity and focal length.

Each protrusion in the surface can be fabricated in pretty much any shape or size. In this work, the Crosby's group built them with diameters ranging from 50 μm to 500 μm and spaced them 10 to 50 μm apart. At these sizes the transition speeds are 30 ms or faster, and as the lenses get smaller, the speeds go up.

"[The material] could potentially be applied in arrays of on/off operating devices, such as optical switches and as actuators that control other components." said Hongrui Jiang of the University of Wisconsin, who last year produced a liquid lens that mimics the human eye. Jiang added that the fabrication process must now be improved to produce lenses with highly uniform shapes and smoother textures.

Items for Samplings have been provided by Don Price, CSIRO.

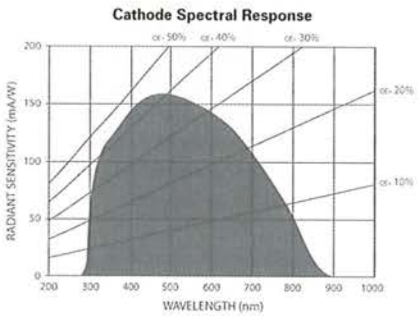
Product News

Lastek

New Red-Sensitive Fiber Optic Input PMT XS7F007 from Photon

Photonis is excited to introduce a revolutionary new light sensor. Based on a Photomultiplier Tube with a robust multi-alkali photo-cathode, this sensor provides best-in-class spectral response covering the 300-850 nm wavelength range.

With its unique Fiber-Optic input, this sensor is ideal for laser-induced fluorescence applications where superior signal-to-noise is required. The ultra-low-noise high-efficiency power supply and signal amplifier provide both ease of use and stable operation.
The PHOTONIS Group, is a global



business serving the photo sensor technology needs of world-leading clients in the areas of Industry & Science, Medical Imaging and Night Vision. Uniting under the PHOTONIS brand, the group brings together the people, products and technologies of BURLE, DEP and PHOTONIS.

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Quantum Composers introduces 9520 Series Pulse Generators

The model 9520 series heightens the

capabilities of pulse generation and digital delay to new levels. Cost effective, yet extremely capable, this instrument provides solutions to generate and synchronise multiple pulses and triggers for a wide variety of applications. The 9520 series provides up to eight fully independent digitally controlled channels with width, delay, rate and amplitude control on each output. For automated test sequencing, all common computer interfaces are available such as RS232, USB, GPIB and Ethernet.

Key Features
• 250 ps timing resolution with ← 200 ps jitter
• Internal rate generator
• 10ns period resolution over entire range of instrument
• Complete channel and system setup stored in memory - Provides 12 memory storage bins
• Remote programmability
• All of the 9520 series instruments offer RS232, GPIB, USB and Ethernet
• Single cycle pulse by pushbutton or reference trigger - One pulse with each pushbutton, internal, external signal or software command.

Advanced Hardware Features:
• 820 nm and 1310 nm optical outputs available with ST® connectors
• Optical inputs available with ST connectors
• Trigger input per output available

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F: +61 8 8443 8427
email: sales@lastek.com.au
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Newspec

Newport 150W Low Cost Solar Simulator

Oriel, a division of Newport Corporation has released a new low cost 150W solar simulator, offering an option for lower power and lower budget applications. The system offers a 33mm (1.3-inch) diameter collimated output beam and a small arc size allowing the user to focus the output onto a fibre optic bundle or liquid light guide. Further optional Air Mass Filters, Dichroic Mirrors, and Bandpass Filters let you shape the output spectrum.
For information contact Neil McMahon
neil.mcmahon@newspec.com.au
t: (08) 8463 1967

Improved Newport Motorised Stages

Over the past 6 months Newport has upgraded many of its motorised linear and rotation stages. Improvements include higher performance, lower cost, lower profiles, more compact motor and electronics block, manual control knob on stepper motors, more flexible control cables, simplified product configuration, and more easily accessible mounting holes.

BGS50 and BGS80 Motorised Goniometer Stages
• Improved version of old BGM series stages
• Available with DC or Stepper motor drive
• BGS50 travel range: +/-30 degrees
• BGS50 resolution: 0.0000698 degrees (DC) or 0.0000969 degrees (Stepper)
• BGS80 travel range: +/-45 degrees
• BGS80 resolution: 0.0005 degrees (DC) or 0.0001 degrees (Stepper)
• BGS50 has compact folded motor
For further information contact Neil McMahon,
neil.mcmahon@newspec.com.au
t: (08) 8463 1967

Product News

Cyan™ Scientific 488 nm CW Laser

The Spectra-Physics Cyan™ Scientific CW 488 nm laser provides researchers with unprecedented beam quality and reliability at power levels of 10-50 mW. Based on a highly reliable externally doubled diode laser, the Cyan Scientific laser provides intrinsically single-frequency operation with best-in-class power and wavelength stability. Designed to minimise space requirements, the compact Cyan laser head measures only 125 x 70 x 34 mm and is ready for use right out of the box.

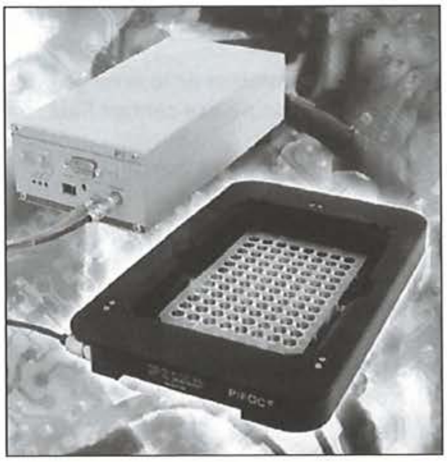
With a linewidth of <1 MHz, the Cyan Scientific laser is ideal for interferometry, Raman spectroscopy and other applications requiring high coherence and spectral stability. Intensity noise of less than 0.2% makes the Cyan Scientific the favoured light source for demanding applications in bioinstrumentation, particle measurement, and confocal microscopy.

For further information contact Graeme Jones at:
Graeme.jones@newspec.com.au
t: (08) 8463 1967

Warsash

P-737 PIFOC Z-Stage: PI's new nanopositioning Z control system

Warsash Scientific is pleased to announce the latest addition to PI's large line of products for microscope automation – the P-737 specimen Z-stage.



Specifically designed for biotech research microscopes utilising deconvolution and 3D imaging techniques, the P-737 PIFOC specimen Z-stage features up to 250-μm travel, millisecond response times and nanometer precise motion under closed-loop control. Convenient Z-stack imaging with multiple objectives and very high throughput is achieved due to millisecond sample settling time. Applications for the P-737 include Z-stack acquisition, autofocusing, scanning and alignment tasks in microscopy and biotechnology.

Features & Advantages:
• Choice of Travel Ranges: 100 μm or 250 μm
• Choice of Controllers: Digital, Analogue w/ Display or Compact Controller
• Custom Tuning for Highest Speed (few milliseconds per step)
• Compatible with all Major Image Acquisition Packages
• Closed-Loop for Nanometer Precise Motion Control

Further information on this and other nanopositioning systems is available from:

Warsash Scientific Pty Ltd
Tel: +61 2 9319 0122
Fax: +61 2 9318 2192
sales@warsash.com.au
www.warsash.com.au

Active Vibration Isolation Platform from Warsash Scientific

The Kinetic Systems 8001 Series Active Electronic Vibration Isolation Platform, available from Warsash Scientific, offers the ultimate in vibration control and isolation for vibration sensitive equipment. The platform is microprocessor controlled and incorporates a feedback loop which monitors and reacts to eliminate unwanted vibrations down to a frequency of 0.7 Hz across six translational and rotational modes of vibration. Furthermore, the platforms are capable of adjusting to dynamically varying loads and are available in either a compact, lightweight floor mount or bench top configuration.

