WHAT PEOPLE ARE SAYING

Remuneration for Scientists

"The scientific community is rapidly losing relativity in terms of general community remuneration. For example the Experienced Scientist award rate is now only 23 per cent. above the average weekly earnings compared with 54 per cent. in 1966. In ten months this figure is likely to be as low as 10 per cent. The remedy lies in collective action. The whole concept of employer—employee relationships in the professional area is changing fundamentally; there is, more than ever before, a need for a profession to unite if it desires better employment standards". — L. Boxhall, Proceedings of the RACI, January 1975.

Theory or Experiment

"The work of the theorist, if it should have any sense, should be of extremely high quality. In this respect, we do not need more theorists than, say, Egyptologists. Physicists with less than exceeding capabilities should do experimental work. For instance, measuring the density of all materials on earth is a useful work which does not require much insight". — Quotation from Enrico Fermi, Europhysics News, December 1974.

Research or Administration

"I think it’s fatal to become isolated from the mainstream of intellectual endeavour, and in a place like this the only way to keep up with it is to do the hard work yourself". — Professor R. Street, ANU Reporter, 13 December 1974.

Threats to British Research

"Current trends in funding are all downward and, unless the contraction is shared out with great care, could have lasting and damaging effects on the scientific and technological life of the country". — IOP Bulletin, December 1974.

International Science

"There is only one science and only one science community. I would like to make a very strong plea to consider the scientific community as a world community. It just happens that some live in Europe, and some live in America or Japan or elsewhere. We should think of it as one community, speaking the same language, doing the same work and helping one another if things get difficult here and there. It is more or less accidental and unimportant at what geographical location the advances are made". — Professor V.F. Weisskopf, Physics Today, November 1974.
EDITORIAL

SCIENCE FUNDING

The 1974/75 budget brought down by the Australian Government could have the effect of curtailing the development of Government science in Australia. This is not immediately apparent since the sums to be expended are up on 1973/4 figures. However they are not increasing at a rate to match the pace of inflation and the difference is to be covered by reductions in expenditure on plant and equipment.

The situation can be illustrated by figures for the largest Government science organization - CSIRO. Out of $94 million provided in 1974/5 by the Australian Government, $81 million will be needed for salaries and general running expenses and $10½ million for building and works. This only leaves $2½ million for plant and development items, compared with $5½ million in 1973/4. This is a savage cut in 'spending-money' for Government scientists at a time when a sizable increase would be needed to overcome the effects of inflation.

The allocation for salaries and general running expenses is $11½ million above the actual expenditure in 1973/4 but most of this is necessary to cope with expected adjustments in costs and salary levels. A sum of $1½ million is provided for the development of new and high priority projects in the study of cattle, sheep, weeds, grain, marsupials, forest and marine resources, solar energy, etc.

There is undoubtedly room for management to manoeuvre within the budget estimates that have been approved. However, the overall mood within Government science must be one of struggle to meet the demands for new directions in research from a constant staff complement and much reduced funds for plant and equipment. Perhaps the most significant aspect for consideration by the AIP is the reduced employment prospects for physicists.

PHYSICS FOR WOMEN

1975 is International Women's Year – an event which, on first consideration, would seem to have little to do with physics. But, then, why are only 3½ per cent. of AIP members women? Is it true that physics is the only subject for which the average mark at Matriculation level is less for girls than for boys? Are we to conclude that girls are hindered in some way in their enjoyment of physics?

It is well known that girls are better than boys at reading and English and experiments suggest that they are superior at purely verbal tasks. On the other hand, boys show greater skill at purely visual tasks. Such differences could have some effect on the learning of physics. After all, physics teaching is heavily dependent on visual aids – graphs, diagrams, bench and laboratory experiments are all used to give students a 'feel' for physical principles.

Could it be that, for girls, all those apt illustrations and absorbing experiments are boring substitutes for some inspiring descriptive passages? Perhaps in this new Elizabethan era we need a new Shakespeare to write on physics. The Australian Physicist will be pleased to hear readers' views on these questions and to receive examples of physics prose which are particularly effective in conveying an understanding of physics.

NATIONAL CONGRESS

This issue contains extracts from the program and abstracts of the Second Conference of Australian Physicists held in Melbourne from 20-23 August 1979. This information comes from a contribution to the AIP Archive by J.F. Richardson. The Archive now contains information on four prewar conferences but a copy of the program of the third conference held in 1931 is needed to complete the set.

The AIP Archive is housed in the Adolph Basser Library, Canberra, by courtesy of the Australian Academy of Science. Any further contributions of material relating to the history of physics in Australia will be welcome. They may be sent directly to the Librarian, Adolph Basser Library, Box 216 Civic Square, Canberra 2600, or via the Editor of the Australian Physicist.

The Second National Congress of the Australian Institute of Physics is to be held at Sydney University during the common vacation week, 10-14 May 1976, nearly half a century after the meeting referred to above. Physicists are urged to bear this date in mind, particularly when planning events for 1976. Following the success of the Adelaide Congress in 1974, the Sydney Congress promises to be a very significant event for Australian physics. Plan early to participate in this event.
NOTES AND NEWS

People and Institutions

New Deputy Chairman of Universities Commission

Professor E.O. Hall of Newcastle University has been appointed to the Commission with particular responsibility for equipment, special research grants and new developments, particularly in science and engineering faculties.

New head for Meteorology research centre

Mr R.H. Clarke has been appointed Officer in Charge of the Australian Numerical Meteorology Research Centre jointly operated in Melbourne by the Bureau of Meteorology of the Department of Science and CSIRO. Mr Clarke will direct the scientific programs and administration of the Centre (formerly the Commonwealth Meteorology Research Centre). The centre aims to provide numerical methods designed to improve the accuracy and time scale of weather forecasting, and carries out research aimed at an improved understanding of the global climate. It devises computerised methods which can be used by meteorologists at the Bureau of Meteorology to produce maps for weather forecasts.

