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This month's cover picture shows the recently released NZS100 which features Ernest Rutherford and his scientific work. See article on page 36 for full details.

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PRESIDENT'S COLUMN

Launch of the Strategy Plan

At long last the Strategy Plan has been completed and published. At the launch by Science Minister Ross Fixed on 12 February there was an opportunity to thank those who had taken the lion's share of the responsibility for producing it: Bruce McKellar, Ian McCarty, Tony Thomas, and the other members of the National Committee for Physics and the working party established to draft the Plan. This column provides an opportunity to thank the very many others who took the time to write submissions or to provide constructive criticisms of the document as it approached its final form.

Not surprisingly, the Plan is somewhat uneven in the detail of the recommendations that relate to the many areas of physics. Where geography, timing or the general level of cohesiveness of those working in a particular area encouraged it, the recommendations are specific. In other areas, however, work remains to be done to map out priorities. As one of our members said in criticising an early draft "Perhaps the Plan should be regarded more as a plan for a plan". But it is already more than that, and whether there are specific recommendations that require translating into action, or whether sub-disciplines need to be encouraged to determine their priorities, as proposed in Recommendation 36, it is clear that immediate action is required to implement the Plan's 38 recommendations. While all members can help in one way or another, a focal point for action is required, and Tony Thomas and Ian McCarty, who chairs the National Committee for Physics, have already discussed this point. At the AIP Council Meeting early in February it was agreed that Tony Thomas should be proposed as the chair of an Implementation Committee. That Committee will need working funds, and it was also agreed that $10,000 should be set aside for that purpose. Other funding will be required and sought from other sources. If real benefits are to be gained from the enormous amount of work that has gone into preparing the Plan, it is vital that continuous and consistent effort should be made to implement it.

The launch of the Strategy Plan was Tony Thomas's last official function as President. Unfortunately he was unable to take the chair at the AGM, due to a prior commitment, when there would have been an opportunity to thank him publicly for his outstanding work as President. His will be a hard act to follow. Like his predecessors, he gave unstintingly of his time during an otherwise full and active professional life, and the Institute owes him and the other office-bearers; the Hon. Secretary, John Riley, the Hon. Treasurer, Robert Fleming, and the Hon. Registrar, Robert Leckey, a great debt of gratitude. Much has been accomplished during Tony's two-year presidency. On behalf of all our members, I take this opportunity to thank him for his steady and wise leadership - and to warn him that we are unlikely to let him retire completely!

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Editorial
Physics Based Industries

By the time you read this we will know who our political masters are for the next few years. The process of converting promises into goals will have begun. Rapidly if the Coalition has won, as it can claim, as most incoming governments now do, that they have found the financial situation to be much worse than they could possibly have imagined. Serious belt tightening will unfortunately be necessary. More slowly if Labor has won, because some aspect of our Gross National Behaviour will first have to be found which has recently and unexpectedly changed for the worse etc. etc. The only real worry is that whoever wins will really try and fund their extravagant election promises.

What won't improve, in the short term, is the need to defend physics in particular and science in general against level playing field, economic irrationalist, Flat Earthers who believe that the best way to finance the farm is to sell the paddocks off, on one at a time, starting with the best ones. Noticing the success we have with numbers and equations, they have embraced them with unbridled enthusiasm, particularly the linear extrapolation. Do they ever consider the exponential implications of a 3% growth rate year after year? They prefer to count rather than read and even then tend to concentrate only on the bottom line. Rather like the meaning of life, the universe and everything being 42.

There is little hope that they will learn to take a less simplistic approach, so we must justify ourselves to our financial masters in their terms. Not a new idea. The problem of maintaining your integrity without alienating your patrons is an age old one for all creative people. Look at the trouble Mozart had in getting tenure. The Institute of Physics has realised this in their submission to the new Office of Science and Technology, which is guiding the UK government's future policy in these areas. It contains some very impressive bottom lines for Physics Based Industries in the UK. During the 1980s PBI exports trebled to £78 billion, sales doubled to £85 billion and Investment in PBI increased by 39%. All this at a time when the financial whirlhigs of the City of London were making the British economy what it is today.

Of what use is this to us? Australian government and business is still subject to the weakening but still powerful overseas effect, which means it must be better because it comes from overseas. It is harder to recognise feet of clay at a distance. We have spent decades importing financial, educational and political ideas from the UK and the USA. Often with a few years time lag that frequently means we are just starting to implement them when their disastrous side effects are beginning to show up in their countries of origin. Here is a chance to redress the balance by pushing a highly successful example with a great track record and which looks like going from strength to strength.

Of course we need our own numbers and our own policies, which are being produced, but we should also use what the IOP has much greater resources has done. They have started publishing Physics in Business, a newsletter for physicists working in industry. The first issue, January 1993, indicates it will have a wide appeal. Many of their concerns apply to Australia, such as physics being taught in schools by people without a minimum qualification in the subject and the uncertain future of the whole educational and research infrastructure on which the above impressive numbers rest. The launching of 11,500 new UK PB enterprises in the 80s can only be sustained in the future if the system produces the high quality people to operate them.

There are dramatic changes occurring in Australia. Last year the export of machine tools went up by 27.6% on 1991, exports of spectrophotometers, spectrometers and spectographs increased from $33.6M to $45.3M in the same period. We have been neglecting our physicists in business and industry. Why don't you write in and help us correct this?

Jak Kelly
THE SOLAR ECLIPSE OF 1994

I am trying to organise a trip to Bolivia to observe the 3 November 1994 total solar eclipse. The NZIP has agreed to the formation of a joint NZIP - Royal Astronomical Society of New Zealand expedition, and of course we would be delighted for members of AIP to join also. It is quite likely that an American group from San Diego who have had a previous link-up with a New Zealand Eclipse Viewing Group (to Mexico) will also join the expedition.

At present, it is possible to fly from Auckland to Buenos Aires for about $NZ$2300 return, and obtain an add-on of a return air trip plus four days accommodation from Buenos Aires to La Paz, Bolivia for $NZ$700.

The 3 November 1994 eclipse is a particularly good one, 3 to 4 minutes of totality, occurring fairly early in the morning, in potentially good viewing areas in Bolivia and Paraguay. The path of the eclipse traverses a section of Bolivia to the south of La Paz and continues over southern Paraguay and over Asuncion. Preliminary advice received tends to favour viewing from Bolivia rather than Paraguay but it is possible that two groups could be formed, one going to each country, especially if some members are doubtful of spending several days at an altitude above 4000m as would be required for the Bolivian viewing.

I am continuing to liaise with Dr Mervyn Thomas of the Astronomical Society who has visited many eclipse sites in the last 15 years. If you would like to be on the NZIP mailing list for details, when a Group Proposal has been put together, please complete the form below or otherwise send your name and address to the undersigned.

It is only by getting a good response at this time, that a group will be able to be organised and considerable savings made in group bookings. Accommodation in the area is very limited and early bookings will need to be made. Giving your name now will in no way commit you to joining the group, but unless there is a strong expression of interest from NZIP and AIP, it is possible that the Astronomers will organise their own group.

Please return by 1 May 1993

NAME........................................................................................................

ADDRESS(Postal and email)............................................................................................

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I am interested in receiving details of a joint NZIP/RASNZ Eclipse Expedition to Bolivia, 3/11/94

☐ I am interested in other short side trips after the Eclipse

Please return to Keith R. Dawber

Physics Department, University of Otago

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The Launch of “Physics - A Vision for the Future”

What happened to the Strategy Plan for Physics? Well its finished, printed and at last launched, not as the Strategy Plan but as “Physics - A Vision for the Future”? Is the anguish of that long gestation now all over? Can we sit back, sigh with relief and watch as physics begins to take its rightful place in the funding rounds in this country? Or is this just the beginning of a long road of more hard work, more pain, more lobbying to convince those that matter that the “Vision for the future for physics” is an essential component of the vision for the future of Australia? To quote from the plan, “Making Australian physics stronger: A pathway to more competitive Australia”, while the media release from the ARC headed its comments “Dealing in Physics Futures”.

The “Vision” was set “afloat” by the present Minister for Science, Mr Ross Free, on Friday the 12th of February within the dome of the Academy of Sciences in Canberra. While the late afternoon sun played its reflective visions from the waters of the moat across the pillared walls rising above us, the isolation from the outside world represented by that moat was mirrored in the isolation one felt in the Minister’s speech in relation to the problems of physics documented in the plan. That plan was sponsored by the ARC and its Chairman, Max Brennan introduced it, and its raison detre, prior to the speech by Mr Free. While Max Brennan as a committed physicist certainly has sympathy for the plans tenets, at the same time as ARC Chairman he felt compelled to state that “there are recommendations directed to the Australian Research Council, some of which we will - I hope - accept, some of which we have reservations about, and the fate of those recommendations as they are directed to us will be determined at our Council meeting in May”. He did also however stress the importance of the document and indicated that the Council looked forward to working with the physics community, the Academy and “other bodies” in looking at ways to implement the recommendations in “whatever ways consistent with the Government response to them”. Eric Weigold, now the Director of the Research School of Physical Sciences at ANU then spoke on behalf of the Academy and detailed the arduous processes in formulating the plan and particularly thanked those who dedicated their considerable time and effort in its production.

In many ways the Minister’s speech was predictable. Following remarks concerning “the importance of physics in shaping the nature of modern society - as the ‘enabling’ science” (a quote from the plan) he launched into a party political speech on behalf of the ALP outlining what great things the Government had done for science. (Hey but I thought we were looking at where physics stood in relation to the other sciences. Well, he is facing an election!) We again heard that one about scientists (not just physicists you note) studying what they wanted - going about their private ways - little compulsion to explain or bring economic benefit to the nation”. I seem to remember studies which pitched the long term outcomes by government to science against the long term economic benefits to this country which belies that view. A view which seems to be pushed by the Government as justification for “cleaning up” the university sector, the CSIRO and DSTO. (For example did he read the top of page 13 of the “Vision” concerning the contribution of the Aeronautical Research Laboratories?). He went on detailing the governments achievements with the 150% tax concession scheme, the setting up of the CRC’s and the recent strengthening of the Pooled Development Funds program to encourage institutional investment in small and medium sized companies. (Positives I suppose but, in these initiatives where has physics improved in its relation to the others as the “enabling” science?) Then we heard that the Opposition still had no policy, but I guess we will hear something of one before March 13 unless it too becomes buried with the environment under the GST and unemployment.

He returned to comments in the “Vision” document; concerning the impact of medical instrumentation on world niche markets by applying the results of physics-based research; to note the results of an MTIA survey in 1991 which showed that the exports of “elaborately transformed manufacturers” had grown by 45% in the three years from 1989. He attributed this success to the Government’s drive to lift innovation performance and value added manufacture (are governments always solely responsible for performance gains and never for losses?). After praising the “scientific” community for its dedication and enthusiasm in producing “Physics: A vision for the future” came the sting in the tail- “One can therefore overlook a degree of hyperbole in some of the analysis, and while I cannot endorse everything it says, the publication’s collation and analysis of information about the role of physics today is a valuable basis on which policy can be formulated”. (Fair enough on the latter but “overlook the degree of hyperbole” gives little confidence that many of the recommendations will not be just put aside as “pie in the sky”

Tony Thomas as, still then, AIP President concluded the launch by responding to the Minister. He highlighted that three things needed to be addressed in the plan; physics’ ongoing contribution to the nation, the lack of a defined budget or mechanism for funding major facilities and the problems the submission raised relating to senior secondary maths and physics education. He indicated finally that the next AIP Council meeting would consider putting financial resources toward promoting the plan and realising its aims in the future.

But where from here? We are in the midst of an election with a possible change in government, a new Minister with new policies. Is it “better the devil you know than the devil you do not”? Whatever that outcome the problems of the recession and high unemployment are going to dominate the next few years. The physics community will face extreme problems in promoting the plan’s ideas and persuading whichever government that, despite the present dominant issues of economic recovery, it has to promote physics to become competitive with the other sciences to realise a more competitive Australia in the longer term.

The plan is now finalised. Any previous doubts about its structure and recommendations must now be put aside so that as a community we can support it fully. Hopefully then we will ensure that there is a future in physics futures for future physicists.

John Sandeman, Associate Editor
AIP Branch Canberra
CONFERENCE REPORT

NSW PHYSICS PhD CONGRESS 1992

The first New South Wales Physics Postgraduate Congress was held on 23rd November at the University of Technology in Sydney. This Congress, which was based in part on a series of successful meetings at Yanchep in Western Australia, is aimed to achieve the following objectives:

1. To give postgraduate students the opportunity to perfect their presentation skills in an environment outside their normal department.
2. To assist in establishing widespread research networks among postgraduate students between different institutions.
3. To familiarise postgraduate students with the depth and variety of research in Physics which is currently undertaken at tertiary institutions in New South Wales.
4. To present the results of research in progress to a wider community.
5. A future goal is to allow undergraduate students to have the opportunity to see what research is undertaken at different institutions in New South Wales.

This Congress was originally planned to be staged at the UTS Conference Centre at Yarrawood. Unfortunately, there were insufficient acceptances for this booking to be retained and so a modified programme was undertaken as a one day meeting at the University of Technology, Sydney. At this meeting thirteen students from UTS, University of N.S.W., University of New England and the University of Newcastle presented talks on topics ranging from thin films to nuclear magnetic resonance, surface analysis, RBS and superconductivity. The presentations demonstrated a variety of abilities. The programme matched that of many conferences consisting of a 20 minute presentation and a 5 minute question time. The questions were a valuable feedback to the participants as they would see how effectively they presented their material, and conveyed the message they intended. The presentations were judged by three experienced physicists and on the basis of style, presentation and clarity, a prize was awarded by the CSIRO Institute of Information Science and Engineering. The CSIRO Award for 1992 was made to Philip Stephenson from the University of New England, who spoke on NMR Spectral Density Functions for two dimensional lattice diffusion.

In 1992 the Congress was intended to be held as a residential meeting at Yarrawood, however, there seems to be a diversity of views as to which is the best format. Some students expressed a preference to get away from their institutions and enjoy a residential school, while other feedback suggested that many students did not attend because they prefer it to be a city-based conference.

The format for the 1993 Physics PhD Congress is currently under review and information will be circulated to Physics Departments in the coming months.