The 8001 Series vibration isolation platform is a portable, cost-effective solution for isolating high-end or highly sensitive instruments such as interferometers and microscopes, delivering a level performance not possible with standard passive systems.
Features & Advantages:
• Active feedback vibration control system provides fast response and control of vibrations
• Vibration Isolation for all six translational and rotational modes of vibration
• Ultra low natural frequency < 1 Hz
• No low frequency resonance
• Isolation beginning at 0.7 Hz, increasing rapidly to 40 dB at 10Hz
• 500 times stiffer than air tables
• Table tops up to 600 mm × 785 mm in area with up to 270 kg load capacity
• Automatic levelling
• Compact, lightweight, ergonomic design

Further information is available from:
Warsash Scientific Pty Ltd
Tel: +61 2 9319 0122
Fax: +61 2 9318 2192
sales@warsash.com.au
www.warsash.com.au

Product News

Coherent

PhotonMax Electron Multiplying CCD camera now available in Megapixel format

The PhotonMAX EMCCD camera from Princeton Instruments is renowned as a high-performance EMCCD camera for the most demanding low-light level imaging applications.

The original PhotonMAX:512B was a 512 x 512-pixel, back-illuminated EMCCD with →90% quantum efficiency, ←1 electron read noise and faster-than-video frame rates.

The new large format PhotonMAX:1024B with megapixel (1024x1024) format has 3.25x the field of view while providing the same single photon sensitivity, deep cooling, permanent vacuum and other benefits as listed below.

Whether an application involves single-molecule detection, adaptive optics, luminescence, phosphor imaging, tomography, or low-light spectroscopy and fluorescence, PhotonMAX delivers the utmost in performance and reliability.

Features and Benefits
• Back-illuminated EMCCD for highest sensitivity
• Choice of detector formats, for maximum field of view or highest speed
• Permanent vacuum with all-metal seals. Maintenance-free and guaranteed for life
• Deep thermoelectric cooling for lowest dark current
• Dual-amplifier configuration with independent gain settings. Two cameras in one for maximum versatility
• 10MHz, 16-bit digitisation
• Lowest read and clock-induced noise on the EM channel. Best dynamic range and single photon detection capability
• Programmable TTL I/O and trigger ports. Easy integration for complex set-ups
• Comprehensive software options
• Optional fibre optic interface for remote operation
• Compact design. One camera head, no external boxes or controllers.

For more information or to arrange a demonstration please contact Paul Wardill at:
paul.wardill@coherent.com.au
Coherent Scientific Pty Ltd
sales@coherent.com.au
www.coherent.com.au
Ph: (08) 8150 5200
Fax: (08) 8352 2020

The Ntegra Scanning Probe Microscope from NT-MDT

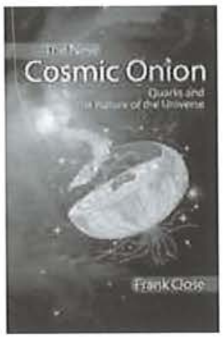
Combining ultimate performance in SPM with unlimited flexibility of use
Main features;
• Interchangeable between XYZ tip scanning, XYZ sample scanning or Z tip with flat bed X-Y scanner for ultimate sample flexibility
• Ultra low-noise capacitive closed looped sensors on all scanners (can be switched off)
• Complete software package, including advance capabilities for nanolithography, nanomanipulation and force spectroscopy
• System capable of more than 40 known techniques common to scanning probe microscopy (including electric modes), spectroscopy and lithography
• 1μm resolution optical viewing of sample
• Ability for measurement in controlled gas atmosphere as well as vacuum (up to 10-4 Torr)
• Large range of liquid cells, including hermetically sealed cells with flow through liquid and temperature control options
• Integrated electrochemical SPM and STM options available
• True quantitative nanoindentation option available
•Therma head option for temperature control (-30°C through to 300°C) with a thermal drift of less than 10nm/degree for achieving high resolution images for experiments with long duration or the ultimate in repeatability

The Ntegra was designed to be integrated with other techniques to allow more complex characterisation of samples. Some of these techniques include:
• Scanning Near-field Optical Microscopy (SNOM)
• Integrated Scanning Confocal/Near-Field Microscopy, SPM and Raman Spectroscopy system for chemical characterisation of samples in conjunction with SPM
• Integration with inverted optical microscope for additional characterisation of biological or other transparent samples
• Integration with ultramicrotomy for nanoscale 3D reconstruction of sample structure

Contact Dr Jen Weeks (jen.weeks@coherent.com.au) for further information.
Coherent Scientific Pty Ltd
sales@coherent.com.au
www.coherent.com.au
Ph: (08) 8150 5200
Fax: (08) 8352 2020

Prompt Critical Reviews

More Layers of the Onion



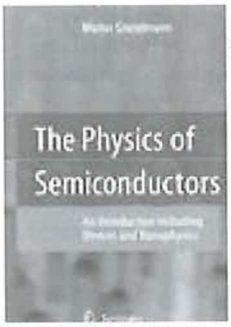
It is almost a quarter of a century since an excellent presentation of high energy physics titled The Cosmic Onion – Quarks and the Nature of the Universe by particle physicist Frank Close was published. Unlike some popular books on the subject it was not dumbed down to an extent that impeded any hope of understanding. Rather it conveyed to serious readers the thrill of the chase to unravel the deepest secrets of the early universe where high energy physics meets and underpins cosmology.

Five years later Dr Close published a much less meaty treatment, END – Cosmic Catastrophe and the Fate of the Universe, to satisfy popular demand. Now, after two decades of progress and promise in exploring the most intimate layers of matter, he presents us with an updated guide The New Cosmic Onion that is a worthy successor to the earlier version (and bears the same sub-title). The interrelations of fundamental entities are explored in some detail, taking into account such matters as the confirmation of neutrino oscillations and the discovery of the top quark. One is left with a feeling of excited anticipation of the revelations soon to come to pass when CERN starts up its Large Hadron Collider. Dr Close prepares the reader for the Higgs boson, the notion of supersymmetry, dark energy, dark matter and more. String theory is ignored (only a theory – no evidence) and thus the author observes that his book comes with no strings attached!

The New Cosmic Onion is not an easy read for those disadvantaged in physics. However it can be dipped into for elucidation of concepts such as mixing angles, for example. The 219-page paperback is published by Taylor and Francis for A$60.00 and bears the ISBN 1-58488-798-2.

Colin Keay
Reviews Editor.

The Physics of Semiconductors



Marius Grundmann
Springer, Berlin
2006
xxx + 689 pp., Ð 74.85 (hardcover)
ISBN: 3-540-25370-X

This book is based on the author's two semester semiconductor course at the University of Leipzig.

Part I covers fundamentals including bonding arrangement in solids, crystal structures, defects, mechanical properties and band structure. Carrier transport, optical properties and various recombination processes have been described.

The author introduces heterostructures, the effect of various external electric and magnetic fields and its effect on carrier transport in bulk as well as quantum structures. Quantum dots and quantum wires are discussed, including growth processes and optical properties. Current topics such as spintronics, magnetic semiconductors and organic semiconductors are introduced. Photonic bandgap structures, microcavities and resonators structures are introduced. Recent developments in Gallium Nitride and Zinc Oxide are also covered. This will be ideal for undergraduate courses to give an overview of fundamentals about semiconductors.