Mr Clarke is currently with CSIRO's Division of Atmospheric Physics at Aspendale, Victoria, and succeeds Dr Brian Tucker who is now Chief of that Division. His special fields of interest include detailed studies of the boundary layer of the atmosphere (up to about 1000 meters above sea level) which plays a vital role in determining energy balances which affect weather on earth.

CSIRO to expand search for space molecules

CSIRO is to build a small new radiotelescope capable of probing the millimetre wavelengths for signals of molecules in space. So far more than thirty organic molecules have been discovered by workers in Australia and overseas. Each discovery is seen as further evidence that life could exist in space. The four metre telescope, costing almost $200 000 will be built at the CSIRO Division of Radiophysics at Epping, and should be operational by the end of 1975. The small telescope will also serve as a 'test bed' for the development of millimetre wave receivers and techniques for use on a future larger telescope CSIRO hopes to build. It would ultimately operate as a survey telescope for the larger instrument.

Recently scientists working with Parkes radiotelescope discovered two more complex molecules in the interstellar cloud, Sagittarius B2, which is 30 thousand light years from earth and was itself discovered 10 years ago by CSIRO scientists at Parkes.

The molecules are methyl formate, the heaviest organic molecule so far found in space, and vinyl cyanide. Methyl formate was discovered by Dr B. Robinson, Dr F. Gardner and Dr J. Whitecoak in collaboration with Monash University chemists, Professor R. Brown, Dr P. Godfrey and Mr J. Crofts. Vinyl cyanide was found at Parkes by Dr Gardner and spectroscopist Dr G. Winnewisser from the Max Planck Institute for Radio Astronomy in Germany.

It is the first organic molecule found in space with double bonding which is important for an understanding of how complex organic molecules form in the hostile conditions of interstellar space.

Another CSIRO scientist, Mr N. Fourikis, was a member of a team that recently discovered the molecules ethyl alcohol and heavy water using a millimetre radio telescope at Kitt Peak, Arizona.

A West German firm, Krupp Industries and Stahlbau, had been contracted to build the 4 metre dish. Two computers worth $30 000 had been ordered from Digital Equipment Australia for control of the telescope and for processing data. A feature of the telescope will be its use of a completely new design of spectrograph, which was developed by Dr T. Cole of CSIRO's Division of Radiophysics. This instrument uses a combination of a laser beam and a train of ultrasonic waves to analyse the spectrum of the incoming radio wave.

Scientific Instruments

The Birch Box

The operational usefulness of cloud photographs received from orbiting satellites has in the past been lessened by pictorial distortions. Computers are used in the United States to correct these distortions but rectified pictures arrive in Australia almost a day too late. Physicist Ray Birch of the Bureau of Meteorology has designed an Australian rectifier which is essentially a photographic enlarger with opposite distortions built in. This is now in routine use in the Bureau's central analysis section and other countries may be interested in this cheap technique. — Science News, November 1974.

New Statistics Software for H-P Desktop Calculators

Both the H-P Model 9810 and Model 9830 Programmable Calculators have new statistics software available. Two Calculator Application Summaries are available, free of charge, for anyone who uses statistics in their job and would like to know more about this software, “One Sample Analysis and Analysis of Variance with the HP 9830”, and “The HP9810 Statistical System”, may be obtained by contacting: Hewlett-Packard Australia Pty. Ltd., MARCOM Department, Box 36, East Doncaster, Victoria 3109.
SYNCHROTRON RADIATION — A NATIONAL FACILITY?

M.J. Lynch
Department of Physics, WAIT.

This article is based on a paper delivered at the AIP National Congress, Adelaide, 1974.

Rapid developments in high energy particle accelerators during the last few decades have enabled considerable progress to be made in the field of high energy nuclear physics. The advances in achievable machine 'energies' imply significant radiation losses in certain circumstances and require that the radiation process and its implication in accelerator design be fully understood.

The first recorded observations of the radiation or 'light' from a synchrotron was that by Elder, Gurewitsch, Langmuir and Pollock [1947a, b]. It was not however until Tomboulian and Hartman [1956] studied the properties of the radiation that the potential of this source as a spectroscopic tool was appreciated.

Radiation intensities are only significant in electron and positron synchrotrons or storage rings. For such particles the energy loss (ΔE) in KeV per revolution per particle is given by:

$$\Delta E = \frac{8.85 \times E^4}{R}$$

where E is the beam 'energy' in GeV and R the radius of the orbit in metres. For a typical accelerator, ΔE can be of the order of several MeV/ electron/revolution. If one takes account of the number of electrons in the beam and the orbital frequency the intensities are found to be comparable to conventional laboratory sources.

Features of the Synchrotron Source

As a light source, synchrotrons have several significant advantages over other alternatives.

Intensity

Fortunately at relativistic energies the classical dipole radiation pattern undergoes extreme distortion and a concentration of the radiation into the instantaneous direction of motion of the charged particle (i.e. tangential to the circular orbit) occurs (see figure 1).

This relativistic focussing into a narrow beam of half angle typically a fraction of a milliradian enables the achievement of high radiation intensities. The radiation intensity, I, from a synchrotron depends on the beam energy and radius of orbit as $E^4/R^2$. It has been demonstrated at the N.B.S. (Washington) and University of Glasgow facilities that even the older, low energy synchrotrons, originally designed for nuclear research programmes, have adequate intensities for good experimentation. With the real prospect of facilities designed specifically to maximise the radiated intensity it will be possible to increase intensities by three of four orders of magnitude. The Tantalus II design,

![Figure 1](image_url)

The classical dipole radiation pattern undergoes severe distortion at relativistic velocities resulting in a concentration of intensity in the direction of instantaneous velocity. The relative intensities of the polarization components with respect to the angle & above and below the orbital plane is shown for the relativistic case.