The organisation of this conference would not have been possible without generous sponsorships from the NSW branch of the Australian Institute of Physics, the CSIRO Division of Applied Physics, BHP Central Research Laboratories, CSIRO Institute of Information Science & Engineering and Eastern Australia Airlines. The organisers of this meeting appreciate this sponsorship and look forward to the continuing support for this conference.

D.J. O'Connor
University of Newcastle

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Dear Editor,

We are writing in response to John P. Costiella's letter (ANZ Physicist November 11, 1992) with regards to his observations at, and opinions about, the Great Australian Science Show which was held at the World Congress Centre in Melbourne during mid 1992. It seems that John missed the AIP's presentation, which we feel, was the best highlight of the show! The AIP Victorian Branch was offered free exhibition floor space so long as we could present workshops and/or demonstrations within a specified time slot. The offer was accepted by the branch committee and we organised and coordinated several workshops and a lecture demonstration. Four individual hands-on workshops (air physics, PC astronomy, electro-magnetism and optical spectroscopy) were conducted with the help of volunteers. These workshops were all run simultaneously on the Sunday morning between 10.00 am and 12.00 noon in the main area of the show. The public interest in these workshops was so great, that queues of people were formed around each of the workshop tables. We even had to beat people back at the end of our time allotment!

The lecture demonstration (titled Sunday Synchro Sound Circus) followed the workshops and was presented by Dr Ian McLaughlin and Dr Tony Lee from the School of Physics at Latrobe University. Tony and Ian put on a magnificent lecture demonstration for over 500 extremely interested people. The audience was captivated for a full hour by the various acoustic demonstrations and enjoyed the "why is it so?" explanations of what they had heard. Maybe the rest of the show didn't offer John or his guests much, but the AIP's show offered a few thousand people, who were there on Sunday, an enjoyable experience with physics that they won't forget.

The AIP Victorian Branch will be contributing to the Great Australian Science Show again in 1993. Encouraged by the enormous demand and praise we experienced in 1992, we hope to offer an expanded program of demonstrations and hands-on activities. We will need more volunteers to help with the organisation and demonstration of the workshops. We extend our invitation to John and others in the physics community to become involved with this event and help make the AIP's contribution to the Great Australian Science Show an even better one in 1993.

Louis Lambrianidis & David Jamieson
AIP Vic Branch Educational Sub-Committee

Australian & New Zealand Physicist Volume 30, Number 3, March 1993 35
It is not every day one gets the chance to make money!

On the morning of June 6th 1991, the Reserve Bank of New Zealand announced that new banknotes were needed. Our existing ones were designed a quarter of a century earlier and many of their security features were about to be overtaken by colour copiers. At the same time the Bank floated the idea that the portrait of the Queen be replaced on some of the new banknotes by those of prominent New Zealanders. A tremendous noise ensued as the Royalists collectively heaved. Before ducking for cover, the Bank sought suggestions for names of suitable people. I certainly had a suggestion.

Ernest Rutherford is the most famous of all New Zealanders and one of the most illustrious scientists of all time. His work ensures his immortality and his fame is clear by whatever measure one selects. His honours include a Nobel Prize and a Peerage and his ashes are interred in Westminster Abbey. He has 26 books written about him and he has appeared on the stamps of four countries; Canada, Russia, Sweden and New Zealand. He radically altered our understanding of nature on three separate occasions. Through brilliantly conceived experiments, and with special insight, he explained the perplexing problem of naturally occurring radioactivity (atoms were not necessarily stable entities as had been assumed since ancient Greek times), he determined the structure of the atom and he was the world’s first successful alchemist (he converted nitrogen into oxygen). Furthermore he led an exemplary life while rising to world fame from the hard times of rural New Zealand in the late 19th century. He is very worthy of being used as a role model for the youth of our country.

Within hours of the bank’s announcement I had written to tell them this. As I wrote to a few mates, “I see this as an issue involving the public perception of science. If we end up with banknotes adorned with Phar Lap and the Captain of the 1924 All Blacks, but none showing Rutherford, then the scientific community will have only itself to blame.” Besides, being interested in promoting science to the public, the opportunity of getting science and one of its heroes, and a great role model for children, onto an item such as a banknote was too good to pass up.

Of our population of about 3,500,000, some 400 people responded to the Bank with a mixed bag of names, such as the wife of ageing rock star Rod Stewart and Dog of Footrot Flats. I liked the idea of Dog. New Zealand would have had a unique banknote. However, because of the steady devaluation of the past decade or two, it might have been more appropriate to use Mickey Mouse. Within days the Bank announced that Ernest Rutherford was first choice of the respondents.

It was clear that certain selection rules would be in operation. All candidates had to be dead and thus beyond the front pages of the tabloids. There had to be a Maori and there had to be a woman. (At least one female was rejected as unsuitable because she had had a bit of slap and tickle on the side, which probably goes to show that the selection committee was all male). The Bank then secretly commissioned Lindsay Missen Design and Production Limited of Wellington to provide layouts and visual reference for new designs featuring the various contenders. At that stage I became involved with the research and possible design elements to be incorporated into a possible banknote featuring Rutherford.

On October 25 the bank released its choices. Cunningly, they gave the newsmedia photographic portraits which were quite different to the ones to be used. They weren’t going to give the forgers a head start. Ed Hillary would grace the $5 note. Though very much alive, his selection was no great surprise.

He had polled a strong second and was a very popular candidate. The Bank were taking a risk but when he was approached he apparently turned to his wife with a gleam in his eye and said “Well, I suppose there’s not much chance of getting into trouble at my age. Kate Sheppard goes onto the $10 note early next year. She led the movement which ensured that in 1893 New Zealand became the first country in the world to grant women the vote. That was also the election in which Ernest Rutherford was old enough to appear on the electoral roll. Another stalwart of the successful movement was Mary Newton, Ernest Rutherford’s landlady and future mother-in-law.

The Queen was retained on the $20 note, the most popularly used of all our banknotes. (Did the Bank’s advisors expect her to soon stand down thus allowing another chance at change or did they show clairvoyent skills in predicting she would stay on the throne until a grandson was old enough to succeed her? We may never know.) Apirana Ngata adorns the $50 note. He was the first Maori graduate of the University of New Zealand, a leader of his people and a Cabinet Minister in Parliament. He was a fellow student of Ernest Rutherford’s at Canterbury College. Ernest Rutherford was destined for the $100 note, our highest value banknote. Probably this was an honour. After all, even I had earlier suggested to the bank that the top contender be on the note whose design is not expected to alter over the years. With hindsight it might have been wiser to opt for a lower denomination note because so few children are going to see a $100 note as part of their everyday life.

The design stage was interesting. In my original letter I had pleaded “Please, 0 please, use a portrait of him as a vigorous,

John Campbell is an educator and solid state physicist at the University of Canterbury in Christchurch, New Zealand.
young man. Too often we portray him as an old fart, a portly 65-year old who wears a truss. New Zealand schoolchildren cannot identify with that image. I recommended the best image of Ernest Rutherford, a pastel portrait sketched at McGill University when 34 year-old Em had his Nobel Prize work behind him, had started his rise to fame and had confidence in his own abilities. Someone in the system insisted that only photographs could be used so I showed the designers the low end of what I held. A 1914 photograph, taken when Em was aged 42 and about to depart for the British Association meetings in Australia and New Zealand, was as low as the decision makers would go.

The background caused difficulties. There is no piece of scientific equipment associated with Em which has instant public recognition. So I recommended his Nobel medal and three diagrams representing his great achievements. His 1908 Nobel Medal for Chemistry is held by the University of Canterbury, as are the rest of his medals. On behalf of the Bank I sought and gained the permission of the Nobel Foundation for use of this image.

Because of security I had not been allowed to be shown the drafts so when the design was officially released it was a disappointment to find that only a sixth of the obverse side of the note had been available to science. His portrait and a watermark of the Queen took up two thirds. Of the three diagrams recommended, the designers selected the one showing the curves of the decay of radioactive elements and the resulting growth of daughter products. This complemented the Nobel Medal. I had submitted two versions. The hand-drawn diagram from his notebook was rejected as it had too much detail for the space available. Hence they chose the other which I had taken from the Rutherford and Soddy paper in J Chem Soc 81 841 1902. I had had it redrawn, and slightly simplified, for clarity by Alastair Dyer of the computer-added cartography section of our Geography Department. The other elements of the background include a Maori weaving pattern (taken from the Whakatāu marae in Nelson to recognise his birth in, and connection with, that province) and a spirograph pattern overlaying a map of New Zealand. Since Nelson is the geographic centre of New Zealand it fortuitously appears at the very centre of the pattern.

The reverse side of each note includes a native bird, tree, insect and scene. I had suggested flax as the native plant for the Rutherford note because his Dad was a flaxmiller. I never followed up why this was not used but maybe all exploitive industries were banned. After all, we keep telling people we are a clean, green country. The Rutherford note sports a yellowhead (Mohua) on the trunk of a beech tree. It appears to be lining up the lichen moth for his next meal. In the background is the misty Eglington Valley of Fiordland National Park.

The notes are numbered starting AA and then a six figure number. The AA series is kept for collectors. AAI is retained by the bank. The next 1000 or so notes are held for collectors of the whole series. The next numbers are used in 200 sheets of 28 uncult notes which are sold to the serious collector at NZ$3200 per sheet. Numbers from about AA66000 to AA8600 are sold as 500 sheets of 4 uncult notes for NZ$465. The bank retains some low numbers of the AB series for sale to casuals and to collectors of particular popular numbers. Prices for the sheets include GST as they are artefacts. Individual notes are sold at face value plus a NZ$10 handling fee. Sheets are available from your local branch of the Reserve Bank or from the Currency Department, Reserve Bank of New Zealand, PO Box 2498, Wellington.

Impoverished schoolteachers could approach their local bank to bludge the four page coloured pamphlet entitled “The New Fifty and Hundred Dollar Notes” or the poster entitled “New Design Banknotes”. Each bank was issued with one poster which they will eventually take off display and possibly discard. The Rutherford banknote went into circulation on Nov 3rd 1992. Two days later the first forgeries were reported. Well, not exactly forgeries. Someone cut the colour photos from the newspaper and used them in a dimly lit shop.

THE POLITICIAN By David Fletcher

Here’s the new design for our bank notes.

What’s this bit about the Reserve Bank “hopes to pay the bearer”?
Elections to the Fellowship of the Royal Society of New Zealand

David Beag lethole and John Lekner, both Professors at the Department of Physics, Victoria University of Wellington, together with Dr Garth Carnaby, Managing Director of the Wool Research Organisation of New Zealand, Lincoln, Canterbury were among those recently elected to the Fellowship of the Royal Society of New Zealand. Members of the New Zealand Institute of Physics offer their congratulations.

Professor John Lekner was elected to the Fellowship in 1991. His initial work was on the theory of electronic and ionic transport, and of the many-body physics and the statistical mechanics of quantum and classical fluids. His work on the liquid-vapour interface of simple liquids stimulated the experimental work of Beag lethole. His recent work has been an intensive and elegant study of the reflection of waves and particles as well as light waves from surfaces, providing a unified and coherent account of many reflection properties, of anisotropic as well as isotropic materials. Much of this work appears in his book “Theory of Reflection”. Some of his elegant papers have especially attractive titles: “What goes up must come down; will air resistance make it come sooner or later?” and “Why some things are darker when wet.”

Beag lethole’s and Lekner’s work has a particularly wide range of applicability, from glaciers to liquid crystals.

Professor David Beag lethole’s election is most gratifying. He is one of New Zealand’s most well known physicists, and has worked and published in a wide range of fields, both theoretical and experimental, in nuclear physics, various areas of condensed matter physics, astronomy and in particular physical chemistry. In many cases the work has been a first study of the phenomenon, and has led to publication in Physical Review Letters. His early work now features in classic solid state texts. He has been a Visiting Professor at prestigious USA and French scientific laboratories, Chair at numerous conferences and an enthusiastic promoter of science. He directed a synchrotron radiation research project in Paris. His recent work has used the technique of ellipsometry to study the surfaces of liquid and solids, in particular the liquid-vapour interface, the interface between two liquids, the adsorption of gas molecules onto solid surfaces, and remelting layers on the surfaces of solid crystals.

Dr Garth Carnaby graduated in Textile Technology at UNSW, Sydney, specialising in Textile Physics, and obtained his Ph.D. at Leeds. He has made many pioneering contributions to related technologies, for example, the first mechanical model of the lateral contraction mechanism of yarns; along with Australian co-authors, the first test on wool structures; a design for tufting needles to reduce yarn breakage which is now used in tufting nearly all the world’s wool carpets; and a new design for liquor control in loose stock-dyeing machines. He proposed the application of linear programming techniques for marketing New Zealand wool. In collaboration with Japanese scientists he devised a method for spinning thin yarns from coarse wool. He organised a successful International Workshop in 1988 on the “Application of Mathematics and Physics in the Wool Industry.” Throughout his career he has received many distinctions.

Queensland

The Executive of the Queensland branch of the Australian Institute of Physics has carefully considered the National Statement For Australian Schools (6 Dec 91) and offers the following comments:

The general description of the nature of science as set out in the sections “Characteristics of Science”, “Investigating in Science”, “Understanding and Using Scientific Knowledge” is primarily written in the terms of the “Inductiveism” (Francis Bacon) and “Falsificationism” (Karl Popper) doctrines as set out for example in the book “What is this Thing Called Science?” (A.F. Chalmers, QUP 1976). However these descriptions are inadequate for a characterisation of the creation, development and possible supercession of the complex structured theories that are a prominent feature of highly developed sciences such as physics. Other doctrines such as “Research Programs” (Imre Lakatos) or “Paradigms and Scientific Revolutions” (Thomas Kuhn) need to be embodied in the general description of Science, otherwise an unsuitable general framework for the teaching of physics will be promulgated.

Although the opening statement of the section “Outcomes of Science Education” states that the science education program caters for all students, in fact those students who wish to study physics to tertiary level, and acquire a significant understanding of the subject, will not develop to the best of their ability, their knowledge about the physical world their knowledge about the nature of physics and the skills and processes that should be used in physics.

Based on the December 1991 draft of the National Science Statement, secondary school students in their final years will have severe problems in making valid subject selections at the tertiary level. As indicated in the next paragraph, they will not have had a satisfactory experience of the methods and contents of physics, one of the major scientific disciplines.