The second part covers devices and applications including diodes, transistors, photo detectors, solar cells, lasers and light emitting diodes. Advanced topics such as quantum well infrared photodetectors, quantum cascade lasers and tunable lasers are introduced. The book meets its main objective of giving a summary of semiconductor fundamentals, devices and applications. Considering that the book covers a broad range of topics, some have only been covered briefly but the reader is directed to very good references. I recommend this book for all university libraries and as a textbook for undergraduate courses.

Chennupati Jagadish
Electronic Materials Engineering
Australian National University

How to Write a Successful Science Thesis

W E Russey, H F Ebel and C Bliefert
Wiley-VCH, Weinheim
2006
x + 223 pp., Ð 22.90 (paperback)
ISBN 3-527-31298-6

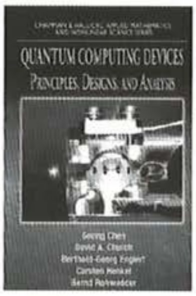
This guide has been prepared by the same authors of The Art of Scientific Writing, published originally in 1987. While the title suggests that it is about writing a thesis, it is more about the whole process. It starts with guidance on the choice of project and supervisor with excellent identification of the issues that a student should consider when making such a critical choice.

The book then proceeds to outline how and why a student should keep a laboratory notebook to maintain a record of all aspects of their experiments, thoughts, calculations etc. It thoroughly discusses the level of detail and nature of records to be kept. Then it proceeds to the literature review explaining how to find relevant articles, track citation trails and how to maintain a database of these papers for future reference.

The section on writing styles and techniques is thorough and includes not only different styles for different audiences but also details on the technicalities of fonts and layout of pages for different applications. All of this comprises the first 25% of the thesis with the remainder concentrating on the structure of chapters, their content and how to lay them out. In this there is considerable help in notation, incorporation of figures and equations, and useful advice on different options for the layout of tables.

Overall this is an excellent book to set a student on the path for a research degree. Although much of the content refers to examples from chemistry, it does not really detract from the message that a physicist, or any other scientist could obtain from this reference.

John O'Connor
School of Physics
University of Newcastle

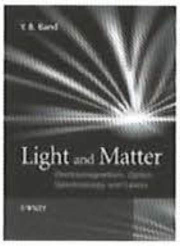


Quantum Computing Devices – Principles, Designs and Analysis
Goong Chen, et al
Chapman & Hall/CRC
Boca Raton FL 2007
xviii + 542pp., Đ44.99 (hardcover)
ISBN 1-58488-681-1

This book aims to provide the reader with a comprehensive overview of the current state of the art in quantum devices on the road to the implementation of quantum information processing. Such coverage is a daunting task given the plethora of proposals in the literature. Nevertheless, with introductory chapters on some basic tenets of quantum information, quantum computing, and open systems, the rest of the book covers the following physical systems: cavity QED, trapped ions, neutral atoms, quantum dots, linear optics QC, superconductors and NMR based systems (including solid-state).

Overall, I found this book to be a good review of the various physical systems currently being used to construct primitive quantum logic gates. As the number of authors suggests, each chapter is written by an expert in the field and there is a satisfying amount of detail. On the other hand, the ordering of the presentation is sometimes a little disjointed: e.g. in the introductory chapter one is suddenly taken from Toffoli gates straight into atomic and molecular basics, from there into the foundational basis of QM through to the Turing principle and beyond, and then suddenly from quantum error correction codes to a section on lasers, and finally a brief discussion of the DiVincenzo criteria. It was obviously a challenging project to pull together, however, on balance it is done quite well and the end result will be useful to the interested reader, and indeed practitioner, wishing to learn about the practicalities of implementing quantum logic in real physical systems.

Lloyd C L Hollenberg
School of Physics
University of Melbourne

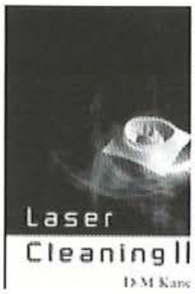


Light and Matter: Electromagnetism, Optics, Spectroscopy and Lasers
Yehuda B Band
Wiley, Chichester 2006
xv + 640 pp., Đ 62.90 (soft cover)
ISBN:978-0-471-89931-0

The extraordinary advances in physics in the 20th century gave rise to a congested university curriculum, with many difficult choices having to be made by those responsible for the layout of three and four year courses. This difficulty has been compounded by the prices of advanced textbooks inflating at a faster rate than particle accelerators or the early universe. Consequently, such textbooks need to offset their hyper-prices by providing the underpinning for a solid slab of material in the higher years, and ideally continuing to be pulled down from the shelves in the period of application following upon instruction.

Light and Matter is a book warranting serious consideration by physics departments offering solid courses in optics, electromagnetism and their applications. It is written at a level appropriate to both third and fourth years in Australian universities, and incorporates quantum mechanical treatments where appropriate.

One aspect of the book which appeals to me is its coverage and its integration. Optics and electromagnetism (perish the thought) used to be regarded as almost separate subjects, but they are integrated here. The "matter" in the title is translated into a proper treatment of a gamut of material properties and techniques for their characterisation. The book covers quite recent developments, has a good layout, index, and list of references. Chapters contain solid problem sets, with some worked out in the text.
I recommend this book as a potential text for senior courses in optics, laser physics, electromagnetism, optical properties of matter and spectroscopy. Its quality and coverage means that if you wanted to pick five books to make up your personal physics library, this might well be one of them.
Ross McPhedran
School of Physics
University of Sydney



Laser Cleaning II
D M Kane
World Scientific, Singapore 2006
xxxi + 289 pp., A$96.00 (hardcover)
ISBN: 978-981-270-372-9

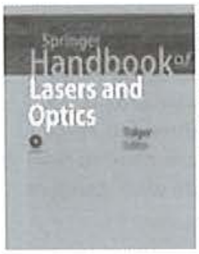
Laser Cleaning II is the second book in the series that reports on state-of-the-art research into the application of lasers for the cleaning of material surfaces and the processing of materials at the micro and nanoscale.

The book has been arranged into fifteen chapters, each written by leading researchers in the field. The first two chapters are devoted to general overviews of laser cleaning and the modification of surfaces via lasers. These chapters also define terminologies used in the field and give an update on progress since the publication of the first book in the series. The subsequent chapters are devoted to topics such as nanoparticle removal using laser light, micro- and nano-machining of surfaces as well as the cleaning of delicate surfaces such as those from museum artefacts and antique artworks, much of which is accomplished though the application of ultrafast lasers.

The arrangement of the chapters is good with each of them reasonably well written. This is not a book that would sit on the bookshelf of every physicist; however, those that have a direct interest in this field would benefit in having the book as part of a reference library. The book serves as a useful introduction to this research field and would be particularly useful for a commencing RHD student in this field.

R T Sang
Centre for Quantum Dynamics
Griffith University

Reviews



Springer Handbook of Lasers and Optics
Frank Trager
Springer, New York
2007
xxvi + 1330 pp., Đ249.00
(hardcover)
ISBN: 978-0-387-95579-7

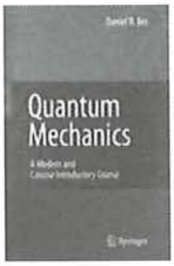
Sometimes you have a lucky day, and I had one when I was invited to review the Springer Handbook of Lasers and Optics. "Lucky", because I get to keep the book in return for my review, otherwise it would have been an instant priority for purchase.

Frank Träger has assembled a veritable WHO'S WHO of laser researchers (dominantly European). The book is divided into four parts: Basic Principles and Materials; Fabrication and Properties of Optical Components; Coherent and Incoherent Light Sources; Selected Applications and Special Fields. Richard Haglund starts off with a few pages of historical context before launching gently into Maxwell's equations; Gaussian beams; quantum mechanics and some statistical properties of classical and non-classical light.