Dr. M.J. Lynch received his Ph.D from the University of Western Australia in 1971 for research into the electronic properties of solids by electron energy loss spectroscopy. Between 1971 and 1973 he was a Senior Research Fellow at the University of Reading and conducted research into the measurement of photoionisation cross sections, photoelectron angular distributions and absolute absorption cross sections at the University of Glasgow 300 MeV synchrotron and the Daresbury National Physical Laboratory SGeV synchrotron. Presently he is on the staff of the Department of Physics at WAIT, and Secretary of the WA Branch of the Australian Institute of Physics.

The Australian Physicist, February 1975
proposed by the Wisconsin group, has a dedicated high
current storage ring light source of moderately small
radius and energy 1.76 GeV. This is an indication of
the research activities in this field which are emerging
from parasitic operation, in association with nuclear
physics facilities, to become independent viable research
establishments in their own right.

In the X-ray region radiation intensities several
orders of magnitude greater than that obtainable
from X-ray tubes are certainly possible.

Spectral Distribution

The spectral distribution of the radiation, as with
the intensity is directly calculable from the machine
design parameters, beam energy and circulating current.
Figure 2 illustrates the radiation continuum available
from the source and further shows that the larger
wavelength intensities vary little with machine energy.
The significant effect of increasing the beam energy is
to dramatically increase in light output in the shorter
wavelength spectral region. The ‘tunable’ nature of the
source peak spectral intensity has some experimental
advantages. The similarity of the spectral distribution
to black body radiation curves has been noted and a
simple calculation shows that a synchrotron radiation
source appears much like a black body at a temperature
of $10^{7}$ – $10^{8}$ K.

Polarization

In a transformation of the dipole radiation pattern
in the electron rest frame to the laboratory frame it is
expected that a high degree of polarization in the
orbital plane will exist. Calculation shows that when
observed in the orbital plane the polarization is
complete, with the electric vector parallel to the
orbital plane. Experiment has confirmed these
predictions. This property has not been fully exploited
to date but obviously has advantage in reccent
studies on oriented samples where the avoidance of the
need to polarize the radiation can result in considerable
intensity gains over alternative sources in the ultraviolet
region.

‘Clean’ Source

In synchrotrons and more so in storage rings, the
vacuum requirements for satisfactory operation are
stringent and typically these accelerators operate at
$10^{8}$ to $10^{18}$ torr. As such they contrast markedly with
the more conventional gas discharge sources where high
gas pressures or particulate matter from the discharge
electrodes (e.g. the Vodar Source) create severe
contamination problems particularly in experiments
involving the surface properties of materials.

Comparison with Alternative Sources

It is certainly not the intention of the author to give
the impression that extremely good research in the UV
and X-ray region cannot be done without access to a
synchrotron. Indeed the bulk of our understanding in
atomic spectroscopy is due to the extremely fine
experimentation based in the main on the utilization of
the narrow resonance lines or continuum produced in

![Figure 2]

The spectral distribution of synchrotron radiation from an electron
for several machine energies.

discharge sources [Hudson, 1971]. The photoelectron
spectroscopy based on the HeI (58.4 nm) line and more
recently on the HeII (30.4 nm) resonance emission
deserve special attention. Similarly in the X-ray region
it has been possible to employ the characteristic
X-radiation from many of the lighter elements (e.g.
Be, S, C, B) [Hentie, Elgin, Lent and Ledingham,
1967] to obtain spectral coverage of the 0.2 to 20 nm
region.

Besides the synchrotron source frequently being
superior in spectral coverage, intensity and cleanliness
there exists certain categories of experiments where its
advantages such as polarization, UHV operation,
continuum nature and intensity stability classify it as
unique. In some respects its contribution and stimulus
to the far UV and X-ray regions will prove comparable
to the achievements that the tunable laser has permitted
in the visible and near UV regions. It is significant that
as more synchrotron facilities become available they
rapidly saturate under pressure from users who are
quick to realize the potential of such a facility.

The Daresbury (UK) facility which began to produce
data in 1972 was provided with two tangential beam
lines and the ability to accommodate about 10
experiments under simultaneous operation. Before the
end of 1972 it became obvious that the facility had
attracted enough experimental groups to be fully
utilized even on a 24 hour operating cycle. The Science
Research Council subsequently established a Committee
in that same year to examine a proposal to construct a
dedicated second facility. The recommendation of this Committee has been made to provide a storage ring purely as a light source.

**Disadvantages of Synchrotron Sources**

Having discussed the merits of the synchrotron radiation source and commented on some of the problems with conventional laboratory sources it is only reasonable to mention some of the problems with the former.

**Cost**

The primary difficulty with a synchrotron source is the substantial initial cost. For example the Tantulus II storage ring proposed by the Wisconsin group was estimated to cost the order of $1.5 million (US). I do not propose to enter into a cost-benefit/effectiveness analysis but it may well be that a dedicated storage ring with its centralised support facilities and the ability to simultaneously accommodate about 50 experimental programmes in around the clock operation is financially and operationally an extremely efficient process compared with any alternative. Thus I suggest the real problem is not really financial in the long term but more that of obtaining the funds collectively in the short term.

**Parasitic Operation**

Many experiments currently using a synchrotron radiation source do so parasitically — with the control over beam energy and beam current determined by the nuclear research groups. It is surprising how frequently the nuclear research groups wish to vary the beam energy or operate with low circulating currents. Ultimately a dedicated radiation facility is desirable with a running schedule which necessarily implies maximum current but permits some flexibility in machine energy on a prearranged programme to suit certain groups of users.