The National Statement does not present Physics in a logical, progressive and coherent manner that is in accord with the intrinsic nature of the subject. Instead physics material is presented in a fragmented, theme based approach, largely within the strand “Energy and Change”.

Physics is a body of knowledge involving distinct yet interconnected components: Classical Mechanics, Electromagnetism, Quantum Mechanics, Thermal Physics, Relativity and so on. These components have a vertical structure in that some components are more basic than others. Thus Condensed Matter Physics requires an understanding of Thermal Physics, Quantum Physics etc. Although certain entities (particles, fields...), properties (mass, charge,...), quantities (energy, entropy...), basic concepts (space, time,...), and features (conservation, dynamical laws...) appear throughout physics, their
understanding demands an orderly development within the above mentioned components. The strand "Energy and Change" not only stressed one physical quantity but mixed everything illogically, and this approach will lead to the failure of students to appreciate the coherence of the subject.

Furthermore, experimental and logical/mathematical investigations are coequal in importance within physics. The latter is not adequately dealt with in that the application of the process strands "Investigating in Science" and "Understanding and Applying Scientific Knowledge" to the conceptual strand "Energy and Change" places virtually no emphasis on making theoretical predictions.

The National Statement places an inordinate emphasis on the technological and sociological implications of science in general and physics in particular, to the detriment of understanding what science is. There is inadequate emphasis on investigations based on controlled experimental environments and on theoretical analysis of the behaviour of simple model systems.

The ASTEC document "Profile of Australian science 1989" reported that the overall strength of Physics was not commensurate with the general level of the development of Australia and was lower than for the other branches of science.

The health and vitality of the discipline of Physics are of crucial importance to the Australian Community and a knowledge of modern physics is essential in engineering and environmental science and is also vital to the competitive performance of much of Australian industry.

The Australian Academy of Science has via its Physics Committee formulated a National Strategy Plan for Physics to help deal with this situation in physics. The National Strategy Plan refers in its recommendations to a national crisis in school science and particularly in physics. It recommends the creation of a National PHYSICS Curriculum (and not a curriculum on "Energy and Change") in consultation with the Academy of Science and the Australian Institute of Physics. The treatment of physics within the present document falls far short of such a curriculum.

In summary we request that the initial Complete Consultative Draft of the National Statement for Australian Schools be totally restructured in the light of the views presented.

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**COVERS PLEASE**

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THE STATE OF THEORETICAL PHYSICS IN AUSTRALIA

ROBERT DELBOURGO & BRIAN KENNY

Introduction

In 1991 physicists around the country were invited to contribute to a Strategic Plan for the future of physics in Australia over the next 15 years. This was motivated by a number of factors, not the last being the general agreement that currently the state of science, and physics in particular, was not healthy. Our original aim was to gather comprehensive data with a view to making some recommendations at the AIP Congress in Melbourne in February 1992. As theoretical physicists we felt that if the state of physics as a whole in Australia was believed to be unhealthy, it was more than likely that the health of theoretical physics was somewhat worse. However because this was conjecture on our part and since the basis of good science consists in first collecting factual information, we decided to do so. Early in November 1991 we sent out a questionnaire to Heads of Departments of physics at 36 tertiary institutions. A copy of the questionnaire appears at the end of this article. They were asked to supply us with certain statistical data on the composition of their department. We also asked heads a number of specific questions relating to the role they saw for theoretical physics in their department, both in teaching and research. With respect to research we further sought comments concerning the interaction between theorists and experimentalists within their department. In addition, heads were requested to circulate this questionnaire to the theoretical staff in order to ascertain their views on the same issues. In mid-December a follow-up note was sent to those departments which had not responded by that time. By the end of the second round about three quarters of the institutions had replied and our analysis is based upon this incomplete sample.

After some thought and discussion with colleagues we decided not to send the questionnaire to people working in departments of mathematics as applied mathematicians. We realise this is a moot point. Recognising that research carried out by some applied mathematicians may legitimately be regarded as theoretical physics and that the distinction between applied mathematics may be rather arbitrary and possibly unfortunate, nevertheless for the purpose of this exercise we needed to draw the line somewhere. For example theoretical studies in fluid mechanics are traditionally done in departments of applied mathematics while experimental studies in this area are usually carried out in departments of civil engineering. (We would be happy to classify this area of research as physics and to see both theory and experiment carried out in a physics department. However to the best of our knowledge, there is little work carried out in this area in Australian physics departments.) Another example is materials science which has close ties with condensed matter physics but is more likely to be studied experimentally in mechanical engineering departments. While recognising the dangers in drawing boundaries, we decided rather to focus on the interplay between theory and experiment in physics departments around the country.

Philosophy

From decade to decade in modern times, the principal effort in physics has changed: on the one hand fields of scientific knowledge have been reduced to practice, whereas on the other hand, new fields have opened up by fresh experimental or theoretical discoveries. Physics may be called a point of view about the natural world and a method of attack on its problems, a method based upon certain general principles and disciplined by the close interplay between experiment and theory. With a kind of confidence that the understanding of nature may be reduced to a few comprehensive principles, physicists have always searched for those central ideas by which great areas of common experience may be brought into order and coherence. To achieve their aim they have proceeded using mathematical tools, experimentation and logic. The history of physics may be characterised by intermittent bursts of new and promising theoretical ideas followed by a period of extended testing as these ideas are applied to a widening array of phenomena, culminating eventually in the realisation of the limitation of existing theory and the search for a replacement. It may fairly be said that both theory and experiment proceed alternately step by step, usually maintaining a healthy state of mutual stimulation. Although a reminder of the nature of physics in this preamble may be regarded as self-evident by many of our colleagues, we nevertheless feel that it is important to make a philosophical statement of principle in order to place our survey and its results in a context which ought to be at the heart of thinking about physics and its future.

Data

The first piece of information sought was data on the number of people engaged in experimental or theoretical physics in all tertiary institutions around Australia. We divided them into three categories: permanent staff, contract/postdoctoral.

Professor Robert Delbourgo and Dr Brian G Kenny are in the Physics Department at the University of Tasmania.
staff and higher degree students. From the total data collected
one may examine how various institutions compare with the
national average. Not surprisingly the ratio of theory to ex-
periment within the three categories varies considerably
between institutions. We therefore also decided to distinguish
between three types of institution: the eight "old" universities
(Group I), other pre-Dawkins universities (Group II) and the
newly constituted, post-Dawkins universities (Group III).
In fact we observed little difference between Groups I and II.
The big difference occurred in the next group (III): in many of
those institutions there was not a single theorist, while in one
theorists formed the majority! The reasons for this are often
clear...in very new tertiary institutions there is often a distinct
applied bias which militates against the presence of theorists.
It should also be borne in mind that many less established
universities (i.e., some of II and all of III) are in a state of
growth as far as student numbers go. In such cases it is likely
that neither the total staff numbers nor the proportion of
theorists to experimentalists will have settled down to a
"steady state", although in practice an applied bias exists in
many of the newer universities.

Confining the statistics to eight established universities
(Group I) which replied to our questionnaire, namely U. Qld.,
and U.W.A., the totals read

<table>
<thead>
<tr>
<th>Type of Staff</th>
<th>TP</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenured staff</td>
<td>39</td>
<td>140</td>
</tr>
<tr>
<td>Contract postdoctoral</td>
<td>41</td>
<td>60</td>
</tr>
<tr>
<td>Higher degree students (Syd.)</td>
<td>89</td>
<td>301</td>
</tr>
</tbody>
</table>

The other "traditional" universities (Group II) comprising
LaTrobe U., Deakin U., Griffith U., James Cook U., Flinders
U., Murdoch U. and A.N.U., produce similar statistics:

<table>
<thead>
<tr>
<th>Type of Staff</th>
<th>TP</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenured staff</td>
<td>19</td>
<td>53</td>
</tr>
<tr>
<td>Contract postdoctoral</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>Higher degree students</td>
<td>29</td>
<td>81</td>
</tr>
</tbody>
</table>

Finally, the new (Group III) institutions, comprising U.T.S.,
Charles Sturt U., W.Sydw., Ballarat U.C., Bendigo U.C.,
Curtin U.*, Edith Cowan U.*, U. Canberra and N.T.U.
provide the following figures:

<table>
<thead>
<tr>
<th>Type of Staff</th>
<th>TP</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenured staff</td>
<td>6</td>
<td>59</td>
</tr>
<tr>
<td>Contract postdoctoral</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>Higher degree students</td>
<td>3</td>
<td>70</td>
</tr>
</tbody>
</table>

We note that the number of staff in TP as a percentage of the
total varies from about 24% (Groups I and II) down to 9%
(Group III). This is to be contrasted with the view expressed
by many of our colleagues that at the "better" institutions in
the USA and Europe the number lies between 30 and 40%.
We are currently seeking hard data on this point and would
welcome assistance from our readers. A number of correspon-
dents have suggested certain historical reasons for the
depressed TP/EP ratio in Australia. However, whatever
the reasons, we found that many correspondents strongly
believe there is a serious imbalance in tenured staff numbers
in physics (and the corresponding student body) which should
be addressed in the future.

**Response to the Questions**

The rest of the questionnaire requested answers to a number
of specific questions and also solicited general comments.

**Q1.** The first question asked the heads of department (and
separately the theorists in the department) whether or not
their numbers constituted a "critical mass". There was
considerable variation in the answers we got which may
or may not be related to the head being an
experimentalist. By and large the big established
universities claimed to have a good nucleus. However, in
the smaller ones the theoretical numbers were generally
felt to be nowhere near "critical" and several respondents
complained of a feeling of isolation.

**Q2.** Our next question asked our respondents if they felt that
there was a good interaction between theoreticians and
experimentalists within and outside the department.
Specifically we asked if the function of theory was to
provide support to experiment. On the whole the answer
was YES, but we were somewhat surprised to receive
NOs from a couple of the larger universities.

**Q3.** The third question asked respondents for their views on
what they would regard as a satisfactory ratio of theorists
to experimentalists. Again we found wide disparity
between answers, sometimes reflecting the difference in
views between heads and theorists. Many of the newer
universities which are more "technologically oriented"
felt there was no call for theorists to be employed at their
institutions. However the larger, better established
universities (Groups I and II) suggested ratios which
hovered around 1:2, much as in the EEC and USA.

**Q4.** The distinction, if any, between the contributions made by
theorists and experimentalists to departmental teaching
programs was the subject of the next question. There was
a fair amount of unanimity here: most replies indicated
that theorists tend to teach the harder courses (in later
years) and play little or no role in laboratories. In

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**Challenger**

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tony@cres.anu.edu.au.
THE STATE OF THEORETICAL PHYSICS IN AUSTRALIA

QUESTIONNAIRE

Q0. (Below, TP = Theoretical Physics, EP = Experimental physics)
Institution

Tenured staff positions ............ TP ............ EP
Contract staff positions ............ TP ............ EP
Postdoctoral res. staff ............. TP ............ EP
Higher degree students ............ TP ............ EP

COMMENTS

(Cross out boxes below, as necessary)
We would be interested to hear of any comments you may wish to make vis-a-vis theoretical physics in Australia as distinct from physics as a whole. Some possible questions which occur to us (but are by no means intended to provide a complete list or preempt other questions) are:

Q1. Do the numbers in your department constitute a sufficient nucleus (a critical mass) which enable you to interact with each other in certain common areas of research interest? [Yes] [No]

Q2. Do you regard your function in whole or in part as to provide theoretical support to experimental physics
a. in your department, [Yes] [No]
b. locally (in your city or interstate), [Yes] [No]
c. overseas, [Yes] [No]
d. none of the above? [Yes]
Correspondingly, do you feel that experimentalists solicit support from theorists in your department, locally or overseas? [Yes] [No]

Q3. Do you regard the fraction of TP:EP in your department as satisfactory? If not, do you think it should be higher or lower? A quantitative figure would be useful (eg 1:1, 1:2, 1:10). Please give your reasons.

Q4. Comment on the contributions made by theorists in your departmental teaching programmes, in contrast to experimentalists? Is there is a distinct role to be played by each?

Q5. Give the year when you last appointed
a theorist ............ , an experimentalist ............

If you have any comments which you feel might be usefully included in a later more detailed questionnaire, please indicate below. We intend to send a summary of the relative numbers and comments received to the National Committee for Physics (who are formulating the strategic plan) in order that it may form part of the discussion at the AIP conference in Melbourne next February.
practice this implies that TE's have a heavier lecturing load than EP's but do little laboratory supervision.

Q5 Finally we asked when each institution last appointed to the academic staff a TP or an EP. Although there were a few exceptions, at the larger, established universities the majority had last appointed a TP in the mid-70's whereas an EP was appointed within the last year or two. This simply reflects the imbalance deduced from the first question and the paucity of lecturing positions.

Conclusion

The National Strategic Plan 4 recommends the establishment of a Centre for Theoretical Physics modelled along the lines of the Santa Barbara Institute for Theoretical Physics. Such an institution would run a visitors program, provide a focus for (currently lacking) graduate physics courses and assist with travel expenses. If the recommendation is implemented it will go some way towards defusing the concerns of many of our respondents and provide a good milieu where Theoretical Physics could really flourish in this country as well as provide a regional centre for theoretical physics in SE Asia.

References

1. AIP/Australian Physicist
2. Tony Thomas/Australian Physicist
3. Encyclopedia Britannica on philosophy

* Asterisked institutions signify those that did not respond. Their data is missing from the figures.

Nominations are invited for the 1993 award of the Walter Boas Medal of the Australian Institute of Physics and should reach the Honorary Secretary not later than 30th April 1993.

The Medal was established in 1984 to promote excellence in research in Physics in Australia and to perpetuate the name of Walter Boas. The award is for physics research carried out in the five years prior to the year of the award as demonstrated by both published and unpublished papers prepared for publication which should accompany the nomination.

Any AIP member may make nominations for the award and self-nomination is permitted. Nominees need not be members of the AIP or the be Australian citizens but should have been residents of Australia for at least five of the seven years preceding the closing date for nominations. The award is conditional on the recipient delivering a seminar on the subject of the award at a meeting of the Victorian Branch of the AIP in October 1993. The recipient is also expected to provide a manuscript based on the seminar for publication in the Australian & New Zealand Physicist.