Each of these topics is expanded further by the likes of Gerard Milburn on Quantum Optics and Norbert Lindlein and Gerd Leuchs on Wave Optics. The chapter on Nonlinear Optics by Zheltikov, L'Huillier and Krausz gives a good example of the way most topics are treated. After a solid introduction to nonlinear optical phenomena, the chapter evolves to discuss solitons and super-continuum generation ending with cutting edge applications of high harmonic and attosecond pulse generation. One feature is the effort the authors have made to take us from the science background to the cutting edge of current research.

It is not possible to give the depth and detail that a single focus book aims to achieve, I found these links to the state-of-the-art refreshing providing a snapshot of not only where we have been, but also where we are going in this continually evolving and exciting field. In short, go out and buy this book; it is an excellent desk reference for researchers and research students. Undergraduates will find much to interest them, especially those contemplating entering the field. My only problem is where to hide my copy before my students think it should be on their shelf!

Barry Luther-Davies
Laser Physics Centre
Australian National University



Quantum Mechanics A Modern and Concise Introductory Course
Daniel R Bes
Springer, Berlin 2007
xix + 239 pp., Đ 44.95
(paperback)
ISBN: 978-3-540-46215-6

Lecturers who have not updated their advanced undergraduate quantum mechanics courses would do well to look at this reasonably small textbook. It is certainly a welcome deviation from the standard wave-mechanical approaches of fifty years ago. The author introduces the concept of the state as a vector in Hilbert space from the beginning and measurement theory soon after that, recognising the latter as essential for introducing probability into quantum theory.

He covers the Heisenberg and Schrödinger pictures and the traditional applications to the harmonic oscillator, band structure, angular momenta, many-body problems and so on. He covers of time dependence well and gives short but understandable descriptions of quantum dots, Bose-Einstein condensation, quantum Hall effects, entanglement, quantum information, Bell states, quantum cryptography, quantum computation, decoherence and alternative interpretations of quantum mechanics. I think the approach used is excellent and would certainly have liked a textbook like this when I was a student, even without the very modern parts.

Overall, I strongly recommend the book, not just as a student text but also for those physicists who have not been part of the recent quantum revolution and would like to gain some knowledge of it in a reasonably painless way.

D T Pegg
School of Biomolecular and Physical Sciences
Griffith University

High Power Microwaves, 2nd ed.
J Benford, J A Swegle and E Schamiloglu
Taylor & Francis, New York 2007
531 pp., A$225.00
(hardcover)
ISBN 0-7503-0706-4

High power microwave sources are defined here as those that operate in the centimetre to millimetre wavelength range (1 to 300 GHz) and deliver short, one to several hundred nanosecond, pulses with peak powers of hundreds of megawatts or even gigawatts. The average powers are low.

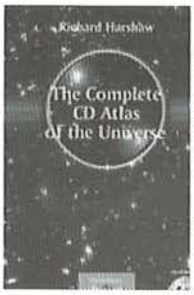
The principal applications are military. A significant number of pages in this book are devoted to weapons for disabling electronics, non-lethal antipersonnel weapons and radar. Other applications include power beaming from satellites, space propulsion, plasma heating and particle acceleration.

The book aims to provide a guide to the design of complete high power microwave systems so it covers the power supplies and antennas, as well as microwave sources. It provides an excellent review of the current state of the technology in these areas and would be a valuable resource in an engineering library.

On the other hand the authors see this as a textbook for a course or for individual study. There are chapters on the fundamentals of waveguides and cavities and the broad physical principles of the different varieties of sources. There are individual chapters on the major types of high power microwave sources such as magnetrons, backward wave oscillators, klystrons, gyrotrons, etc. Each chapter is well-referenced and comes with a set of exercises.

G F Brand
School of Physics
University of Sydney

Reviews



The Complete CD Atlas of the Universe

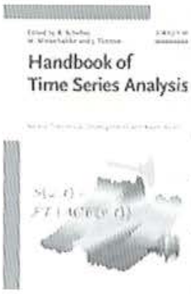
Richard Harshaw
Springer, London 2007
xiv + 120 pp. + CD-ROM,
Đ39.95 (hardcover)
ISBN 0-387-46893-5

Whatever this book is, it is not the complete atlas of the Universe. A more accurate descriptive title for the book could be, "A description of 13,238 celestial objects as seen from light polluted areas of Missouri, United States". That title may not be as interesting as the current one, but it would certainly be a better description of the book. Although of limited use for someone observing the sky from the southern hemisphere, it represents an impressive observing effort by the author Richard Harshaw.

The printed part of the book contains clear and simple explanations of some of the basics of amateur astronomical observing such as how to polar align a telescope (using Polaris), double star position angles and separations as well as the types and the catalogues of deep-sky objects.

The heart of the work is the CD-ROM with finding charts and the listing of the 13,238 objects, the majority of which are double stars as these are easiest to observe from light polluted areas. For each object the listings give full details and a description of how it was observed by the author. What is particularly useful is a rating code indicating how easy the object is to observe and how spectacular it looks through a telescope. There are also measurements (in inches) for a scale model to help visualise the system being observed. Overall for those amateurs in the northern hemisphere of a taxonomic bent this CD atlas would be of great assistance. Maybe sometime a local amateur will emulate this work and publish a similar descriptive list for the southern sky.

Nick Lomb
Sydney Observatory
Powerhouse Museum



Handbook of Time Series Analysis: Recent Theoretical Developments and Applications

B Schelter, M Winterhalder and J Timmer (eds)
WileyVCH, Weinheim
2006 xviii + 496 pp.,
Đ159 (hardcover)
ISBN: 978-3-527-40623-4.

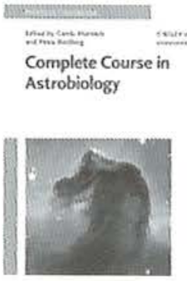
This volume aims to provide beginners, experts and practitioners with a modern survey of methodology and applications of time series analysis. It consists of an introductory chapter written by the three editors followed by seventeen individually contributed chapters written by various experts from key areas of methodology and applications. The introductory chapter provides a brief overview of the topics covered and their connectedness. However, for the novice the introduction would be insufficient background preparation for reading the various contributed chapters that follow.

Topics covered fall into several overall categories broadly classified into dynamical non-stochastic systems, linear stochastic models and the interplay between them. There is strong emphasis on multivariable systems and applications in the biosciences particularly the human brain, cardiovascular and ocular systems.

The editors are members of the same research group with a strong emphasis on complex systems in the field of neurology based on multivariate time series. The topics covered in this collection of articles reflect these interests. However, for a book aiming to survey modern developments in time series, there are a number of notable omissions in coverage including Bayesian methods, particularly hierarchical Bayesian models for spatio-temporal processes and methods for discrete valued processes. The articles on stochastic models provide excellent coverage of the now, well-developed, linear multivariable models. However, for the complex systems applications motivating the choice of topics covered, this reviewer would have preferred more on non-linear spatio-temporal stochastic models.

Overall the articles are clear, well written and comprehensive. For experts in the area this is a useful reference source. This volume also aims to be a 'text', but those beginning to study time series methods will need to read this volume side by side with standard reference works.