**Instrumentation**

Specialized monochromators have been designed to take full advantage of the specific properties of the synchrotron source. Such one-off instruments tend to be very expensive as they may have to be compatible with the UHV requirements of the synchrotron facility.

Nevertheless commercially produced monochromators are equally common in such establishments and at least one instrument has been designed to be compatible with conventional and synchrotron sources.

**Radiation Levels and Radiation Protection**

Perhaps a more restricting aspect of this field of research is that of radiation protection. The problem differs somewhat in synchrotrons and storage rings but nevertheless both are potentially dangerous and require proper arrangements for personnel protection. Traditionally this implies that monochromators and any other experimental apparatus must be operated remotely. Computer controlled experiments using stepping motor drives are now well established at many of these facilities and from personal experience these are an advantage — particularly when on 24 hour operation. It does however increase the experimental installation cost and introduces another potential source of breakdown, implying the necessity to have good technical service support.

**Research Areas in the Physical Sciences**

I do not wish to describe the extensive range of experiments which have been successfully undertaken in the physical sciences but rather highlight some of the more exciting areas where the special properties of synchrotron sources have enabled significant advances to be achieved. Reference to the excellent bibliographies [Marr, Munro and Sharp, 1972, 1974] and conference proceedings [Marr and Munro, 1973] will provide further details.

**Atomic Physics**

Absolute absorption cross section measurements (including metal vapour work using heat pipes); resonance profile measurements; partial photoionisation cross sections and photoelectron angular distributions over an extended wavelength region; lifetime measurements using the electron beam modulation.

**Solid State Physics**

Variable wavelength ESCA studies; photoemission at extended photon energies; fluorescence spectroscopy; optical constants over extended photon energies, which permits sum rule consistency checks; modulation spectroscopy; direction evaluation of electron momentum by variable wavelength Compton scattering.

**Intensity Standards**

Photodetintegration, photoejection dynamics, mass spectrometric techniques.

**Optical Instrument Calibration, optical component performance.**

**Scanning X-ray microscope.**

**Structural analysis and crystallography with a continuously variable and intense X-ray source.**

**Biological and Medical Research**

The character of groups using synchrotron radiation facilities has changed in recent years as a result of the realization by medical and biological researchers that the source has considerable potential for application in their disciplines.

The development of the new generation of dedicated synchrotrons is making available for the first time the prospect of real time studies of photochemical/biological events in living systems directly attributable to the substantial intensity advantages offered by synchrotrons over all other sources in the X-ray region.

Consider as an example the chemical effects induced in the retinal region of the eye as a result of a light stimulus. It is apparent that little is understood about the role of the production and movement of the light sensitive protein — rhodopsin — in the vision process. Investigation has been limited basically because such
processes operate on a millisecond time scale. Traditional X-ray source observations require exposure times of typically several minutes or even hours. It has been claimed that the synchrotron source intensity will permit the reduction of exposure times down to the millisecond or physiological time scale [Holmes, 1974].

In Germany the new high energy facility, DORIS, comprises intersecting storage rings and the European Molecular Biology Organisation have established a facility on the positron ring to initiate experiments into biological, biochemical, and physiological research. In particular, the field of real time studies of chemical changes induced in muscle tissue by contraction and the structure of long chain protein molecules using variable wavelength radiation have been proposed.

The Brookhaven Symposium on Research Applications of Synchrotron Radiation reports a variety of experiments proposed in the biological/biophysical area using absorption and diffraction techniques [Watson and Perlman, 1973].

In the UK the Medical Research Council has funded experiments in the biological studies field at the Daresbury synchrotron. Earlier this year a meeting was held at Reading University to discuss physical, chemical and biological research with synchrotron sources.

**Implications in the Australian Context**

Recent developments in several countries have established a trend towards the provision of national facilities for synchrotron radiation users. The recent National Science Foundation decision to consolidate and stimulate research in this field by up-grading the Stanford University facility (SPEAR) with a $1.2 million injection of funds and to make the facilities available to users throughout the USA is one such example.

Consistent with this trend is the SRC Committee recommendation to establish a dedicated national facility for synchrotron radiation research. In Germany at Hamburg and Bonn and in France (two facilities ACO and DCF) invitations to use the facilities have been extended nationally (and in some cases internationally).

What implications does this have in the Australian context? In writing this article it has not been my intention to describe the synchrotron radiation source and research programmes and then conclude "Australia must have one of these!" Rather I am more concerned with the matter of national science policy and national scientific resources and I see such a facility as a relevant consideration in this context. Physicists in general are too concerned with their own short term scientific objectives and should give more emphasis to the consideration of national goals, national science policy and national facilities. A scan of contents of the "Australian Physicist" or papers presented at the recent AIP Congress (Adelaide) will substantiate these arguments. There has for example been little discussion of the document "Towards a National Science Policy" issued by the Minister for Science in March 1974 despite it having been discussed by the AIP Council and various Branches. It is refreshing to read that the next ANZAAS Congress has as its theme "Science, Government and the People". One hopes that physicists will respond to this opportunity.

In conclusion I return to the matter of synchrotron radiation facilities. My personal view is that such a facility may be justified in Australia providing that substantial support for the facility was forthcoming from the medical, biological, biochemical and physiological disciplines. Basically, despite the pioneering work and extremely good current research being carried out by physicists, it is becoming increasingly obvious that a much longer term research contribution is to be made in solving certain aspects of the complex biological problem.

It is perhaps worthwhile to raise the question of X-ray lasers (preferably tunable) in view of the intense interest in this field recently. Such a source would probably make the synchrotron source obsolete but the question of when (or if) they will be satisfactorily developed and how much they will cost may leave this an open question. Certainly some countries are 'having a bet both ways'.