Further details may be obtained from:
Honorary Secretary, Australian Institute of Physics, Clunies Ross House, 191 Royal Parade, Parkville VIC 3052

Australian & New Zealand Physicist Volume 30, Number 3, March 1993
Paperless Publishing: E-mail or perish?

GEOFF STEDMAN

The electronic revolution in publishing has commenced; see for example the vigorous correspondence in Physics Today (January 1992, June 1992). The principal damper to enthusiasm for electronic publishing is probably no longer its feasibility or the data entry problem, but the threat to easy browsing and the possible loss of hard copy. We go neither to bed nor beach with a SUN screen. The threat to our professional lifestyle is a powerful deterrent to change.

I suggest that we have to change; we are steadily losing periodicals in our libraries. At University of Canterbury, the charges for science journals in New Zealand currency have increased at the unsustainable level of 19% per annum over the last four years, despite a major (12%) cancellation exercise.

Nearly all the components of a fully electronic journal are in place. E-mail is widely used for the electronic submission of text and mathematics in the standard - and free - TeX or its derivatives, for PostScript figures, for refereeing and for retrieval from preprint databases. Publishers (notably AIP, IOP and of course Aust. J. Phys.) already can leave typesetting to authors, who benefit in drafting and proofreading. Convenient front ends for TeX such as Scientific Word now exist. Bibliographic details including titles and abstracts of published articles are available electronically through Current Contents.

We desperately need international collaboration between institutes such as ANZIP and librarians and computer scientists. This needs to be sufficiently imaginative to offer worthy solutions to the problems - and standards for - of user-friendliness and low-cost basic access: the use of departmental hardware will help libraries provide for browsers, and capitalises on the availability of familiar and convenient hardware and software. We need to balance the inevitable loss of some advantages of paper archives with those of electronic archives; machine-aided text searching and downloading become possible; library storage costs fall; cost-effective international databases would reduce the need for local archives.

If we fail to act as a community, piecemeal and rival commercial development will put the next generation as much at the mercy of the software vendors as of the publishers. Libraries are already forced to invest heavily in information systems, each of which has severely limited abilities. Library automation systems such as Innopac, Dynix, DRA, GEAC etc. are only now implementing protocols for user-friendly if expensive retrieval of bibliographic records from rivals’ systems. The various Periodicals on Disc series, which is currently being heavily invested in by many Australian academic libraries, is for all its promise a doomed technology. The use of graphics dumps of published pages rather than ASCII storage where possible (that is, of text and mathematics) is a stiff penalty.

Text browsing and downloading is impossible; reproduction quality is poor; the shelves fill quickly since only 8000 journal pages fit on one CD. We need fences at the top of the cliff now, not ambulances later.

The electronic preprint database has proliferated (see Paul Ginsparg’s letter in Physics Today, June 1992 p13), so as to be heralded as the de facto solution to our journal problems. In a recent article in Physics World, Brian Wybourne and I argue for a professionally controlled journal database as well as the preprint database.

Why? What would matter if such quality control were to lapse? “access for all” means much less if we all have to scrounge through a mass of electronic trivia. Judgements about the funding of science rest with people who are not expert in the topic. No superficial index such as the number of downloads or citations of a paper - which may only fuel an e-mail or perish” syndrome - is all we can offer our administrators. The legal profession has found to its advantage that librarians take professionally set guidelines seriously. On abandoning quality control we would disadvantage students, frustrate archivists, and lose credibility as a profession. From this point of view the electronic databases, for all their promise, are taking on the hue of a black market.

How? We suggested that Physics societies operate their databases in two sections, one per journal being regulated (a professional archive) and one general and unregulated (the bulletin board). Authors freely bulletin their electronic preprints, thus ensuring both their priority and immediate public access. The copies are later revised if necessary before consideration for the archive. Public-domain electronic feedback from readers in the interval would be linked to the submission and would make a referee’s task easier and also reduce two banes of our current archives: errors and duplication.

In summary:

- Professionally regulated Journal structures are vital for the continued health of any profession whose communal activity centres on its literature. This control can coexist with and even benefit from the immediacy of electronic publishing.

- Imaginative standards and protocols in hardware and software requirements for the production and dissemination of the electronic literature need to be set.

- Our professional societies urgently need to address these issues if we are to avert the technical, commercial and professional dangers which are already becoming evident.

Geoff Stedman is in the Department of Physics and Astronomy at the University of Canterbury in New Zealand.
OBITUARY

FRED JACKA 1925-1992

Dr Fred Jacka, President of the Australian Institute of Physics for the term 1973-74, died in Adelaide on October 16, 1992. He was born at Ouyen, on March 14, 1925, in north-western Victoria, one of four children of Rose and Percy Jacka. He gained his PhD degree at Melbourne University. The subjects of his post-graduate studies were cosmic rays, aurora and geomagnetic disturbance. He was a person of great talent, doing an enormous amount of good, not only for science, but also for the great number of his colleagues and friends.

His early scientific period: associated with the Antarctic Division

Fred joined the Australian National Antarctic Research Expeditions (ANARE) in 1947 and worked with a team at the Physics Department, University of Melbourne, preparing the cosmic ray equipment for the expeditions. In December 1947 he sailed to Heard Island, where the ANARE established a research station. Fred carried out cosmic ray observations there throughout 1948 and returned to the Physics Department in 1949 to analyse his results. In 1950 he joined the Antarctic Division in Melbourne as chief scientist.

As an experimenter at Heard Island Fred had a stabilising influence. His sensitivity, his cool logic and his imperturbability led him to be greatly respected by his colleagues and he became a sort of father figure at the station. These same qualities, combined with his fine intellectual capacities, earned him the devoted loyalty of everyone in the Antarctic Division who worked under him.

In 1950 the cosmic ray program was transferred to the Physics Department at the University of Tasmania in Hobart. Fred supervised the transfer and continued to take an active interest in the work until it became firmly established.

Over the next four years he developed his personal research activities in the aurora and upper atmosphere physics (UAP) generally while assisting in enlarging the scope of scientific programs at the island stations and in preparing for an assault on the Antarctic in 1954. Together he and Law designed the format of the ANARE Reports and for several years he was assistant editor until he took over from Law the editorship, which task he continued until his resignation.

There was much to do in those early days. A lot of effort went into building up the smooth collaboration between the Antarctic Division and its associated scientific bodies - various Commonwealth and university departments. Selected scientists were trained and equipment was designed and either purchased or built. In the latter regard Fred spent years of, at times, most frustrating labour in organising an efficient instrument workshop for the construction of optical and other scientific equipment. He played an important role in committee work leading to the exciting IGY period and, later, represented Australia at a number of international IGY and CSAGI conferences. He became Secretary and eventually Convener of the SCAR Working Group on UAP.

He had a remarkable talent for design, not only in scientific instruments but in Antarctic equipment generally - clothing, field equipment, huts, and logistic support items. One of his outstanding efforts was the design of a large cold room, large enough for a scientist to work in while testing equipment in temperatures down to -40°F.

However, his work was plagued by a number of worrying frustrations. It took some years for Government approval to be obtained for the construction of an instrument workshop and, thereafter, continuing battles for approval for the creation of adequate positions for instrument makers and other workshop staff. There were problems, too, with accommodation - the workshop successively removed from Lt Lonsdale Street, City, to Church Street, Richmond, and to Riversdale Road, Hawthorn, before finally settling permanently at the later St Kilda Road premises. Nothing was accomplished without heart-breaking effort.

Altogether, Fred Jacka’s contributions to the achievements of the Antarctic Division were immeasurable, for his unselfish and vigorous influence permeated every field of endeavour. It was, indeed, a major deprivation for the Antarctic Division when he resigned in 1965 to become the Director of the Mawson Institute for Antarctic Research in Adelaide University, a position which was a fitting culmination to his scientific career.

Fred was first and foremost an experimental physicist. In the 50s he developed parallactic photography, all-sky cameras and photometry for aurora studies. His principal effort in upper atmosphere physics in the late 50s and early 60s was the determination of the location of the southern aurora zone and the frequency of occurrence of auroras there. With the assistance of F.R. Bond, he determined these things with great accuracy for that period.

This Australian work gave scientists everywhere data essential for theoretical developments then, and complemented similar work being done in the northern hemisphere, principally by scientists in USSR and USA. The work was fundamental to the understanding of the interaction of the Earth’s magnetic field with the interplanetary medium. This is now understood to be...
crucial to the understanding of the region of space in which artificial satellites move, which in turn is important to modern communication technology. He fostered in his group, theoretical studies related to the aurora; Dr G. Simonow worked on parallactic photography, while Cole worked on this subject as well as the theory of interaction of the solar wind, the magnetosphere and the ionosphere. B.J. O’Brien (later Professor of Physics at Iowa State University and Rice University) was for a time a member of the group, before joining the US space program.

Numerous ANARE physicists were associated with Fred Jacka in that period on aurora and upper atmosphere research, including the late R. Blake, the late N.M. Brice (who became a Professor of Electrical Engineering at Cornell University), K.D. Cole (later Foundation Professor of Physics at La Trobe University), G. Cowling, J.V. Denholm (later Senior Lecturer at RAAF Academy, Melbourne University), R.L. Dowden (later Professor of Physics at Dunedin University), R.H. Eather (later Research Professor at Boston College), R.J. Francis, B.P. Kilfoyle, G. Major, R.L. Paine, I. Thomas, and the late R.H. Wilkinson (later Senior Lecturer in Physics at Melbourne University). In cosmic ray studies, he was associated with Dr. N.R. Parsons and Dr. R. Jacklyn.

There was a research environment which could be "felt" in the upper atmosphere section of the Antarctic Division, largely due to Fred Jacka's influence. Physicists who went on expeditions with ANARE were greatly helped by Fred "to find their feet" through his wise counselling and support.

**His second scientific period: the Mawson Institute for Antarctic Research**

In 1965 Fred was appointed to the post of Director of the newly created Mawson Institute for Antarctic Research within the University of Adelaide. Here he had a charter to conduct research in or related to Antarctica, and to be the curator for Mawson's records. He had extremely high regard for Mawson as a scientist and a person and had many of Mawson's qualities of adventure, courage, leadership and devotion to science and life. During the period of transition from the Antarctic Division to the Mawson Institute for Antarctic Research he was developing photometry of the hydrogen aurora with R.H. Eather.

In this new position new opportunities opened up for Fred. Here he was able to pursue the development of a variety of optical instruments with the help of Don Creighton and many graduate students (most of whom are mentioned in the co-author list below). The instruments were tested at the Mt. Torrens observatory for eventual deployment and use in Antarctica. In this he was assisted by the Antarctic Division. He designed and constructed photometers, interferometers and lasers for application to upper atmosphere studies, and this work was soon at the forefront of the field. With his colleague co-authors, listed below, he made numerous important original contributions to UAP. Topics on which he made significant contributions are:

- photometry of the aurora;
- development of Fabry-Perot and dual Fabry-Perot interferometers for aurora and airglow studies;
- remote sensing from the ground, of temperatures and wind speeds in the region of space where orbiting satellites move;
- the influence of magnetic activity on the upper atmosphere;
- internal atmospheric gravity waves;
- dynamics of the thermosphere;
- dynamics of the sodium layer in the mesosphere;
- development of a lidar system for studies of the stratosphere and troposphere.

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**Dr. Fred Jacka**

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OBITUARY

Fred also applied his talents in optics to the application of lasers to the treatment of tumours, collaborating with medical colleagues in Adelaide and while in Adelaide, he engaged in some lecturing which he found interesting and challenging.

A great labour of love was his editing, with his wife Eleanor, of Mawson's Antarctic diaries. Produced as a book this work stands as a most important resource for scholars of the life of Sir Douglas Mawson. Without the dedicated efforts of these two, the publication of this historic material would have been delayed indefinitely.

He was greatly disappointed by the decision of the University of Adelaide not to continue support for the Mawson Institute for Antarctic Research beyond his retirement.

Fred was intensely Australian. As a young man, in an age when many of his contemporaries travelled extensively to the United Kingdom or Europe to find themselves or their place in the world, Fred stayed in Australia. He fashioned his identity here, recognising clearly that, despite the great past of Europe, Australia was a place where the dreams of a better, more just life might evolve, free of the historical tensions which periodically wrecked havoc in those distant lands.

He strongly developed his contribution to Australian life by his influence on his family, his scientific colleagues and his wide circle of friends from all walks of life. His scientific background helped to foster in him this Australianism, through his recognition that universal truths can be discovered anywhere, although his interests in art, music and literature may have been equally persuasive to him in this regard.

Fred Jacka, through his publications, his work on SCAR committees, and his training of young physicists who later, were to attain high positions overseas, made an important contribution to the international image of Australian science.

Scientific Publications

Fred's scientific publications were mostly in the field of the aurora, geomagnetic disturbance, and the physics of the upper atmosphere, principally above about 80 kilometres altitude. In recent years his interests have been coming down in altitude to the stratosphere and lower. He had a very high reputation internationally for his contributions to UAP and his work is important in understanding environmental change, because the upper atmosphere gives us early warnings of some disturbing trends. Witness for example, the changes in the ozone layer.

He was responsible for the production of an atlas of the aurora in mid-career.

His work on upper atmosphere and auroral physics was often presented at the international forums of the International Association of Geomagnetism and Aeronomy, the Scientific Committee on Solar-Terrestrial Physics, the Committee on Space Research and the Scientific Committee for Antarctic Research, in addition to the meetings of the Australian Institute of Physics and ANZAAS.

AN S.O.S. MESSAGE

BETA RAY SPECTROMETER

A reduction in the level of UK Government support for nuclear data measurements at NPL has meant that the laboratory can no longer sustain a programme of work based upon its iron-free double-focussing magnetic beta-ray spectrometer.

The NPL spectrometer is perhaps the last remaining fully operational instrument of its type, with a number of features which render it uniquely suitable for measurements of beta spectra and for the characterisation of internal version spectra.

Given that it is very unlikely that any alternative source of funding can be found to support beta-ray spectrometry at NPL, we are faced with the need to dispose of the spectrometer so that the space which it occupies may be used for other purposes. In the absence of alternative proposals it seems inevitable that this valuable piece of equipment may shortly end its days on the scrap heap.