William T M Dunsmuir
School of Mathematics and Statistics
University of New South Wales



Complete Course in Astrobiology

Gerda Horneck and Petra Rettberg (eds)
Wiley-VCH, Weinheim
2007 xx + 412 pp.,
Đ69.00 (softcover)
ISBN:978-3-527-40660-9

Astrobiology is a multidisciplinary science that is coming of age; textbook writers are at work. There are four or five textbooks now, and this is the most recent. It is the first from a European perspective, being based on a series of 90-minute lectures facilitated by the European Space Agency. There are 13 chapters derived from those lectures, and a CD of the Powerpoint presentations for 11 of them. The CD is a great resource for anyone lecturing in this field.

Because this field is so extraordinarily multidisciplinary, and in its infancy, it is extremely hard to describe in a single book, even one like this with multiple authors. So while all the chapters of this book are mostly authoritative, when the authors stray from their core expertise errors superficiality creeps in. As a geologist at core I caution against accepting most of the palaeobiology presented. Look elsewhere for authoritative discussions on the geological evidence of early life on Earth.

Even so, this is a valuable addition to the textbook literature on astrobiology. I recommend it with some reservations.

Malcolm Walter
Centre for Astrobiology
Macquarie University

Reviews

Spintronic Materials and Technology

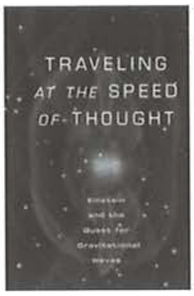
Y B Xu and S M Thompson (eds)
Taylor and Francis, New York 2007
423pp., A$ 270.00 (hardcover)
ISBN 0-8493-9299-3

Spin based electronics, coined as spintronics, is a study of electron/nuclear spins in a condensed matter environment. The birth of spintronics occurred when giant-magnetoresistive material (GMR) was discovered in 1988. A spintronic device carries an electric current due to spin-polarised electrons achieved by an applied magnetic field or by injecting spin-polarised electrons from suitable magnetic electrodes.

Spintronics is a rapidly expanding area of multi-disciplinary research, currently covered under the noisy banner of highly promised nano-technology. This book deals mainly on materials and technology with less fundamental science. Its sixteen chapters cover three parts. Part I on 'Spintronic materials and characterizations' describes properties of magnetic oxides, metallic GMR materials and dilute magnetic semiconductors. Part II on 'Spin torque and domain wall magneto-resistance' tells about the operation of spintronic devices with spin-polarised current with or without an external magnetic field. Part III dwells on 'Spin injection and spin devices' exploring Si and III-V semiconductor based transistors with future applications to marry spintronics with photonics.

Since the book is a collection of articles on a wide range of topics in material science, there is lack of uniformity regarding the contents and expected depth. At times there are misleading statements; namely in Chapter 1 "two equivalent fourth Maxwell equations" leading to the correct relation of electrical conductivity with the imaginary part of dielectric function (eqns.1.21-1.23). Despite these weaker points, this expensive book is recommended as a reference book for libraries.

Mukunda P Das
Institute of Theoretical Physics
Australian National University



Travelling at the Speed of Thought

Daniel Kennefick
Princeton University Press, Princeton NJ 2007
xii + 319 pp., US$ 35.00 (hardcover)
ISBN: 978-0-691-11727-0

Gravitational wave astronomy is still not a reality but the 4km LIGO laser interferometers are now working at their initial design specification giving them a few percent chance of detection in a year's observation. They are sensitive to events beyond 15 megaparsecs, a very respectable distance, but still not enough that strong events are likely to be frequent. The next two steps in sensitivity will occur over the next 10 years, taking the event rate up to a conservatively estimated 20 per year. At this point unless there was something seriously wrong with physics, gravitational wave astronomy will begin. By this time a detector in Australia will be crucial to unravel the polarisations, pinpoint the source galaxies and extract the distance information that is uniquely encoded in gravitational wave signals.

This is good timing for a new book. Travelling at the Speed of Thought explores the long and puzzling history of the theory of gravitational waves. In this book we learn how gravitational waves were postulated earlier than Einstein, and how Einstein twice proved that gravitational waves did not exist. The most extraordinary story is of a 1936 paper by Einstein and Rosen which proved the non-existence of gravitational waves. It was submitted to Physical Review but then withdrawn by Einstein because the editor had had the temerity to send it to an anonymous referee. Kennefick's admirable detective work tracked down the referee. It was H P Robertson of the famous Robertson-Walker metric. His report (included in an appendix) was scholarly and skeptical. Einstein sent his paper to the Journal of the Franklin Institute, but this version had reversed its claim. Now gravity waves existed! So Einstein's reputation comes out a bit tarnished.

Today when most of us are comfortable with the concept of gravitational waves as ripples in an elastic spacetime it is surprising that it took so many decades before the issue of their theoretical existence was decided. This book explains why it was so difficult to understand. In one chapter ("prehistory") Kennefick shows how similar puzzles in Newtonian theory plagued our understanding of lunar motion. The problem in general relativity was the mathematical complexity associated with the choice of metric. We learn how mathematical "gauge waves" travelling at arbitrary speed ("the speed of thought" in Eddington's disparaging phrase) could appear in the theory as well as the real waves traveling at the speed of light.

This book is very insightful. It is definitely a book for physicists. The combination of history and science is at a high level of scholarship. I found the first chapter, the role of analogy, quite discouraging, but the final chapter that discusses the tensions between mathematics and physics is quite riveting. I highly recommend this book to anyone who wants a deeper understanding of the theory and the history that underpins one of the fundamental foundations of modern physics.

David Blair
School of Physics
University of Western Australia

The SQUID Handbook, Vol II: Applications of SQUIDs and SQUID Systems.

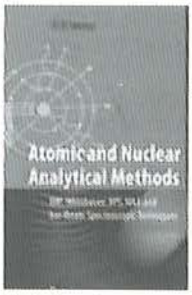
J Clarke and A I Braginski (eds)
Wiley-VCH, Weinheim 2006
ISBN: 3-527-40408-2

This volume of the handbook encompasses the up to date coverage of the existing and emerging applications associated with magnetic or electromagnetic properties of matter. These applications are enabled by the unique capabilities of Superconducting Quantum Interference Devices (SQUIDs).

The book is absorbing for scientists, guiding for engineers, educational for students, informative for specialists, clarifying for technologists, capturing for investors, challenging for researchers, and interesting for casual readers. The scope of the applications described in the book includes various SQUID-based sensors and devices employed in medicine, materials science, geology, physics, electronics, and metrology. The great value of the book is in its comprehensive analysis of the technology and design of SQUIDs dependent on the desired performance and sensitivity. Its significance is so prominent because this analysis is thoroughly backed up by the fundamentals of the operational issues and by the practical guide for understanding on how to extract useful information delivered by SQUID systems.

A great deal is devoted to the theoretical and practical problems of electro-magnetic mapping of various matters, such as humans and their biological rhythms (e.g., heart and brain functions), magnetic anomalies for natural resource explorations, as well as civil and mechanical engineering structures (for example, deep-laying cracks and corrosions in aircraft structures). The extremely broad scope of the SQUID applications dealt with in the book is presented to the readers as the collection of the very comprehensive articles written by a number of renowned experts in the field from around the globe. However, the material is delivered in a cohesive, well thought-through structure and style without duplications and omissions as if it was written by a single author.

Alexey V Pan
School of Engineering Physics
University of Wollongong



Atomic and Nuclear Analytical Methods
H R Verma
Springer-Verlag, Berlin 3007
xiv + 375 pp, Ð 129.95 (hardcover)
ISBN 978-3-540-30277-3

This book covers a range of atomic and nuclear analytical methods including X-ray fluorescence spectrometry (XRF), Mossbauer spectrometry, X-ray photoelectron spectroscopy (XPS), Neutron Activation Analysis (NAA) and accelerator Ion Beam Analysis (IBA) spectrometry. This is a very broad range of techniques requiring an equally broad range of facilities from desktop to nuclear reactor size. It successfully manages to coherently pull together detailed discussions on the principles behind these techniques, the experimental methods as well as a range of common applications. The treatment is focused on the needs of a good undergraduate in science.