**References**


Institute Affairs

25TH COUNCIL MEETING

The 25th Meeting of the AIP Council was held at Clunies Ross House, Parkville, on 31 October – 1 November 1974. The President, Dr F. Jacka, was in the chair.

General Policy

In March of this year the Hon. W.L. Morrison MP, Minister for Science, issued a discussion paper entitled “Towards an Australian Science Council” in which he identified the principal issues and invited discussion on them. The AIP had responded with considered statements and recommendations as published in the November issue of The Australian Physicist, page 224.

Discussion at Government level had reached a very advanced stage and Council had appointed an AIP Science Policy Committee comprising Dr J.G. Campbell, Professor H.C. Bolton, Dr T.M. Sabine and Dr J.R. Bird, in order to keep abreast of developments, keep Council and the membership informed, and be prepared to submit further comments and arguments to the Minister as and when appropriate.

Finance

The Hon. Treasurer reported that the gross deficit of $1189 in Council-controlled funds was greater than the budget estimate of $400. This was due almost entirely to the large amount of printing, and somewhat offset by an unexpected (one-third) share of profits from activities of the Branches and Groups.

Rising costs were a matter of concern to Council and if services to members were to be maintained, a substantial subscription rise of 50 per cent. at the very least would be required for 1976.

In the meantime Council had budgeted for a deficit of $7040 in the coming year, which was almost equal to the current value of the Council-controlled funds of $7308.

Means for financing this large deficit were discussed and it was resolved that Council authorize the transfer of half the Funds Held on Behalf of Branches (amounting to $12484) to Council for the purpose of continuing its financial operations in the 1974–1975 financial year, it being understood that consideration will be given to restoring these funds at a later date.

Administration

The office at Clunies Ross House, Melbourne, continued to be shared very successfully with the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH) with each society having its own full-time Assistant Secretary.

Membership

The Honorary Registrar reported that as at 17 October 1974 corporate membership stood at 1488 (an increase of 6 since the last Council meeting, total membership was 1734 (an increase of 1), and Company Subscribers totalled 22 (no change).

These net changes in membership included gains by election of new members and transfers from non-corporate to corporate grades, less losses by resignation and removal.

In the opinion of the Membership Committee, forthcoming National Congresses were one of the major activities from which increased membership might arise, and with this in mind the Committee had suggested certain guidelines for future National Congresses for the consideration of Council.

It was reported that many Student members who were no longer eligible for Student membership under By-Law 20 remained on the Register as Students despite requests that they transfer to Graduateship or write requesting an extension of their Student term due to some specific circumstance. There would be 113 students whose term of Student membership would expire in December 1974, 64 of whom would be 12 months or longer overdue. Council agreed that all Students whose term as Student members of the AIP expired on 31 December 1973 or before, and who did not apply for transfer to either Associate or Graduate, or request an extension of their Student membership in writing to the Honorary Registrar, should be removed from the Register in accordance with By-Law 20 as at 31 December 1974.

Tertiary qualifications, with physics as a major subject, which received official recognition for graduateship were –

B.App.Sc. (with special requirements as to physics content) of the Canberra College of Advanced Education.

B.App.Sc. of the Western Australian Institute of Technology.

The Hon. Registrar reported that the status of 16 persons holding overseas professional qualifications had been assessed since 1 January 1974 for eligibility for corporate membership of the Institute. These assessments were being carried out by Dr J.F.G. Darby and Professor J.H. Smith.

The Australian Physicist

The Editor reported that many operational problems had arisen during 1974 which had resulted in late publication of issues. Distribution had been another
major problem particularly with pre-addressed bulk mailing which had lately been disallowed by the Post Office. The journal had now been restored to Category B mailing service, and this should overcome the distribution problems and would keep distribution costs minimal.

Consideration was being given to the possibility of feature issues containing special matters of interest which could be linked to special conferences or exhibitions. Members are asked to give though to such possibilities.

After discussion of the financing of The Australian Physicist it was resolved that there be no change in format or reduction in the number of issues of The Australian Physicist for 1975. Furthermore, in order to cope with the secretarial work involved in producing the journal it was resolved that the Editor be authorized to engage some part-time secretarial assistance.

Conferences, Summer Schools and Special Lecturers

The first National AIP Congress held on 21–24 May 1974 had been a great success and abstracts had been published in the April issue of The Australian Physicist. The second National AIP Congress was planned for Sydney in May 1976.

The 1974 Pawsey Memorial Lecture was held in Brisbane and was given by Professor B.Y. Mills of Sydney University. His subject was “Exploring the Milky Way”. Approximately 130 people attended. The 1975 Pawsey Memorial Lecture will be organized by the ACT Branch in the latter part of the year. The guest lecturer will be Dr J.G. Bolton.

The 1975 Summer School will be held in Hobart on 27–31 January 1975. There will be two themes through the school namely Optical Data Processing in Astronomy and High Energy Astrophysics. A Summer School organized by the NUPP Group will be held in Coorow, WA, 10–14 February 1975 and the principal speakers will be Professor Murray Gell-Mann of California Institute of Technology and Professor Stanley Hanna of Stanford University.

The International Commission for Optics Conference held in August in Sydney had been very successful. Professors Francon and Marechal had been the Special AIP Lecturers and had lectured in SA and Victoria, as well as at the conference. Unfortunately, due to a break-down in airline arrangements, their scheduled lectures in WA did not eventuate.

The International Union of Crystallography Conference had been held in August 1974 in Victoria, and Professor H. Lipson had been the Special AIP Lecturer. He had lectured in Melbourne, Sydney and Townsville.

The visit of Professor A.B. Pippard to Australia in September–October 1974 had been a brilliant success. He had lectured in all States.