If you are in a position to consider acquiring the NPL beta-ray spectrometer for use in your own or a local institution, please contact Peter Christmas, Acting Head, Division of Radiation Science and Acoustics, NPL, Teddington, Middlesex UK TW11 OLW. Fax 081-943-2155


Not only a scientist, Fred had a deep interest in music, art, literature, people, society and the state of the world. Fred used his senses to the full. He understood that scientific instruments are extensions of the senses to areas of truth not accessible by other means. He understood that these instruments provide anchors for the natural senses in a real world. With fervour and humanity he brought important new knowledge and wisdom into the world.

His courage in coping with his illnesses in the latter part of his life was monumental. But most of all, he will be remembered as a person with great zest for life, a fine sense of humour, and an aversion to nonsense and humbug.

He is survived by his wife Eleanor and children Tamara, Marcus, Joe, Xanny, Kate and Sally

Keith Cole & Phillip Law
La Trobe University
Low-Noise Current Amplifier

Stanford Research Systems have released the new model SR570 low noise current amplifier, suitable for a wide range of photonic, low temperature and other measurements. The new instrument has input noise of 5nA/√Hz with 1MHz maximum bandwidth and 1 pA/V maximum gain. The SR570 lets the user sink current into a virtual null or selected DC bias and allows input offset current to be adjusted from 1 pA to 5mA. The instrument includes adjustable high, low and bandpass filters to reject interference and noise. When isolation from line power is needed, the SR570 can be operated from batteries for up to 15 hours. Stanford also offer the model SR560 low noise (1 nA/√Hz) voltage amplifier with gain up to 50,000 for related applications.

For more information on Stanford’s complete product range, please contact:

Coherent Scientific Pty. Ltd.
116 Burbridge Rd
Hilton SA 5033
Tel (08) 352 1111, fax (08) 352 2020

Lumonics YAGMaster YM-1200

This pulsed Nd:YAG laser was recently added to the range of SuperGaussian resonator lasers in the YAGMaster series 111 range.

The flagship YM-1200, with a fundamental pulse energy of 1.4J at 10Hz, retains all of the features of the other devices in the same series. The SuperGaussian resonator technology provides for very efficient energy extraction while maintaining a far field spatial fit to Gaussian of ±2.95. The beam is of such high intrinsic quality and low beam divergence (±0.5mrad full angle) that frequency doubling efficiencies in excess of 50% are specified.

When fitted with the optional injection seeding system the laser operates on a single axial cavity mode, providing a smooth temporal profile and a transform limited linewidth of 0.0045 cm.

Another option for the laser is operation in double pulse mode with the installation of a specially configured Pockels cell. This provides a user controlled interpulse interval of between 1 and 200 microseconds and can be combined with injection seeding to achieve a very high degree of coherence.

For additional information contact
Raymax Application Pty Limited
30 Lockwood Street
Ascot Vale 3037
Tel (02) 477 5654, fax (02) 987 4858

Laser Safety Goggles

Lastek stock the Yamamoto range of laser safety eyewear.

This wide range of laser safety eyewear includes low attenuation goggles to allow the operator to see the laser beam and yet remove the irritating glare.

Goggles for NIR lasers, Ti:S in particular, are a speciality.

For a catalogue call Graeme Jones at Lastek Pty Ltd
400 King William Street
Adelaide SA 5000
Tel (08) 231 2155, fax (08) 231 2169

Surface Science Products From MDC

MDC vacuum components have released their new catalogue for 1993 with a number of new products including a range of electron beam sources. These evaporation sources are the self accelerated bent beam type. An electron emitter held at high negative potential emits electrons in a preferred direction.

Stanton Scientific also distribute a range of surface science products.

For more information contact:
Stanton Scientific
Tel Sydney (02) 818 1207
Tel Byron Bay (066) 85 6902
Tel Wellington NZ (04) 471 0590
Fax Australia (066) 858530
PO Box 928, Byron Bay NSW 2481
E-mail: mshivac@peg.pegasus.oz.au

Series 124 Diode Pumped Ring Laser

This third generation of non-planar ring oscillator laser is designed to provide from 5mW to 75mW of stable, ultra narrow linewidth diode pumped laser light at a very affordable price. As with most of the other NPRO lasers, output frequency tuning of many MHz in a few ms is available.

Several different wavelengths and powers are available: 5-75mW at 1064nm, 5-50mW at 1319nm, 10mW at 2015nm from Tm:YAG and 3mW at 2091 from Tm,Ho:YAG.

The laser is completely self contained with diode pumped laser and control
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Prompt Critical

Science With Something of a Smile
The author of the popular "A Random Walk in Science", Robert Weber, has turned his hand to humour. Now he has compiled a 450-page anthology of funny, half-funny and downright droll extracts from scientific books and Journals. It bears the title "Science with a Smile". Perhaps my appreciation of whimsy is wearing thin with age, because I could read page after page without a giggle. I guess I was amused by about 150 of the 450 pages.

Much of the humour is ponderous to an extreme, enjoyable only by those in the know. However there are many items which struck a chord. Every academic researcher will recognise a colleague (or two) in the wry "Portrait of the scientist as a late victorian ruin". The ruin itself, Professor Flay, striving for a coveted FRS, is a skilful parody of all over-ambitious academics.

Some inclusions, such as Howard Wainer's "How to Display Data Badly", are very unfunny because the worst examples come from media advertising and official government publications. In it, as a contrasting example of beautifully presented information, is Minard's famous graph of Napoleon's dreadful losses during his ill-fated Russian campaign. But the small size of its reproduction, and lack of colour, is disappointing. The only colour inset is a four-page reproduction of the Romanian postage stamp series depicting the "Ten mathematical equations that changed the face of the Earth". They are very interesting and attractive, but not the kind of thing to raise a smile.

The dust cover also features samples from a postage stamp set. These are the cartoon-style series issued to inform the Australian public about metric conversion, back in that long-lost deflated era when it cost only seven cents to post a letter.

"Science with a Smile" is a good source-book for those hard-to-find-when-you-want-them items of trivia, such as H W H O Petard's gem "On the Optimum Size of an Establishment", or Archbishop Ussher's rationalisation determining the date of creation as Sunday, 4004 October 23 BC, or the delightful English advice on "How to act at a seminar", plus many others.

I would like to see Dr Weber's short section on myopic forecasts expanded somewhat. It includes Rutherford's famous pronouncement that atomic energy would never be of commercial value, and Edison's unequivocal dismissal of future AC power distribution. We could add the verdict of a local committee which, in the 1950's, halted transistor development by the CSIRO Radiophysics Division on the grounds that they could see no future use for these devices in communications ("A picture history of CSIRO Radiophysics", J Deane, CSIRO, Melbourne 1985).

"Science with a Smile" is a good book for the library, if only as a source of science-slated material for after-dinner speeches. It is published by the Institute of Physics Publishing, Bristol, and costs £19.50 sterling in hardcover edition.

Colin Keay
Book Reviews Editor

Reviews

Radiation Protection Dosimetry: Skin Dosimetry
H.G. Menzel, P. Christensen and J.A. Dennis
Nuclear Technology Publishing
Ashford, Kent 1991
iv + 208pp., UK£60.00 (hardcover)

The skin is an organ subject to a wider range of radiation risks than most other organs of the body, and its protection involves consideration of a range of dosimetric problems. Indeed, the International Commission for Radiological Protection have set low annual dose equivalent limits (500mSv per annum over any skin area greater than 1cm²) which, unlike the other organs, is derived from consideration of deterministic rather than stochastic effects. Consequently one is concerned with both short and long term effects of both acute and chronic exposure. Of particular importance are the effects of low energy X-rays, β particles and α particles, especially those emanating from surface contamination. This Proceedings, of a workshop held in Dublin, deals somewhat briefly with the biological effects of these particles on the skin but pays more consideration to the physics of measurement. While some papers consider the occupational dose rates from external sources (e.g. from manually handled therapeutic sealed sources) most are concerned with
BOOK REVIEWS

radiation safety in the nuclear reactor environment.

The Proceedings, like the Workshop itself, is split into six sections dealing with the biological aspects, the hot particle problem, implication of national and international recommendations for monitoring procedures, standardization and calibration of skin dosimetry, monitoring techniques and instrumentation including industrial monitoring and field instruments as well as monitoring experiences and problems. Approximately one third of the 36 papers are invited reviews introducing or extending each of these sections.

The results presented in many papers emphasize the need for internationally agreed procedures for standardization and calibration, with several papers exploring the usefulness of thermoluminescence and thermally stimulated exoelectronarios for carrying out thin layer dosimetry. Since the range of exoelectrons is of the order of 100 nm, TSEE dosimeters have a very thin sensitive layer and can truly be used to measure surface doses, or doses at any applicable depth below a surface. They are ideal for beta dosimetry, but further developments are required to make them a dosimeter for everyday practical application. Finally, some papers pointed out that high skin doses can occur at nuclear workplaces, which emphasizes the need for accurate skin dosimetry.

Despite the number of invited papers, this book suffers the fate of most conference proceedings in that there is a lack of continuity between papers (chapters). Nevertheless, for those who need some understanding in this field the book is a useful addition to one's library, though the price may be a disincentive.

Alun H. Beddoo Royal Adelaide Hospital

Physics at SuperLEAR
C. Amsler and D. Urner (eds)
IOP Publishers, Bristol 1992
xiv 444pp., £49.50 (hardback)

This volume comprises 48 specialist papers on antiproton physics presented at the SuperLEAR workshop held at the University of Zurich in October 1991. The workshop discussed the case for a new high luminosity antiproton storage ring at CERN, with momentum in the range 2-15 GeV/c. The present LEAR (Low Energy Antiproton Ring) machine at CERN deaccelerates \( \bar{p} \) from the Antiproton Accumulator, down to 0.1 - 2 GeV/c. Intermediate deacceleration is provided by the Proton Synchrotron prior to injection into LEAR. Until LEAR was commissioned in 1983 the \( \bar{p}-p \) system was relatively unexplored.

The proposed SuperLEAR machine would have superconducting bending magnets and gas targets. It would extend studies of meson spectroscopy beyond the current LEAR and Fermilab ceilings, to the mass range \( >2.4 \text{ GeV}/c^2 \). These include charmonium spectroscopy, searches for CP violation in hyperon decays, exploration of hadron spectroscopy and gluon dynamics, particularly of quark-antiquark pairs accompanied by a dynamical excitation of the gluonic field, and p-nucleus annihilation.

A key issue behind the SuperLEAR proposal is the detailed testing of quantum chromodynamics (QCD), which is the currently accepted quantum field theory of hadrons. According to the quark model, proposed in 1983, all hadrons should consist of quark-antiquark pairs (mesons) or triplets of quarks (baryons). The quarks are bound by gluon exchange and as well acquire a constituent mass via self-interaction with the gluon field. However it is also suggested that the theory predicts exotic mesons made exclusively of gluons (glueballs), a mixture of quarks and gluons (hybrids) or multiquark states. The study of these numerous ordinary and exotic states is far more than an accumulation of data - for these states provide an opportunity to test the fundamental concepts of quantum field theory in a manner that was not possible with quantum electrodynamics, because in QCD the peculiar aspects of quantum field theory are both dominant and accessible to experimental investigation.

R.T. Cahill
Physics Discipline
Flinders University

Entropy Optimization Principles with Applications
J.N. Kapur and H.K. Kesavan
Academic Press, Boston 1992
xi + 408pp., US$64.50 (hardcover)

The major part of this book represents material included in a one-semester honours level course taught by the authors in India and Canada. It is based on two widely used optimisation methods: Jaynes' maximum entropy principle and Kubo's minimum cross-entropy principle. Many applications described in the book range from scientific problems to economics and urban planning.

The text is rather informal, which makes the book easily readable. However, the presentation is not always accurate and more difficult fundamental questions may be glossed over. For example, on p.55 we read: "Shannon's measure of entropy was developed essentially for the case when the random variable takes a finite number of discrete values". Of course, Chapter III in Shannon's seminal work is dedicated to continuous variables. It includes a careful discussion of the fact that the entropy of a continuous variable can be defined only with respect to an assumed standard, i.e. a selected coordinate system where each volume element is given an equal weight. This fact, which is of paramount importance for subsequent applications in statistics does not get mentioned with the entropy of continuous distributions. Interested readers should best go back to Jaynes, E.T.

Jaynes, Papers on Probability, Statistics and Statistical Physics, Reidel, Boston, 1983), but his book is not referenced. The advantage of the present book is in the variety of applications covered in the text. For example, few readers from physical sciences will know that workers in social sciences have successfully explained earlier empirically observed laws using our concept of energy which becomes "cost" and entropy - which amounts to "uncertainty" together with the entropy maximisation principles.

However, the usefulness of the text as a reference work is severely hampered by the lack of references to the original work described in the examples. We do not get to see the actual data and the agreement or otherwise with the applications of the principle of maximum entropy, and we do not get references to the original sources either. The book can thus best serve as an introduction into a variety of methods and applications in this area for the non-specialist.

S. Marcelja
Research School of Physical Sciences
and Engineering
Australian National University

Spectroscopy of the Earth's Atmosphere and Interstellar Medium
K.N. Rao and A. Weber
Academic Press, San Diego 1992
xi + 526pp., No price given (hardcover)

Twenty-five years ago, the earth's atmosphere consisted of nitrogen, oxygen, argon, carbon dioxide and "trace gases". In the interim, we have come to realise the important role many of these trace gases play in the life and health of the biogeochemical system of which we are just one part. Methane,>}
Research, examines the role that high resolution spectroscopy is playing in the identification and profiling of many of these trace species. The first two chapters outline the achievements in this pursuit offered in the far-infrared and microwave region (by Carl and Carlotti) and in the mid-infrared region (by Brown, Farmer, Rinland and Zander). The final chapter (by Winnewisser, Herbst and Ungerechts) looks beyond our atmosphere to the molecular oddities found among the stars. No buckyballs (as yet), or CFCs, but plenty of organic "stuff", and even the suggestion (by Hoyle) of bacteria. These three chapters are backed by three more theoretical ones. Levy, Lacome and Chackerian examine the theory of collisional line mixing, and its applications, while Chapman, Locie and Pierie cover the spectra of spherical top molecules, such as CH₄SF₆ etc. Finally, Smith, Rinland, Devi, Rothman and Rao provide an update on infrared line parameters - a guidebook to the published literature.