Chapter 1 combines the techniques of XRF and Particle Induced X-ray Emission (PIXE), providing detail on both thin and thick target problems, K and L shell excitations, practical methods for improving detection limits and common computer analysis methods. The section on microprobes, however, was too short with little extra information and somewhat underplayed the importance of this area of research.

Chapters 2 and 3 describe Rutherford backscattering (RBS) and Elastic Recoil Detection (ERDA) with adequate theoretical descriptions and numerous examples from real situations. The differences and advantages of heavy ion scattering and medium energy ion scattering compared with standard RBS are also adequately covered. Excellent insights into mass-energy relationships for different recoiled ions are provided.

Chapters 4, 5 and 6 move away from ion induced techniques to cover Mossbauer, XPS and NAA methods. As with previous chapters, theoretical aspects for each of these methods are particularly well treated. The discussion of synchrotron radiation under XPS is poor, not at all comprehensive and should have been omitted completely as it adds very little to the Chapter. Applications and limitations of NAA are comprehensively discussed.

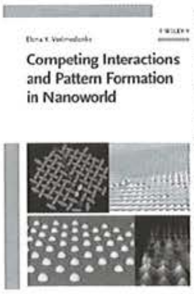
Chapter 7 and 8 return to the accelerator based techniques of Nuclear Reaction Analysis (NRA), Particle Induced Gamma Ray Emission (PIGE) and Accelerator Mass Spectrometry (AMS) again principals, experimental methods and common applications are all well treated. This is a common theme through this book. There are numerous tables providing relevant information and good graphs visually demonstrating commonly occurring situations.

References are organised by chapters, not extensive but representative of current literature and contain the significant reviews for most areas covered. I also liked the extensive further reading references for each chapter. The three appendices are particularly sparse of useful information for the broad range of topics discussed and probably would not be used by most readers.

In summary this is an excellent undergraduate book for low energy applied physics applications. It is well written, very easy to read and should appeal to both the novice wanting to understand sufficient detail to able to apply these techniques and the expert looking for a concise but accurate summary of a broad range of common atomic and nuclear analytical methods. It is an excellent reference book for the field.

David Cohen
ANSTO

Reviews



Competing Interactions and Pattern Formation in Nanoworld

Elena Y Vedmedenko
Wiley-VCH, Weinheim 2007
xi + 202pp., Đ 119.00 (hardcover)
ISBN: 978-3-527-40484-1

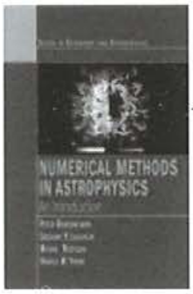
Patterns are a visual indication of structured or ordered systems throughout all areas of nature. Self-assembly (or self-organisation), which is "the evolution process of complex structures where ordered systems emerge spontaneously, driven internally by variations within the system itself," is of central importance in nanoscience. Much literature has been published on self-assembly processes, but there has been a distinct lack of encompassing texts in the area, especially those that deal with the subject from a physics perspective.

Thus this book enters the scene as an excellent introduction to this area, and does so by highlighting the many and varied theoretical models (Ising, XY, various lattice models) that exist to describe such behaviour. It covers areas such as frustrated systems, competitive interactions, spin and magnetised systems, and dynamic self-organisation. Personally, I found the section on fractal behaviour to be most fascinating.

I was surprised at the wide range of applications which covered, for example, Bose-Einstein Condensates, dipole and multipolar interactions, colloidal crystals, and patterns in ferrofluids. These combined with an excellent review of modern literature and selected example problems at the end of each chapter (with worked solutions), make this a useful supplemental resource for an honours level subject or research reference for anyone interested in this area.

Jamie Quinton

School of Chemistry, Physics and Earth Sciences
Flinders University



Numerical Methods in Astrophysics – An Introduction

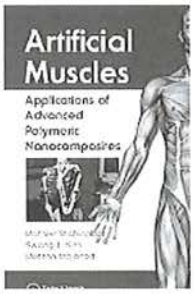
P Bodenheimer, et al
Taylor and Francis, Boca Raton FL 2007
vii + 329 pp. + CD, $A 120 (hardcover)
ISBN 0-7503-0883-4

This is a timely book covering many of the numerical techniques that are employed currently in astrophysics. The book begins with an introductory chapter on the development of the basic equations, which form the subject matter of the text. My only quibble here was in the representation of turbulent "viscosity" as an analogue of molecular viscosity. The ensuing chapters treat various particle methods (mainly N-body and SPH) and grid-based methods in a thorough fashion enabling a newcomer to grasp the essentials of the various techniques and the problems associated with each. The ideas behind Adaptive Mesh Refinement are well treated in Chapter 6.

Nevertheless, it would have been good to see a more comprehensive treatment of conservation-law-based Godunov schemes, which are increasing in popularity. A more comprehensive treatment of magnetic fields other than in the ZEUS code would also have been valuable although an entry into the current literature is given at the end of Chapter 8. Chapter 9 on radiation transport is a welcome adjunct to the earlier chapters and provides a good introduction to the relevant numerical techniques for calculating the emerging spectrum and the effect of radiation on the evolution of the matter. Notwithstanding the above reservations, this book, together with the code samples provided with it, is a welcome and authoritative introduction to many of the fundamental techniques for integration of the Euler, magnetohydrodynamic and radiation equations; both graduate students and experienced researchers will find it a valuable resource.

G V Bicknell

Research School of Astronomy & Astrophysics
Australian National University



Artificial Muscles: Applications of advanced polymeric nanocomposites

M Shahinpoor, K J Kim, and M Mojarrad
Taylor and Francis, Boca Raton FL 2007
443 pp. + CD, A$ 150.00 (hardcover)
ISBN: 1-5848-8713-3

Polymer nanocomposites have received tremendous attention over the past decade due to their superior multi-functional properties. There have been many edited and authored books written about polymer nanocomposites on a wide range of subjects. However, none of them deals with the same topics contained in this book on which the authors have made significant contributions.

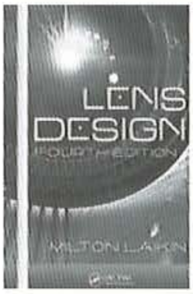
Overall, it provides the readers with basic knowledge of a range of ionic polymer-based materials, such as ionic polymer-metal nanocomposites (IPMNCs), polyacrylonitriles (PANs) and ionic polymer gels, and how they may be fabricated and characterised. Also covered are their applications as actuators, sensors, transducers, artificial muscles, etc. for different industry sectors.

Generally, the authors focused mainly on their own work, and many parts of the book are presented simply as results and/or observations without much in-depth discussions. It would be more balanced if they could include and compare with published data of other researchers more extensively. In many instances, references are also not given; possibly taken from their unpublished research. It is unfortunate that there are some obvious errors or repetitions in the book. For example: Figures 3.5 and 3.7 are identical but the captions are different. Figures 3.9 and 2.5 and their texts on pages (28, 29) and (70, 71) are the same.

This book is clearly the first of its kind and covers several fields of advanced smart nano-composites, polymer science and biomedical engineering. It will be a welcome reference book for those who are beginning, studying or working in this new interdisciplinary field.