A Joint International Solar Energy Society–AIP Conference had been held on 8 November in Sydney with over 100 registrants.

Groups

The Biophysics Group, in conjunction with the Australian Regional Group Hospital Physicians' Association had organized the 14th Conference on Physics in Medicine and Biology in Sydney on 21–24 May 1974. Joint sessions were held with the Annual Meeting of the ANZ Society of Nuclear Medicine, and the conference was integrated with a one-day meeting on 25 May of the NSW Society of Medical and Biological Engineering.

The Education Group had held several meetings in Sydney and Melbourne and had conducted a survey of Physics Courses in Australian Tertiary Education. The Group was endeavouring to assist Science Teachers generally, and felt a great need to get out into the teaching area.

The Nuclear and Particle Physics (NUPP) Group was steadily growing in strength. The lecture notes for the first NUPP Group Vacation School had been produced. Details of the Group's 1975 Summer School are given above.

The Vacuum Physics Group had reported a very successful year, the highlight being the Vacuum Physics Conference in February 1974.

Other Scientific Organizations

The Conference of Allied Societies which embraced the Australasian Institute of Mining and Metallurgy, the Australian Institute of Physics, The Institution of Engineers, Australia, and The Royal Australian Chemical Institute, now included the Australian Institute of Agricultural Science and the Institution of Surveyors Australia. These bodies had met together to exchange views on subjects of mutual interest such as the Government Science Policy and the problems of continuing education.

Archives

Arrangements have been concluded whereby the records of the AIP dating back to the beginning of the Australian Branch of The Institute of Physics (UK) are now housed in the Adolph Basser Library, Australian Academy of Science, Canberra.

The AIP Branches have also been asked to consider depositing their records in the Basser Library, and for the physics archival records to be even more complete, other scientific institutions are invited to notify Dr Michael Hoare, Research Historian at the Basser Library, of any material held locally which could usefully be cross-referenced.

It is expected that reports on the archival material will be published in The Australian Physicist from time to time.

26th Council Meeting and 12th Annual General Meeting

The next Council Meeting is scheduled for May 1975, and the 12th Annual General Meeting will be held at 3.30 pm on 29 January 1975 in Hobart during the Summer School.

K.H. Clarke, Honorary Secretary.
THE REGISTER

CHANGES IN MEMBERSHIP FROM 8 OCTOBER 1974 TO 12 NOVEMBER 1974

FELLOWSHIP

(a) New Election
Window, B. University of Sydney, NSW

(b) Transfers
Ciddor, P.E. National Measurement Laboratory, NSW
Green, R. University of New England, NSW
Jeffery, P.M. University of Western Australia
Lowenthal, G.C. Australian Atomic Energy Commission Research Establishment, NSW

(c) Resignation
May, R.M. (O/S)

MEMBERSHIP

(a) New Elections
Alabaster, P.S. Swinburne College of Technology, Vic.
Chandra, S. University of Newcastle
Farrow, A.J. Macquarie University, NSW
Humble, J.E. University of Tasmania
Haberkern, G.P. Queensland Institute of Technology
O'Sullivan, R.A. Royal Melbourne Institute of Technology Vic.
Robertson, J.A. Macquarie University, NSW
Stock, H.J. The University of Western Australia
Wall, T. Australian Atomic Energy Commission Research Establishment, NSW

(b) Transfers
Budd, R.S. Cancer Institute, Vic.
Borns, A.R. Western Australia School of Mines
Thiel, D.V. Griffith University, Qld
Trehewke, J.V. Q&S
Watts, D.L. State College of Victoria
Whittlestone, S. Australian Atomic Energy Commission Research Establishment, NSW

(c) Resignation
Ashton, H.T. (Vic.)

GRADUATESHIP

(a) New Elections
Brown, G.I. University of Melbourne, Vic.
Lowrey, M.R. Monash University, Vic.
Martin, L.U. University of Melbourne, Vic.

Reekie, C.M. O/S
Rooney, W. O/S
Were, A.V.W. Australian Newsprint Mills Ltd, Tas.
Whitham, P.S. University of Tasmania

(b) Transfers
Atkin, R.G. Education Department, Vic.
Bagliani, F. University of Western Australia
Bell, P.L. University of Melbourne, Vic.
Condello, G. NSW Institute of Technology
Harrison, A. IRT Electronics Pty Ltd, NSW
Mathers, P.K. Education Department, Vic.
Scott, D.W. Kodak (Asia) Pty Ltd, Vic.
Shield, P.G. Education Department, Qld

(c) Resignation
Morris, D.F. (SA)

ASSOCIATES

(a) New Elections
Catalano, C.S. (NSW) Puggioni, L. (Vic.)

(b) Transfer
Cass, A. (Vic.)

STUDENTS

(a) New Elections
Casey, R.N. (Qld) Ovtokin, M.M. (NSW)
Douglas, L.M. (NSW) Grace, J.R. (NSW)
Green, P.R. (Tas.) Heap, D.G. (NSW)
Hook, I.K. (NSW) Hons, A.W. (NSW)
Hosie, D.J. (WA) Hugill, A.L. (NSW)
Moore, R.R. (Vic.) Seery, M.R. (NSW)
Stamford, P.A. (Tas.) Van Emmerik, E.F. (Tas.)
Voulatas, Z.D. (NSW)

(b) Resignations
Kneale, R.I. (Vic.) McMurtie, R.L. (ACT)
Penhall, I.G. (ACT)

GROUP AFFILIATE

New Election
Owen, R.J. (O/S)

1975 COMMITTEES

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Conference Report

SOLAR POWER

A Symposium on the Physics of Solar Power Utilization was held at the University of NSW on 8 November 1974 under the co-sponsorship of the International Solar Energy Society and the NSW Branch of the AIP. Preprints of most of the papers were made available to the 160 participants.