This book is probably not a good place for a graduate student to begin a study of the subject, nor with 1500 references is it intended to be definitive. However, for a perspective on an important subject, and an introduction to a large body of research, it should prove most useful.

Michael Box
School of Physics
University of New South Wales

Advanced Welding Processes
J. Norrish
IOP Publishing Ltd, Bristol 1992
xiii + 375pp., UK£24.75 (paperback)

This very reasonably priced paperback is targeted at the general interest market and aims to present the most recent advances in welding technology. The coverage of various processes is extensive and for someone who knows little about welding there is a wealth of information in this volume. However, for the professional in this field I suspect that the book has very little to offer in the way of new information although it may provide a reminder of alternative processes and procedures available for some applications.

The book is very readable, well illustrated and well referenced and will prove a valuable addition to libraries in many industrial enterprises.

G.M. Haddad
National Measurement Laboratory
Lindfield

Thin Film Resistor Sensors
P. Ciureanu and S. Middlehoek (eds)
IOP Publishing Ltd, Bristol 1992
x + 491pp., AS£207 (hardcover)

The decreasing price of electronic hardware has resulted in electronic measurement, monitoring and control systems extending in range to cover a very large collection of activities from major area projects of environmental control and monitoring to very small size medical diagnostic systems. The sensor inputs can be followed by simple processing circuits up to very complex multisensor systems involving expert systems and neural networks. The advances in processing electronics have
BOOK REVIEWS

not been matched by similar reductions in size and price of the sensors which are an integral part of the system. Research and development of new improved sensors is an important activity. This book gives an overview of a certain class of sensors called 'thin film resistive sensors'. Sensors can be self-generating such as solar cells or modulating when some physical parameter, such as dielectric constant, changes which can then be measured. The field covered by this book is restricted to modulating sensors based on the change of resistance.

The book opens with a chapter by the editors of a review of sensor representation followed by specialist chapters written by staff members of the Institute of Physics and Technology of Materials Bucharest Magurele. Topics covered are photoreisitive sensors made with polycrystalline and amorphous films, Piezoresistive sensors, Thermoresitive sensors, Magneto-resistive sensors and Chemiresistive Gas sensors. Each chapter has a good balance between basic theory and application examples followed by an extended list of references. The text is clear and easy to follow as the topics are covered in a progressive and logical manner. This book would be a good text for a final year undergraduate course or as a research reference book.

A.J. Marriage
Microelectronics Centre
University of South Australia

Electromagnetic Instabilities in an Inhomogeneous Plasma
A.B. Mikhailovskii
IOP Publishing Ltd, Bristol 1992
x + 298pp., £55.00 (hardcover)
Mikhailovskii is well known for his contributions to the theory of electrostatic instabilities, in the Reviews of Plasma Physics. When the kinetic pressure is comparable or larger than the magnetic field pressure electromagnetic effects become important. This book deals with the theory of these instabilities in an inhomogeneous inhomogeneous plasma. The geometry is mainly straight field lines although some effects of curvature are also discussed. Even with these limitations there are many possible electromagnetic instabilities and Mikhailovskii discusses most of them. The presentation is given from a general physics viewpoint. This make the book accessible to any theoretically inclined researcher. However, I doubt that the non-specialist would make the effort.

While electromagnetic effects are important for modern fusion experiments, as well as many space applications, so also are geometrical effects. However, an adequate treatment of realistic geometries more often than not renders analytical methods unfeasible and one is left with the numerical alternative. The analytical approach presented in this book, while not directly applicable in situations where geometry is of the essence, gives a good understanding of the basic physics. The book might therefore serve as an introduction to a specific problem keeping in mind that geometrical effects may alter the picture.

This book represents an up-to-date reference source in an important and rapidly developing area of plasma physics. Unfortunately, as is often the case in Russian literature, the references are somewhat one sided. The book is definitely a must for the library and would also be handy on the shelf of the researcher in the field if one could afford the price.

Mikael Persson
Department of Theoretical Physics
Austalian National University

Smart Structures and Materials
B. Culsaw, P.T. Gardiner and A. McDonach (eds)
IOP Publishing, Bristol 1992
xvi + 420pp., £65.00 (hardcover quarto)
The field of smart structures and materials is emerging as a very interesting and important technology. At the structure level the ideas are often simple; like integrating a sensor and/or actuator system into a structure so that by using the sensors, the environment of the structure can be constantly monitored and with a control loop system, the actuators modify, in an appropriate fashion, the structure’s properties. An example of a smart sensor structure is the weaving of optical fibre sensors into a wire rope. Smart sensors advance this concept one step farther, where the sensing and response functions are built into the material itself.

This book is a collection of papers presented at the first European Conference on Smart Structures and Materials, held in Glasgow from the 12-14 May 1992 and chaired by Professor Brian Culshaw. In addition to the plenary session there were eleven other sessions with a total of 93 papers presented, the majority being reproduced in this book. Most sessions had an invited speaker.

The sessions covered the following topics:

1. Smart sensing applications dealing with suitable smart structures and materials for monitoring parameters such as motion, vibration, temperature, humidity, breathing and crack detection.
2. Fibre optic sensors, covering smart sensors for use in a range of concrete and aircraft structures, a gravitational wave interferometer detector, temperature and strain movement.
3. Actuator applications, based on piezoelectric materials, shape memory alloys and heat pump modules.
4. Smart concepts in various engineering disciplines, including civil and mechanical. Examples are: buildings (particularly those in seismic zones), dam walls, truss structures, helicopter blades, aircraft wings, structures for operation in space, pipes and gas turbines.
5. Reliability implications, examining the fatigue and other stress/failure parameters of composite materials containing imbedded sensors.
6. Control and signal processing issues, including fuzzy logic, artificial neural network and feedback methods.
7. Future developments: papers discuss light emitting intelligent Langmuir-Blodgett films, smart polymer gels, superionic materials and smart materials which sense, activate and repair damage.

The volume includes both an author's and keyword index. It is an excellent book for those wishing to identify research groups and the latest work being undertaken in this important field.

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Sheet Metal 1992
B. Shirvani and D.R.H. Braggs (Eds)
IOP Publishing, Bristol 1992
428pp., £65.00 (hardcover)
This publication is the proceedings of an international conference on diverse aspects of sheet metal engineering, held at Birmingham Polytechnic in April 1992. The 39 papers are divided into six sections titled: Fabrication, Quality Management and Maintenance, Press Tools, Forming, Management & Logistics, and Control Automation & Laser Cutting. All but four of the papers are of UK origin, and 11 of them are from Birmingham-based authors. There is more here for the manufacturing or process engineer than for the
BOOK REVIEWS

metallurgist or applied physicist, but having read that it is an interesting study of how technical developments in industry are often driven by new management philosophies, techniques and fashions rather than by the emergence of new technologies per se. The techniques and implications of Total Quality Management, Computer Integrated Manufacturing, automation, employee involvement, flexible manufacturing and Computer Numerical Control are frequently discussed. In many cases these are described in a context wider than just the sheet metal industry. For those interested in technical developments, there are papers on subjects ranging from laser cutting and welding, to finite element simulation of forming processes, expert systems for tool monitoring, texturing of sheet metal surfaces, flexible forming using discrete tooling, and actuators for high speed machines.

I.M. Robertson
Ship Structures and Materials Division
MRL, Melbourne

Fundamentals of Dynamical Systems and Bifurcation Theory
Milan Mavdel
Adam Hilger, Bristol 1992
viii + 293 pp., UK£33.00 (hardcover)

It is claimed in the Introduction that the book "is designed for graduates and students of mathematics, technical and economic scientists, as well as for scientific workers in the field of physics, chemistry, economics and biology and for those who solve problems of dynamical character". After going just through the first two chapters one must realize that the claim is too optimistic. In fact, the reader who is unable to just scan through these chapters and who needs actually to study the topics covered in those 62 pages should not attempt to continue. Though everything is defined, the information is too compressed to have a significant educational value. Even though there are some fairly down-to-earth examples scattered throughout the book (like linear dynamical systems in the plane), the bulk is a highly technical abstract exposition suitable for pure mathematicians who want to join the field. However, even they might be frustrated by being frequently referred for details to references, that is, for which are in Russian, Czech or Slovak. Although the fundamental features of the modern qualitative theory of dynamical systems are present, to find them and translate them into a form usable for solving problems of dynamical character is certainly not easy.

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Thin Films For Emerging Applications
M.H. Francombe and J.L. Vossen (eds)
Vol 16 in "Physics of Thin Films" series
Academic Press, San Diego 1992
xi + 367pp. No price given (hardcover)
The four topics reviewed in this edition have been chosen for their importance to a range of technologies which are for the most part at early stages of development. A better understanding of the physics behind specific thin film and film substrates and the growth processes leading to desired structures and properties are the central issues. Book based review articles such as these should be sufficiently self contained to serve as an ongoing basic reference and as a guide to all the important relevant literature. They should also provide stimulus and a clear view of the significance and prospects of the field for those new to the area.

"Permanent magnet thin films: A review of film synthesis and properties" by F.J. Cadiou. "Lateral diffusion and electromigration in metallic thin films" by K.V. Reddy and "Fracture and cracking phenomena in thin films adhering to high elongation substrates" by P.H. Wojtczchowski and M.S. Mendolia; each succeeds to different degrees in these aims, largely because they are sufficiently focussed with bibliographies ranging over 60 pages (Cadiou) to 135 (Reddy).

However the largest article 'High Tc superconducting thin films' by N.G. Dingle is in a different league altogether in trying to condense the contents of 540 articles! (almost all from just four years, 1988 to 1991) into a readable and useful review. The results and style of the article reflect the enormity of the task. Amazingly it is nearly all text, with a few diagrams (well chosen but too few) and mathematical equations and no chemical equations, despite considerable emphasis on processing. The resultant almost unbroken saga eventually becomes a little indigestible. This plus the very large number of sentences that begin along the lines "X et al prepared ... or Y et al discovered that ...". It does not make for stimulating reading. Furthermore a number of quite significant references are missing. The fault here is probably with the series editors who should have commissioned more than one article in this field. It is broken up into sections according to deposition technique so that at least if you are just interested in laser ablation or sputtering you do not have to wade through it all. The relevant underlying physics is also not presented well.

The other articles are well worth reading even for those not specifically involved in the topic because they address a number of basic and intriguing issues.

I personally learned a lot of value from the article on fracture and cracking phenomena in low elongation films on high elongation substrates, an area we have taken a very empirical view of up until now. The intricacies of sputtering the correct directly crystallized stoichiometry and anisotropy in two, three and four element thin film alloys to get large coercive forces and remanent magnetization areCellained in the Cadiou article. The reality of miniature periodic permanent magnet arrays with field strengths as high as bulk magnets opens up interesting possibilities in optics, free electron lasers and semiconductor devices. The article on electromigration is not all encompassing and doesn't pretend to be) but rather is directed at some important and proven experimental approaches to its study.

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Superconductivity: Its Historical Roots and Development From Mercury to the Ceramic Oxides
Per Fridjof Dahl
American Institute of Physics
New York 1992
xiii + 460pp., $US55.00 (hardcover)

My introduction to cryogenics in 1947 was Mendelsohn in Oxford propounding his empirical "two-fluid" model of superconductivity and superfluid helium. Part of the "fluid" was in a frictionless ground state. At Cambridge, Shoenberg and Pippard were applying microwave techniques to problems of penetration depths in metals and the concept of "coherence"length of the superconducting electrons. Soon after this Tinkham confirmed the energy gap with far infrared measurements. Frohlich and Bardeen independently suggested that vibrating ions played a role in the electron interactions, confirmed by the observations at Rutgers and NBS of change in transition transition temperature with isotopic mass.
This book covers this period but devotes much more detail to the prehistory, the personalities involved in cryogenics 100 years ago, early electron theory and why Kamerlingh-Onnes was so interested in measuring the resistivity of Au, Pt and Hg in 1911. There follows the long saga of 20 years of experiments on the “magnetics” and thermodynamics of the superconducting transition. Then Meissner and Ochsenfeld confirmed the flux expulsion so that B=0 becomes more important than R=0. Dahl does not forget the efforts of many eminent theorists in the prewar era to try and explain superconductivity.

The author's interests are revealed by a rather too long and technical chapter on the use of superconductors in particle accelerators. Also it misses out on a few topics like Josephson and Squid devices as well as technology of MRI, levitation, and motor devices. However, I enjoyed this book and suggest that young graduates embarking on superconductivity would benefit from it. The final few pages introduce the age of High-Tc materials.

Guy White
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Superconductivity and its Applications
Y-H Kao, A.E. Kaloyeros and H-S Kwok (eds)
American Institute of Physics, New York xi + 779pp, US$120 (hardcover)

This book is a collection of papers presented at the Fifth Annual Conference on Superconductivity and Applications held in Buffalo, New York on September 24-26, 1991. The conference attracted over 200 scientists from 8 countries and it chronicled the continued progress in thin film and bulk processing techniques which will enhance the development of practical high temperature superconducting (HTSC) ceramics. Interdisciplinary research on HTSC materials is the main focus of the contributions in this volume. Several aspects of the thin film and bulk material field from fundamental properties to applications are examined. The volume attests to the significant progress that has been made in this field, as well as reporting on the challenging problems that still remain to be solved.

The book contains a massive 78 papers which are distributed into six sections. The first section contains 4 illuminating reviews on the various aspects of films, tapes and layers written by recognized experts such as Gabelle, Malozemoff, Chudhuri, Bando and others. The second section consists of 16 papers covering the synthesis, structure, and properties of thin film and multilayer heterostructures. Section three contains 29 papers dealing with chemical vapor deposition as an exotic processing technique for HTSC thin films. High quality thin films with a high critical current density (Jc>106 A/cm²) were successfully synthesized. Bulk processing and properties of HTSC are covered in section four which contains 22 papers. In spite of their low critical current, much progress has been made in overcoming the tyranny of weak links and flux creep for the bulk high-temperature superconductors.