Y-W Mai
Mechanical Engineering
University of Sydney

Reviews



Lens Design (4th ed.)
Milton Laikin
CRC Press, Boca Raton 2007
xxii + 478 pp. + CD, A$270.00 (hardcover)
ISBN: 0-8493-8278-5

There are many lens design and optical ray tracing programs available now and the one thing those programs won't do is to teach you how to make a lens. That is where this book finds its niche and indeed has done so since the first edition. The current edition has, in common with earlier editions, a comprehensive set of design information for a wide variety of lens and optical systems.

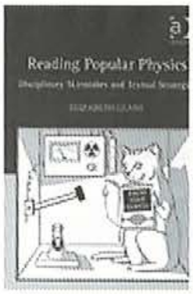
The stimulus for the new edition has been to update the range of glass data as new glasses have become available and also some glass types are no longer commercially available. Additionally, the advent of the stabilised-image digital movie camera has brought with it a new optical design as have diffractive optics, LCD projectors and spectrographic systems.

I particularly liked the referencing to the original patents and the new section on the human eye, as well as the experience the author conveys to the reader. This book comes with a CD containing the lens designs and, while the emphasis is towards the ZEMAX software, the information may be incorporated readily into other packages.

This book is a worthwhile investment for those using optical design software, particularly in lens development, and a great laboratory reference if using optical design software for undergraduate teaching.

J L Holdsworth

School of Physics
University of Newcastle



Reading Popular Physics
Elizabeth Leane
Ashgate Publishing, Aldershot 2007
198 pages, £ 50 (hardcover)
ISBN 0 7546 5850 3

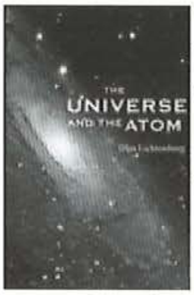
What is the purpose of popular science books, especially those unveiling the weird worlds of quantum physics and big bang cosmology? To scientists, I'm sure the answer seems obvious, but in her book, Leane explores this question in a broader context and examines the reception and impact of popular science. Focusing upon several well known texts (including some on the fringe), the result is an eye opener, with Leane showing that the rise of the "dullard scientist" was not particularly welcomed by literary critics.

Furthermore, Leane reveals that the analogies and anthropomorphizing of physical concepts, the staple of popular science, are often over interpreted and add fuel to debates on the nature of science and cultural relativism, debates which often frustrate the impact of science in the public arena. Leane also examines the stereotyping of scientists through their representation in popular science, but, as ever, the result hardly represents "real" scientists and their activities. The book is well written, but it is a literary analysis, and as an outsider I sometimes found the jargon and discussion a little dense.

Overall, I was disheartened by its portrayal of popular science, but it is clear that Snow's "Two Cultures" are well and truly alive, and our intrusion into "their" world has not been well received. Perhaps, as scientists, we need to step back and ask just what we want to achieve through the popularisation of science and the portrayal of scientists; Leane's book is a good place to start.

Geraint F Lewis

School of Physics
University of Sydney



The Universe and the Atom
Don Lichtenberg
World Scientific Publications, Singapore, 2007
xv + 311 pages, US$54 (paperback)
ISBN: 978-981-270-561-7

This popular book attempts to survey a large fraction of fundamental physics. Whether or not you think it succeeds might depend on how cursory a treatment of topics you are comfortable with. Starting from Newtonian physics it proceeds in roughly the historical order of development through electromagnetism, relativity, quantum mechanics and the standard model of elementary particles. It finishes with a survey of astronomy, including brief descriptions of the planets and of stellar evolution. The last chapter is on supersymmetry and string theory.

For me this book is a "stamp album" of brief physics facts. It does not emphasise understanding or general principles. This is reflected in its historical organisation, rather than organisation according to our current understanding of physics. For example the role of symmetry and action principles in physics did not seem to be mentioned.

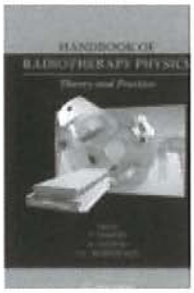
I fail to understand why this book was written. I found few new ideas or ways of presenting old ideas. Nevertheless, the vast ground it covers is slightly impressive and may well appeal to people who like to read dictionaries or concise encyclopedias.

If I was looking for a popular book to show the beauty and grandeur of physics to friends or relatives this presentation wouldn't be very high on my list. I would look for something with an explicitly modern perspective.

Craig Savage

Physics Department
Australian National University

Reviews



Handbook of Radiotherapy Physics
P Mayles, A Nahum and J-C Rosenwald (eds)
Taylor & Francis, London 2007
1432 pp., UK£ 155.00 (hardcover)
ISBN 0-7503-0860-5

The Editors have been inspired, by a long running Radiotherapy Physics training course, to produce a textbook for practicing Radiation Oncology Medical Physicists. Many well respected names are included in the list of contributors, with a strong representation from UK and other European Union countries.

The book is subtitled Theory and Practice, with the "Theory" section providing an overview but not covering any subject too deeply. There are the expected chapters on Linear Accelerators, kilovoltage units, Planning Algorithms and Dosimeters, as well as related topics such as Record and Verify systems, the DICOM standard and the use of MRI in treatment planning. Tables of Electron Stopping Powers and Photon Interaction Coefficients are included.

Welcome additions are the overviews of Radiobiology and Biological evaluation of treatment plans. The more exotic treatment modalities are not neglected, with Protons and Fast Neutrons included. For the experienced, some of the overviews will seem a little frustrating in their brevity, but a large number of references are included, which are suitable for extra reading.

For the "Practice" part of the text, there are sections covering most aspects of modern radiotherapy. Included are many useful and practical items, such as examples of QA tests for the QA of Linear Accelerators and Planning Systems, and a chapter on the practical aspects of IMRT. Electron Planning Techniques is a very sensible discussion of treatment options, while the chapters on Total Body Irradiation and Total Skin Electron Irradiation both include diagrams of patient treatment positions and in vivo dosimeter locations. The chapter on Monte Carlo Dose Computation lists the most useful codes with contact details and web addresses.

The Brachytherapy section includes traditional techniques; modern dose optimization for planning; and a chapter on Radiobiology for Brachytherapy. The Radiation Protection section includes some good discussion of practical issues for Radiotherapy.

In general, the book is relevant to practice in Australia and New Zealand, with the chapter on Linear Accelerators including some excellent diagrams for both Varian and Elekta linacs. The Absolute Dosimetry chapter references IAEA 398, which is also the current Australasian standard. Even the UK specific Radiation Protection Regulations chapter includes a few examples which can be adapted locally.

The combination of theory and practical aspects of modern Radiotherapy makes this a useful textbook for basic training, as well as providing a good overview of the current state of Radiotherapy Physics for those interested in the field.

P M Ostwald

Department of Radiation Oncology
Newcastle Mater Hospital

The Power of α
M H MacGregor
World Scientific, Singapore 2007
xxix + 428 pp., US$ 93.00 (hardcover)
ISBN: 978-981-256-961-0

Sub-titled "Electron Elementary Particle Generation with α-quantised Lifetimes and Masses", this book arrived by surprise and at first sight looked attractive and interesting
It was sent for review to a highly qualified particle physicist who, after inspecting it, circulated the book among his peers for their opinions. They unanimously judged the book to be rubbish, despite the author's claim to have been formerly of the Lawrence Livermore National Laboratory (which should have been a good recommendation).

So don't waste funds on this particular offering and thereby send a message to the publishers to be more discerning in their offerings.