Selective Surfaces

A temperature of 600 K has been achieved using BHP ‘Solarox’ chromium oxide coatings. However these coatings degrade quickly at high temperatures. Although the selectivity of Solarox can be explained in terms of its complex refractive index, neither the composition nor the structure is well understood at the moment.

Metal blacks, which are produced by evaporation of metals such as gold, molybdenum or chromium in a controlled atmosphere, have good selectivity at 400 K. Again these are unstable at high temperatures.

A metal mesh with holes of about 1 μm in diameter can act as an optical waveguide with the prospect of achieving both selectivity and high temperature stability. Such a mesh can be constructed and the performance is as expected but a high hole density has yet to be achieved.

Photovoltaic conversion

Photovoltaic devices are well established and highly practical devices whose use is at present limited by cost considerations. Work continues on the development of new types of cell including organic cells, and on auxiliary equipment such as a conical concentrator which can increase the energy reaching a cell by a factor of five or more. Load matching can be a problem because the impedance of a silicon cell changes with the level of solar radiation.

Selective Surface Reflection

Dr Gipps of Philips displayed a long sodium vapour lamp which uses an indium oxide reflector — a technique ready to apply to solar energy work. Replace the sodium lamp by a blackened tube carrying a suitable coolant and a solar energy collector is not difficult to make. The important point is that the selective surface will remain relatively cool if it is acting as a reflector rather than absorber.

Philips are planning to market a molten salt device for heat storage at about 700°C for use in overcoming the fluctuating availability of solar energy.

Thermoelectric Refrigerator

Thermoelectric generators offer a means for producing electricity when the source temperature is relatively low. One application is the direct connection to a thermoelectric refrigerator. Feasibility has been demonstrated using bismuth telluride although the efficiency is quite low.

With ARGC grants for solar energy research in 1975 totalling $126 000 we may look forward to an even more stimulating symposium in a year’s time.
SECOND CONFERENCE OF AUSTRALIAN PHYSICISTS
Melbourne, 20–23 August 1929
Extracts from “Proceedings and Abstracts of Papers” received from J.F. Richardson, CRL, Melbourne.

PREFACE

“This meeting was held at the invitation of the Australian members of the Institute of Physics, following on the success of the previous Conference held in Canberra in August 1928. An account of that Conference and of the events leading up to it has already been published in similar form to this”. [See Aust. Phys. 10: 59 (1973)].

“The Conference met at the Natural Philosophy Department of Melbourne University, and was associated on its opening day with an exhibit of apparatus by the laboratory, the Observatory, the Research Section of the PMG’s Department, and by a number of Melbourne firms. In addition to business meetings, a motor excursion was made to Olinda; the laboratories of the Defence Department at Maribyrnong and of the PMG’s Department were visited; and a party spend an evening at one of the theatres and were afterwards entertained by Professor and Mrs Laby.

A shadow was cast over the Conference by the sudden death just before it met of Associate Professor Bieler, of the Geophysical Experimental Survey, and of Dr Duffield, Director of the Solar Observatory at Mount Stromlo, who had acted as host at the Canberra meeting. References to their work were made at the opening session.

It has been decided not to hold a separate meeting next year, in view of the Australasian Association for the Advancement of Science meeting in Brisbane in May; but to hold a separate meeting of physicists again in August 1931, in Sydney”.

PROGRAM AND ABSTRACTS OF PAPERS (Extracts)
Tuesday, 8 p.m.

B. Cavanagh, M.A., D.Sc., Senior Lecturer in Physical Chemistry, University of Melbourne.

1. An Application of the Generalised Hyperbolic Function
   A Discussion of the calculations involved in a refined and extremely precise method of potentiometric titration...

2. Note on explosion of Second Law of Thermodynamics

H.S.W. Massey, B.A., M.Sc., Atchison Travelling Scholar, University of Melbourne (not attending)

1. Scattering of Fast Electrons by Matter and Dirac’s Theory
   ...a scattering formula is obtained, generalised for relativity and spin...it is found that the formula gives only about 2/3 of the observed scattering. It seems that the only way of accounting for the discrepancy is to suppose that a good deal of energy is lost by radiation during the process of collision....

2. Motion of Electrons in Crystal Gratings and Functions of Mathieu
   .....the problem of electronic conduction being the object in view....

3. The Anomalous Scattering of Alpha Particles and Polarization Forces on the New Mechanics
   In investigating the scattering of Alpha particles by light nuclei, Bieler found that the scattering was less than that predicted by the ordinary inverse square law of repulsion, while Rutherford and Chadwick using still closer distances of approach found that the scattering increased again. This was explained on classical lines by Hardmeier as due to a polarization of the nucleus, an effect virtually introducing an additional inverse fifth power attractive force.

   It is here shown that this explanation is unsatisfactory on the new mechanics, although the assumption of polarization can be made to fit the results of Bieler by appropriate choice of the arbitrary constant, the polarizability of the nucleus. This is done using Born’s theory of collisions and applying contour integration to carry out the integrations involved....


The Wave Mechanical Theory of the Raman Effect
   .....The case of the diatomic gas is the only case amenable to theoretical treatment. The effect is here treated on wave mechanics, a generalised scattering formula due to Waller being the starting point....

Wednesday, 9.30 a.m. — 1 p.m.


Observations of Long Period variables.

Series of Observations of long period variable stars made with the 8 inch refractor at the Melbourne Observatory were shown....
Working Drawings of a Photo-electric Photometer for Stellar Work


The Spectroscopic Parallaxes of B-Type Stars
The spectra of 350 B-type stars are now available and have been classified first into spectral sub-type and then into line-character groups in each sub-type according to well-defined criteria...