Papers by S. Jin and R.L. Snyder discussed new hopes and challenges for these non-film materials. Bayya et al. reported a very fast self-propagating high temperature synthesis (SHS) technique for producing phase pure 2212 and 2223 in the Ti-Ba-Ca-Cu-O system. Fundamental properties of HTSC materials are covered in section five which contains 19 papers discussing transport, magnetic and tunneling properties. The final section contains a promising 10 papers on the applications which include infrared detectors, magnetic shielding, microwave devices and optoelectronic devices.

In general, this volume covers a wider and deeper breadth than the previous volume. All the papers are very technical, specialized and are thus not easy for those not directly involved in the mainstream to obtain a reliable assessment of scientific and technological progress. The book describes no breakthroughs in the understanding of the science and technology of HTSC materials. One wonders if these will ever eventuate in the immediate future.

On balance, the book contains no papers on mechanical and chemical properties even though HTSC materials are well known to possess unacceptable low strength, toughness, and chemical stability. These properties should deserve immediate attention before the engineering applications for these materials can be realized.

This book is a useful up-to-date reference work for the specialist and a valuable tool for the non-specialist. However, the price of US$120 may deter even a researcher in this field to own a copy. A good library with serious readers should have a copy.

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Curtin University of Technology

Diagnostics and Applications of Thin Films
L.Eckertová and T. Ruziecek (eds)
IOP Publishing, Bristol 1992 vii + 314pp, £67.00 (hardcover)
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This book presents the refereed Proceedings of the International Summer School on thin film physics, technology, and applications, held this year in Chlum u Trebòvle, Czechoslovakia. It is a product of the collaboration between the Scientific Physical Section of the Union of Czechoslovak Mathematicians and Physicists and the British Institute of Physics in London. In the preface the editors state that "As relations in our part of Europe have recently become more free, we decided to organize the 1991 Summer School on international basis". If they want the readers to believe that it was impossible to organize such schools before, as a former East European scientist I can say that it is not true, and that under the communist dictatorships the International Summer Schools, Symposia and Conferences were quite common events. These were also the rare situations when East European scientists, including people from Czechoslovakia, had an opportunity to meet their Western colleagues, in spite of the obvious hardship of the political situation surrounding them.

The School organizers should be congratulated on their choice of lecturers, a group of really outstanding specialists in their disciplines, most of them coming from the West. However, the range of topics they represent is so broad that almost everyone has spoken about something completely different. This makes a difficult situation for the reviewer who has to decide who should be the target reader of the book. I will thus start with my personal recollections on a few lecturers I met on several occasions. Professor Ludwik Reimer from Germany is an electron microscopist with a long established reputation in the field of detector strategy. He is the author of a two volume book on the electron microscopy (Springer-Verlag, TUM - Vol. 36, 1984, and SEM - Vol. 45, 1985). At Chlum he delivered an introduction to the transmission electron microscopy, which is not much different to what a reader can find in his books, or elsewhere. The second lecturer I know is Jiří Kromka from Czechoslovakia, who specializes in the theory of optical diffraction. He is undoubtedly one of the leading contemporary experts in his field in the world, whose prominence will be rising in the West now the cold war is over. The book gives us a good example of his numerous contributions to the optical diffraction. The third lecturer I know is Dr Peter Barna. For decades he has been a leading specialist in Hungary who has devoted his talents to the studies of thin film crystalization and examination. To read his lecture in the book is to get a picture of what is actually now happening in Budapest in his field.

The rest of the lectures were devoted to the following surface characterisation techniques or subjects: electron probe micro-analysis, low energy electron microscopy, electron energy loss spectroscopy (EELS), extended energy loss fine structure (EELS), X-ray diffraction, surface measurements by backscattered electrons, secondary ion mass spectroscopy (SIMS), high energy electron diffraction (RHEED), scanning tunnelling microscopy, catalysis on particle surfaces, thin film sensors, amorphous microcrystalline and epitaxial silicon, industrial film thickness measurements and methods, and semiconductor layers and interfaces in microelectronics.

Evaluating the book from the Australian perspective I can see it as an interesting reference for the variety of technical subjects, especially those which have something in common with the manufacturing of thin film and the layer structures.

This is a book for the specialists, and thus it should be available at Universities, CSIRO, and the big industrial laboratory libraries. As for the students, only PhD ones can get some profit from reading it. As for the specialists, they should be patient readers, not be put off at first by some obvious uneven level of the presentations.

The book is nicely published (edited and printed), but it would be even better if the advertisement section was not put right at the front (usually the commercial advertisements are confined to the rear pages of the books).

T. Warminski
Telecom Australia Research Laboratories

Introducing Einstein's Relativity
Ray D'Inverno
Clarendon Press, Oxford 1992 383 pp., £69.95 (soft-cover)

This book provides textbook support for advanced undergraduate to early graduate level courses in relativistic physics, with emphasis on modern developments in gravitational radiation, and setting a foundation for work in cosmology. About one third of the book is devoted to setting up special relativity and the mathematics of tensor analysis. It then proceeds to a very readable and well illustrated treatment of general relativity, gravitational waves, black holes and cosmology. As its title implies, the book is almost totally concerned with Einstein's relativity as the standard working model, and less so with details of evidence for this. For instance the systematic parameterised post-Newtonian analysis does not rate explicit mention, though the further reading suggestions would eventually get the student there.

The reviewer teaches a short course in special relativity at honours level, with the same aim as the first part of this book, to provide a solid foundation for
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later work. This book will provide a valuable reference, not as systematic as Weinberg, but easier to find introductory topics in than Misner, Thorne and Wheeler. Relativistic mechanics as applied to particle physics makes only a minor entrance via the exercises. The imaginary, i, makes an awkward appearance in the discussion of Lorentz transformations. The treatment of tensors starts with geometrical flavour for contravariance, but drops back to the mathematical transformation arguments for covariance, and the treatment of integral theorems is decidedly brief. The indexing is quite thorough and helpful, but why Kerr himself has been banished to non-existent pages is a mystery. The book will be welcomed by lecturers and students in intermediate and advanced relativistic physics and gravitational theory.

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Physical Optics
A.R. Mickelson
van Nostrand Reinhold
New York 1992
xv + 345pp., AS131.95 (hardcover)

This text arose from lectures given by the author to first year graduate level students in electrical engineering. The topics covered include Maxwell's equations and plane wave propagation; polarization, dispersion and anisotropic media; geometrical optics; interference and diffraction. Although the material covered appears quite traditional, the approach taken in this book is very different to most undergraduate optics texts. As the author states in the preface, the topics chosen (within the broad areas mentioned above) were those which the author felt would be of most use to the particular group of students to whom he was lecturing. A number of the physical examples given to illustrate the concepts make good use of modern optical devices. For example, the author uses an electro-optical sampling head as an illustration of how Jones matrices can be used to describe the behaviour of the whole device. The level of the book is pitched somewhere between Hecht and Born and Wolf. In many cases the author gives a "rapid overview" of a topic (for example in the application of the WKB method in geometrical optics), with extensive references to the literature. The emphasis is on developing the mathematical basis for a given topic, and on the quantitative application of the theory to relevant problems, making use of appropriate approximations. Each chapter is accompanied by a substantial set of problems (no solutions or answers, however), as well as a reference list.

In order to find the book useful as a text, students would need to have a good preparation in the fundamentals of optics. Although the material was designed for a class of electrical engineering students, I feel the style would be quite acceptable to physics students (something that is not always the case with texts written primarily for engineers). In my opinion the book could be a useful adjunct to a third year or Honours course in physical optics, but is probably more appropriate as a reference book for postgraduate students. However, the price (A$131.95 for a fairly slim volume) is likely to deter most people from acquiring it for their personal libraries.

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Single Particle Detection and Measurement
R. Gilmore
Taylor and Francis, London 1992
xvi + 245pp., UK£35.00 (hardcover)

Curiously, nowhere in this monograph are to be found any biographical details of the author. Not even his institution rates a mention. We may surmise his wife's name from the dedication, but no more.

Fortunately, this anonymity of the book's author does not reflect upon the quality of its contents. Its 200-odd pages comprise a nearly self-contained introduction to the principles and practice of modern particle detectors. The physical principles underlying the operation of scintillation, gas-filled and semiconductor detectors are clearly enunciated. For example, there are very good elementary treatments of the physics of scintillation counters, and the development of the signal in gas-filled detectors, of the role of quenching and electro-negative gases, of photomultiplier tubes and light guides, and of the Fano factor. These are followed by sufficient detail of the operation, variations and limitations of the commonly-used types of detector to give the reader an excellent idea of their possibilities. Wisely, however, the author avoids the seductive appeal of completeness, and instead refers the reader to the literature for more rigorous or detailed treatments.

The choice of examples throughout the book clearly marks the author as a high-energy physicist, more at home perhaps with a multi-wire proportional chamber than a germanium detector. A minor criticism is that this exclusivity has resulted in some significant omissions, and one or two errors of fact. There is no mention, for example, of phoswich detectors which are widely used in low- and intermediate-energy nuclear physics, or of hybrid gas-filled detectors which instrument the focal planes of many magnetic spectrometers. To say "The principal component of any chamber gas mixture is a noble gas" is to ignore the widespread use of pure isobutane as a counter gas in many nuclear physics applications, and to quote 1.5% as the typical resolution of germanium detectors for MeV photons is to denigrate their performance by an order of magnitude.

But these are relatively minor quibbles in what is otherwise a well-written, nicely-judged book. It is a repository of much useful information for the practicing physicist, but in addition, would be a very useful source text for a third or fourth year physics course on particle detection.

L. Keith Fifield
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A. Laubereau and A. Seilmeier
IOP Publishing, Bristol 1992
xx + 650pp., UK£68.00 (hardcover)

In these days when laser pulse lengths have diminished to the order of an optical cycle, and the Fourier transform-limited spectrum of the generated light spans the entire visible/IR region, we are fast approaching the point where further progress towards new records is restricted by the bandwidth and dispersion of available materials. But the applications of these extremely short, wide bandwidth pulses are only just being exploited, and laser systems are now being developed which are tailored to meet these specific needs.

Recent advances in this field are reported in the proceedings of the 7th Symposium on Ultrafast Processes in Spectroscopy held in Bayreuth, Germany in 1991. The applications span almost the full range of scientific endeavour from high temperature plasma physics to cell biology.

Plasmas in which the energy deposition time of the laser pulse is too short for the electrons to equilibrate to a meaningful temperature yet which at the same time approach solid density open up a new regime of dense, strongly
coupled laser-plasma interactions. The use of very fast pulses in unravelling rapid exciton transfer processes in protein complexes produces new insights into photosynthesis. And the use of very short pulses to study rapid relaxation processes in quantum wells aims at producing ultrafast photonic switches.

Recent progress in these and many other areas is described in four page abstract format in this proceedings. There is also a short author and subject reference. This book would be a useful starting point for anyone entering the field of short pulse generation and applications with its compendium of works from many of the major players in these fields.

Ken Baldwin
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**Optics of Femtosecond Laser Pulses**

Sergei A. Akhmanov, Victor A. Vysloukh and Anatoly S. Chirkin
American Institute of Physics
New York 1992
xv + 366pp, US$90 (hardcover)

The generation of coherent light pulses with a duration and a power density in the order of 10 femtoseconds and $10^{17}$W/cm$^2$ respectively has provided unprecedented opportunities for studying the interaction of light with matter on the time scale of a few optical oscillation periods. The last decade has seen the intensive development of femtosecond laser technology and methods for measurement so that commercial forms such as the ultrashort pulse Ti:Sapphire are now available. Applications are being made to such diverse fields as the study of the dynamics of biologically active molecules, the demonstration of picosecond switching devices for computers, the high speed transmission of information along optical fibres by solitons, experimental quantum electrodynamics, picosecond X-ray sources, etc.

This book presents a timely review of the now mature field of femtosecond optical science. Chapter 1 gives a comprehensive account of the mathematical framework required to treat the propagation of ultrashort pulses through optical devices and media. The self-action of the pulses due to the non-linearity of the medium, including self-focussing, modulation and compression are thoroughly discussed in Chapter 2. Chapter 3 deals with the non-linear effects such as frequency doubling, mixing, and stimulated Raman scattering, and the topic of fast phase control for pulse compression is treated in chapter 4. The formation of optical solitons and their propagation in fibres is discussed in Chapter 5. The technology of femtosecond laser systems is covered in Chapter 6. This is followed by conclusions in section in which the status of the field and projections for future developments are made.

Each chapter has a substantial bibliography that facilitates access to key papers in the field and enables the development of the subject to the followed. It must be borne in mind that this book is an English translation of a Russian text published three years previously. Whilst this necessarily dates the content somewhat, the book does give an excellent introduction to and review of the field.

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**Atoms in Intense Laser Fields**

M. Gavrila (ed)
Academic Press, San Diego CA 1992
xv + 516pp, No price given (hardcover)

The recent development of compact high power lasers producing ultra-short ($\sim$ps) pulses has given impetus to research into the interaction of intense laser radiation with matter. It is now possible to achieve focussed intensities in excess of $10^{18}$ W/cm$^2$ from top-structured systems, a value far above that for which perturbational approaches to describing the laser-atom interaction break down since the laser light field is more than an order of magnitude larger than the atomic fields. Thus in this high intensity regime the physical picture of multi-photon ionisation of the atom developed in the 1960s breaks down and a rich range of new phenomena such as above threshold ionization (ATI); high harmonic generation; resonant enhanced multi-photon ionization, etc., appear.

This book presented a series of review articles some dealing with experimental results others with the theory of this non-perturbational regime. The contributors are from amongst the foremost researchers in the world in the field with the main emphasis of the articles focussed on developments that have occurred in the last decade. The book is aimed broadly at a research audience and would be a particularly valuable to graduate students entering this field of research. Overall I found it an excellent summary of the current research status containing valuable accounts of many of the most important aspects, both experimental and theoretical, of this blossoming topic.

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**Magnetism, Magnetic Materials and Their Applications**

F. Lenci and et al (eds)
IOP Publishing Ltd, Bristol 1992
xi + 342pp., UK£48.00 (hardcover)

This publication is a collection of 49 papers presented by invited and contributing speakers at a workshop on magnetism which occurred in May 21-29, 1991 in Havana, Cuba. It is not made clear which papers were presented by invited speakers.