Conferences

Feb 17 – Feb 21
POLYCHAR 16: World Forum for Advanced Materials
Lucknow, India
www.polychar16.com

Feb 19 – Feb 23
3rd Environmental Physics Conference
Aswan, Egypt
www.geocities.com/Athens/Library/7348/EPC_08.html

Feb – 25 – Feb 29
ICONN 2008
Melbourne, Victoria
www.ausnano.net/iconn2008/

Mar 10 – Mar 16
Solid State and Materials Chemistry
Cancun, Mexico
www.zingconferences.com/solidstate

April 14 – April 19
15th Young Scientists' Conference on Astronomy and Space
Kyiv, Ukraine
ysc.kiev.ua/index.php?text=about

April 14 – April 18
International Conference on Optical Fibre Sensors OFS-19
Perth, Western Australia
obel.ee.uwa.edu.au/OFS-19/

May 21 – 23
Advances in Fluid Mechanics 2008
United Kingdom
http://www.wessex.ac.uk/conferences/2008/afm08/index.html

June 13 – June 15
Third International Conference on the Nature and Ontology of Spacetime
Montreal, Quebec, Canada
www.spacetimesociety.org/conferences/2008/

June 27 – July 5
International School "Frontiers in Numerical Gravitational Astrophysics"
Erice, Sicily, Italy
astro1.phys.uniroma1.it/ericeschool/index.html

June 29 – July 11
BIPM Metrology Summer School 2008
France
www.bipm.org/en/events/summer_school/

July 19 - July 22
II International Workshop "High Energy Density Hydrodynamics"
Novosibirsk, Russia
www.sbras.ru/ws/mg12/

July 28 – Aug 1
2008 International Conference on Electronic Materials -ICEM 2008
Hilton Sydney, Sydney
www.aumrs.com.au/ICEM-08/

July 7 – July 10
OECC/ACOFT 2008
Sydney Convention & Exhibition Centre, Sydney
www.iceaustralia.com/OECC_ACOFT2008/

July 7 – July 10
International Commission for Optics Congress (ICO-21)
Sydney Convention & Exhibition Centre, Sydney
www.iceaustralia.com/ICO2008/

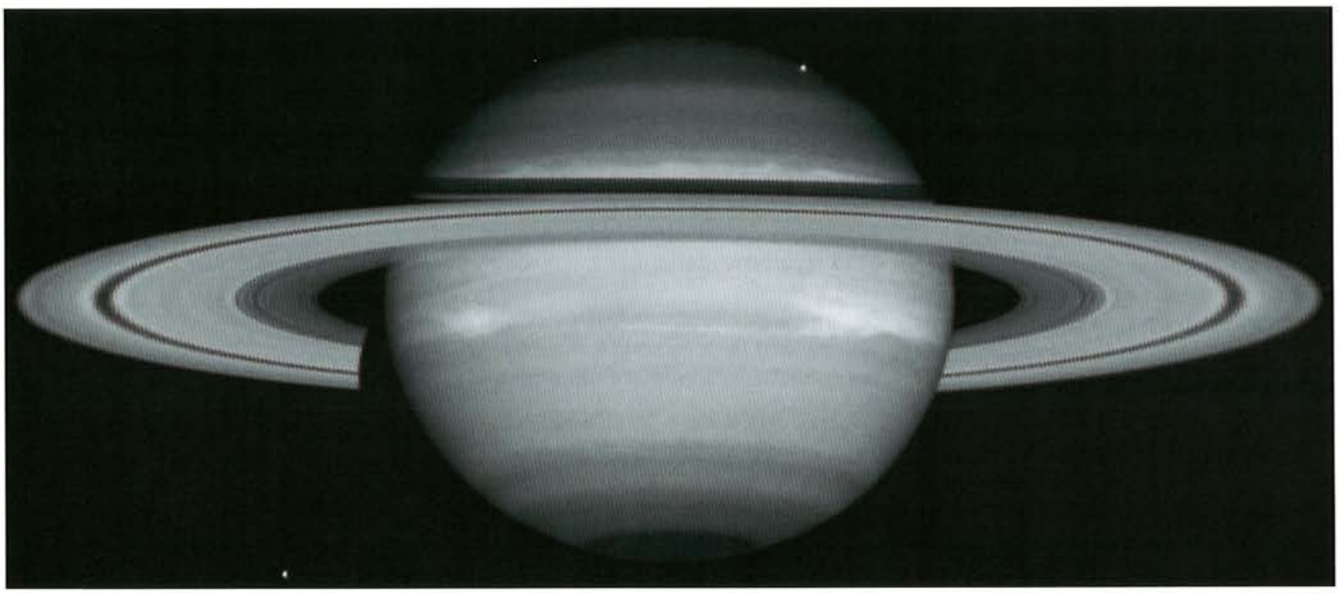
July 13 - 20
37th COSPAR Scientific Assembly and Associated Events
Canada, Quebec
http://www.cospar-assembly.org/

July 28 - August 1
International Conference on Electronic Materials 2008 (ICEM 2008)
Sydney, Australia
www.aumrs.com.au/ICEM-08

August 3 - 10
Quantum Monte Carlo and the CASINO program III
Italy, Tuscany
http://www.vallico.net/tti/qmcatcp_08/announcement.html

November 17 - 20
14th International Conference on Thin Films
Belgium, Ghent
http://www.ictf14.ugent.be/

Nov 30 – Dec 2
18th National AIP Physics Congress
Adelaide, South Australia
http://www.aip.org.au



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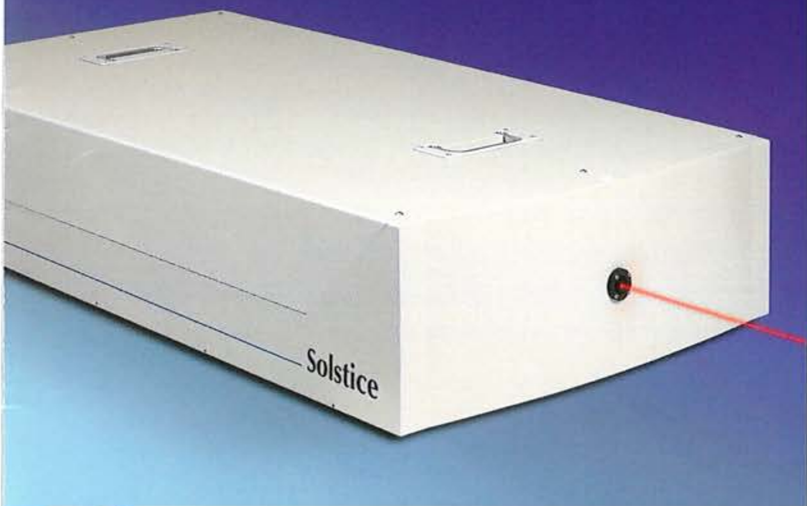

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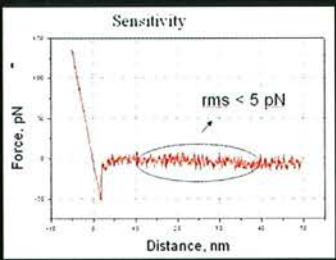
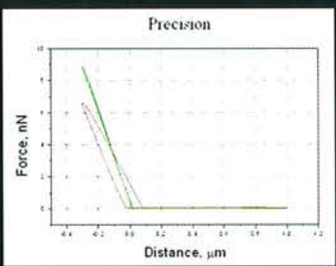


Force-distance curve taken in liquid by silicon nitride triangular probe with 30pN/nm force constant. The RMS noise of force in this case is less than 5pN. Note that force resolution here is limited only by the thermal noise of the probe.



Force-distance curves with close-loop sensors a) on (green) and b) off (red).

Close loop control in the z-axis greatly improves the accuracy of critical force curve experiments

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