The book is divided into two sections: Part I includes 4 papers on theoretical calculations and papers which discuss experimental studies of various ferromagnetic alloys. Part II contains the invited papers with Section III containing the contributed papers. Because many of the authors come from South and Central America as well as Cuba this publication presents a broad cross section of research topics in magnetism that are currently being studied by physicists in this region of the world. Other (presumably invited) speakers came from Austria, Italy, France, Spain and the Soviet Union with only one paper from the English speaking world and none from Japan. The book undoubtedly suffers from translation problems from Spanish into English with quite a few misleading statements probably resulting from "literal" translations. To an experienced researcher in the field of magnetism the correct interpretations of such statements is not difficult. However, students would have much difficulty in understanding some comments. There are countless spelling errors, mistakes in equations and several of the camera ready original manuscripts were very poor.

The following papers caught my attention:

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*Australian & New Zealand Physicist Volume 30, Number 3, March 1993*
“Exchange anisotropy in hard magnetic materials” by R. Ballou is an extremely verbose non-mathematical discussion of exchange interactions in hard magnetic materials containing f & d electrons.

“Influence of microstructure on coercivity of rare earth - iron permanent magnets” by J. Filder included transmission electron micrographs of vanadium iron boride samples showing the phases present when a dopant element (Al, Ga, Cu, Nb, Mo, V) is present in the matrix and also discussed the effects of various heat treatment procedures on the microstructure and magnetisation.

“NMR and domain wall mobility in intermetallic compounds” by Guimaraes, Alves, Sampaio & Cunha discussed domain wall enhancement of NMR signal intensities in RX Y1−x Fe2 intermetallic compounds giving computer fits to the NMR spectra obtained at 4.2K.

“Magnetooptics in ultra-thin films and multilayers” by J. Perre gives a review of recent publications dealing with experimental techniques, some typical results for rough and smooth surfaces and a discussion of data storage using magnetooptical recording.

“RF-SQUIDs using YBCO high Tc Superconducting ceramics” by Ares and Abar gives details of SQUID fabrication and operating properties.

“Magnetic coupling between thin film layers” by Altman and Kiwi discusses magnetic ordering between two ferromagnetic slabs separated by a nonmagnetic thin film.

Although there is a large amount of useful data on properties of magnetic alloys, which has been reproduced from other readily available publications) I cannot see the need for such a publication as this. I am sure that delegates to the workshop will wish to purchase a copy of the proceedings but am left wondering who else would do so and why our funding body, the IOP, should choose to publish it? It is nearly two years since the conference occurred, most of the work presented is refinement of material readily available elsewhere in the literature (eg in J. Magn. Mat.; J. Appl. Phys; J. Magn. Res. etc) and it is a disjointed collection of review and research articles. A far better publication on properties of magnetic materials and their applications would result if the IOP commissioned a review book with contributions from authors selected as a result of their expertise.

Ken Doohan
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BOOK REVIEWS

Materials Modelling: From Theory to Technology

The macroscopic behaviour of materials is often profoundly influenced by the behaviour of point and extended defects on the atomic scale. There is therefore strong technological motivation for the modelling of crystal defects and theory has now reached the stage where there are reliable methods which can be applied to realistic systems.

This book consists of 34 papers on the theory and applications of the modelling of crystal defects, which were presented at a Symposium at Oxford in September 1991 in honour of the 60th birthday of Ron Bullough. Bullough was a theoretician at the Harwell Laboratory of the UK Atomic Energy Authority for over 20 years and so it is appropriate that about half of the papers in the book are specifically concerned with radiation damage and fracture.

The book is a collection of research papers rather than a textbook on the subject, but in most of the papers there should be sufficient introduction and references to enable a reader with some background in materials science to appreciate the modelling techniques.

While not destined to be a classic on the subject, the collection of papers does provide some valuable examples of contemporary approaches to modelling.

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Special Relativity
M. Saleem and M. Rafique
Ellis Horwood, Chichester 1992 x + 257pp., USS71.95 (hardcover)

Despite the abundance of text books on special relativity I still find it difficult after some twenty years of teaching the subject at third year level to recommend wholeheartedly any single one above the others. All, it seems to me have certain deficiencies which make them fall short of the "definitive" text.

How then does this new addition by Saleem and Rafique measure up? There are two areas where I always experience some difficulty in presentation. One is to find a good "clear" argument for the uniqueness of the Lorentz group. The other is to give a convincing presentation of the foundations of relativistic mechanics. I feel compelled therefore to rate this book firstly on these two scores.

On the first count rigorous geometrical arguments can be found for the Lorentz transformations, but they are too demanding and lengthy for this level of discussion. The only alternative is to impose more and more "reasonable" assumptions until the result comes out. This is in essence what the present authors do. However they do not identify their assumptions at the outset, but introduce them one by one as the argument develops. The resulting "proof" is therefore little more than a series of credible assertions. I believe students at this level are entitled to something a bit tighter than this. After all we are talking about the single most important group of symmetries in physics.

On the second matter, namely the foundations of relativistic mechanics, here is what the authors do. First they introduce an unexplained scalar quantity m0, multiply it into the four-velocity and call the result four-momentum. They then "deduce" that the relativistic mass is given by the formula

\[ m = m_0 \sqrt{1 - v^2/c^2} \]

I have never really understood why the concept of relativistic mass need be introduced at all. Rest mass and the formulae for energy and momentum is all that is ever needed. Most significantly, the authors fail to give any justification for the law of conservation of total four-momentum. It's a tricky topic, and one I have no ready answers for. Perhaps this is the best we can do - set up whatever laws one can come up with which are Lorentz invariant and reduce to Newtonian mechanics in the slow velocity limit, and then just assert that these are they.

Despite these failings however, the book has much to recommend it. The treatment of particle mechanics, both collision and decay problems as well the motion of charged particles in electromagnetic fields is well handled. There is a thorough treatment of Liénard-Wiechert potentials, although the argument for the retarded potential from the uniform velocity case is not one I favour. There is an unusual chapter on binary collisions with an introduction to Mandelstam variables. This chapter no doubt reflects the authors' special research interests, but is the kind of specialized material which is quite welcome since it can be quite hard to find elsewhere.

In summary here is a good workmanlike book for physicists who require special relativity as a tool to solve real-life physical problems, but not so good if foundational questions are your concern. As a parting shot however, let me say that I deplore the use of
imaginary time coordinate, since it is impossible to extend to general relativity. I thought the practice had all but died out, but it still seems to have its adherents among particle physicists. Presumably they believe they will never have to worry about gravitation.

Peter Szekeres
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Atmospheric Ultraviolet
Remote Sensing
R.E. Huffman
Academic Press, San Diego 1992
x + 317pp., No price given (hardcover)

Any addition to Academic Press's International Geophysics Series is usually something to be looked forward to. They constitute some of the key references in atmospheric physics, and a number of other fields, and will be found on the shelves of every scientist working or teaching in an appropriate subject area.

Unfortunately, this, the 52nd member of the series, fails to live up to the high standards set by many of its predecessors. It gives the reader a reasonably useful overview of a field which is still maturing, but without going into sufficient detail to make it self-contained.

After chapters on radiometry, sensors and space operations, there is a series of chapters on various UV radiative processes in the atmosphere. The final chapters are applications-oriented, outlining the types of UV observations which are being made (or planned) to study various atmospheric phenomena. Most chapters have good reference lists, where the interested reader will find the full details of what has only been skimmed over in the book.

There are a few annoying features, such as the persistent use of Angstroms (especially on graphs), after promising to use nanometres. These suggest a lack of proof reading, or of a careful editor.

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University of New South Wales

Polymer-Solid Interfaces
J.J. Pireaux, P. Bertrand
and J.L. Bredas (eds)
IOP Publishing Ltd, Bristol 1992
xviii + 498pp., UK£67.50 (hardcover)

This book presents the edited manuscripts of 41 of the 60 papers presented at the First International Conference on Polymer-Solid Interfaces, held at Namur, Belgium in September 1991. It is divided into four sections, namely Polymers on Solids, Metals on Polymers, Bulk/Surface/Interface Polymer Properties and Polymer Plasma Surface Modifications. Each paper runs to around 10 pages, except for the four longer reviews which introduce each of the four sections (with the exception of Bulk/Surface/Interface Properties).

The quality of these introductory reviews is very high, with a well-judged balance between theory and experiment. Within the first two sections the papers are arranged in order of increasing system complexity; in the third section the emphasis is on the electronic structure of single component polymer systems, while the improvement of adhesion at interfaces, e.g. by plasma etching or laser ablation, underlies much of the final section. As would be expected, UPS and XPS data are very much in evidence, with HREELS, TEM and XTEM not far behind.

My experience is that many conference papers are better left unpublished. This book is an exception. Given the wide range of topics covered, and the high editorial standard throughout, I strongly recommend it to any polymer scientists.

R.J. Fleming
Department of Physics
Monash University

“who is doing what, where and how”. The book providing a useful entry point for more comprehensive literature searches.

New Books

Ultrasonics of High-Tc and other Unconventional Superconductors
Physical Acoustics Vol 20
M. Levy (ed)
Academic Press, San Diego CA 1992
xiii + 459pp., No price given (hardcover)

High Frequency and Pulse Scattering
Physical Acoustics Vol 21
A.D. Pierce and R.N. Thurston (eds)
Academic Press, San Diego CA 1992
x + 329pp., No price given (hardcover)

Underwater Scattering and Radiation
Physical Acoustics Vol 22
A.D. Pierce and R.N. Thurston (eds)
Academic Press, San Diego CA 1992
x + 378pp., No price given (hardcover)

Multiresolution Signal Decomposition
A.N. Akansu and R.A. Haddad
Academic Press, San Diego CA 1992
xii + 376pp., No price given (hardcover)

Two-Dimensional Crystals
I. Lyubartsev, A.G. Naumovets and V. Pokrovsky (eds)
Academic Press, San Diego CA 1992
xiv + 423pp., No price given (hardcover)

A Guide to Radiation and Radioactivity Levels near High-energy Particle Accelerators
A.H. Sullivan
Nuclear Technology Publishing, Ashford, Kent 1992
xiv + 161pp., UK£27.00 (hardcover)

Dose and Risk in Diagnostic Radiology: How Big? How Little?
E.W. Webster
National Committee on Radiation Protection and Measurement, Bethesda MD 1992
ii + 65pp., US$20.00 (paperback)

Analysis of Messy Data
G.A. Milliken and D.E. Johnson
Van Nostrand Reinhold (Thomas Nelson Australia), New York NY 1992
xiv + 473pp., AS$79.95 (paperback)

Developments in Acoustics and Ultrasonics
M.J.W. Povey and D.J. McClements (eds)
IOP Publishing, Bristol 1992
vi + 256pp., UK£34.50 (paperback)

Developments in Acoustics and Ultrasonics
M.J.W. Povey and D.J. McClements (eds)
IOP Publishing, Bristol 1992
vi + 256pp., UK£34.50 (paperback)
CONFERENCES & MEETINGS

1993

February 9 - 12  WAGGA 93 - 17th Australian Institute of Physics Condensed Matter Physics Meeting, Charles Sturt University, Wagga Wagga, New South Wales, Australia
Contact: John Bell, Dept. of Applied Physics, University of Technology, Sydney
Tel 02-330-2213, fax 02-330-2219, message 02-330-2206
E-mail: wagga@phys.uts.edu.au

February 15 - 19  The First Australian - Asian Conference on Radiation Science and Nuclear Medicine, at Macquarie University, Sydney NSW Australia
A/Professor Ron Cooper, Convener, AINS/EHARR Subcommittee

February 15 - 19  Nuclear and Particle Physics Group (NUPP) School
Victor Harbour, South Australia
Contact: Prof. A.W. Thomas, Tel 08-228-5113, fax 08-224-0464
E-mail: athomas@physicst.adelaide.edu.au

March 7 - 19  Japan Physical Society International Spring School, Tokyo
Contact: Prof. S. Homma, INS Tokyo. Fax 81-424-64-9480

March 29 - April 1  The Physical Society of Japan - 48th Annual Meeting
Tohoku University, Sendai, Miyagi-ken, Japan
The Physical Society of Japan, Room 211, Kikai-Shinko Building
3-5-8 Shiba-koen, Minato-Ku, Tokyo 105, Japan
Tel 81-3-3434-2671, fax 81-3-3434-0997

April 14 - 16  OzCUPEI: The First Australian Conference on Computers in University Physics Education
Contact: Dr. Ian D. Johnston, School of Physics, University of Sydney NSW 2006
Tel 02-692-2627/02-692-2537, fax 02-660-2903, e-mail: idj@physics.uos.oz.au

May 31 - June 2  ICAM '93 International Conference for Applied Mineralogy, Perth WA
Secretary, ICAM '93, Congress West, PO Box 1248, West Perth WA 6005
International tel 619-322-6906, fax 619-322-1734
Technical enquiries only (Jim Graham) Tel 619-387-0371

July 5 - 9  Second South Pacific Solar Terrestrial Energy Program (STEP) Workshop
University of Newcastle, Callaghan NSW 2308
Contact: F.W. Menk or B.J. Fraser, Department of Physics
Tel 049-21-5424/21-5445, fax 049-21-6907, e-mail: twostep@cc.newcastle.edu.au

August 25 - 27  New Zealand Institute of Physics Conference
Waikato University, Hamilton, New Zealand
Contact: Alistair Steyn-Ross, Physics Department, University of Waikato, Hamilton, New Zealand. Tel 64-7-838-4026, fax 64-7-838-4219, email: asr@Waikato.ac.nz

August 25 - 27  August International Conference on Ion Sources, Beijing
Conference Secretary, Prof. Zhao Weijiang, Institute of Heavy Ion Physics, Peking University, Beijing 100871, P.R. China. Fax 86-1-2564095

September 27 - Oct. 1  6th International Conference on Accelerator Mass Spectrometry
Canberra & Sydney, Australia
Secretary AMS-6, ACTS, GPO Box 2200, Canberra ACT 2601 Australia
Tel 61-6-257-3299, fax 61-6-257-3256, e-mail: tumiz@nucleus.ansto.gov.au

1994

January 24 - 28  The 6th International Symposium on Quantum Optics, Rotorua, New Zealand
Contact: D.F. Walls or J.D. Harvey, Department of Physics, University of Auckland, Auckland, New Zealand. Tel 64-9-373-7599/8843, fax 64-9-373-7445
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Intensity (arb. units)

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