...The following conclusions are made:
1. That the absolute brightness of a star of normal spectrum depends upon its spectral type and upon the character of its spectral line; the sharper the lines the brighter the star.
2. That there is a progressive decrease in absolute brightness as the temperature scale is descended from B0 to B9.
3. That stars whose spectra contain bright hydrogen lines are among the brightest of their spectral type, and they also decrease in brightness as we descend the temperature scale.
4. That stars whose spectra contain strong, sharp enhanced lines of metallic origin are of abnormal absolute brightness, this brightness apparently depending upon the strength and sharpness of these lines.

C.W. Allen, B.Sc., Assistant, Mount Stromlo Observatory, F.C.T.
The Breadth of Lines in the Spectrum of the Copper Arc
The three-prism Littrow Spectrograph at the Commonwealth Solar Observatory is being used to investigate whether all lines associated with the C4D2 (or C4D3) have exactly the same breadth....

Associate-Professor V.A. Bailey, M.A., D.Phil., F.Inst.P., Associate Professor of Physics, University of Sydney (not attending).

A New Method for the Study of Electrons in Gases
...The Electrons enter the diffusion chamber through a slit and under the influence of a uniform electric field Z are collected on a disc which contains a slit similar and opposite to the first. The fraction R of the total stream which passes through the second slit is a measure of the diffusion of the Electrons, and in the case of purely electronic streams the energy k can be determined when the ratio R and the electric intensity Z are known....

R.S. Burdon, B.Sc., F.Inst.P., Lecturer in Physics, University of Adelaide.
Uncertainties in Our Knowledge of the Properties of the Surface of Mercury (a) absorption, (b) surface tension, (c) Photo-electric effect.

Geoffrey Builder, B.Sc., Demonstrator in Physics, University of Western Australia and Assistant, Watheroo Magnetic Observatory (not attending).

1. Effect of Condensation Nuclei on the Atmospheric Electric Elements
Curves are given, based on observations made at the Watheroo Magnetic Observatory, showing the relations found between the counts of condensation nuclei made with an Aitken Counter and simultaneous values of the atmospheric conductivity and potential gradient...It is concluded that, for the range of observation, there is an approximately linear relation between the nuclei count and the reciprocals of the polar conductivities and between the nuclei count and the atmospheric potential gradient....

2. Preliminary note on the Atmospheric potentials recorded with Ionium collectors

Karr Grant, M.Sc., F.Inst.P., Professor of Physics, University of Adelaide.

1. An Improvement in the Construction of the 'Kater' Reversible Pendulum
...With knife-edges the experience of the writer would indicate that it is extremely difficult to secure precise parallelism and that the order of uncertainty in the measurement is at least 1/50 mm....In recent years the construction and measurement of end-standards of length has reached a higher degree of precision than that of line-standards, an accuracy of comparison of 1 in 10,000,000 having been attained....The improvement described depends upon the use of such an end-rod for the rod of the pendulum.

2. (a) Report on the Performance of Shortt clock no. 19;
(b) A Proposed design for free-Pendulum of fused Silica

The proposed design is for a pendulum composed entirely of fused silica swinging in high vacuum.

3. An Instrument for indicating changes of surface-tension and in Particular the Instant of Completion of a Monomolecular Layer


Quantitative Analysis by X-Ray Spectra
...Experiments have been carried out to determine the accuracy with which a quantitative estimation of the amount of an element present by measuring the intensity of its X-ray emission lines....


Progress report of Measurements of Ozone in the Earth's Atmosphere
...almost invariably, high ozone values are found to accompany cyclonic (low pressure) conditions....
Wednesday, 8 p.m.

Professor A.O. Rankine, O.B.E., D.Sc., F.Inst.P., Professor of Physics, Imperial College of Science & Technology, London, S.W. Secretary, Institute of Physics, followed by R.L. Aston, B.E., M.Sc., Imperial Geophysical Experimental Survey, and E.H. Booth, B.Sc., F.Inst.P., Lecturer in Physics, University of Sydney.

Discussion on Seismic Prospecting

R.C.B. Lane, B.A., Science Student, University of Melbourne.

Note on the waves in an Elastic Solid

N.B. Lewis, M.Sc., Ph.D., Imperial Geophysical Experimental Survey.

The Interpretation of the Results of Gravity Surveys

The paper dealt with some of the aspects of the procedure adopted by the I.G.E.S. party at Geeloundale.

First it described how the isogams..were derived from the plan on which the horizontal gravity gradients were vectorially represented.

Secondly it described a graphical procedure for the determination of the gradients due to a body of very great extent in the direction of one of the co-ordinate axes (called a "two-dimensional" body)....


The Design of a Gravity balance for field use


Note on the Relation Between Gravity Gradient and "Horizontal Directing Tendency".

Thursday, 9.30 a.m. – 1 p.m.

L.H. Martin, Ph.D., Senior Lecturer, Natural Philosophy, University of Melbourne.

Absorption of X-rays

A description was given of a balance method for measuring X-ray absorption coefficients....


On the Determination of Thermal Conductivity of Gases

A comparison was given of the plate method used by the authors for air in 1914, and the hot-wire method used by Gregory and Archer....

W.G. Kammelui, B.Sc., Research Student, Natural Philosophy, University of Melbourne.

1. The Wiedemann-Franz Ratio

2. On An Electrical Method of Determining Thermal Conductivities of Metal Wires

The method used is a generalization of the methods of Callendar and of Knudsen. Experiments were carried out to determine the thermal conductivity of a nickel wire 17.6 cm long, 1 mm in diameter; and of a silver wire 17.6 cm long, 0.5 mm in diameter at room temperature.

J.S. Rogers, B.A., M.Sc., Senior Lecturer, Natural Philosophy, University of Melbourne.

The Mobility of positive ions of long life (Preliminary report)

Z.A. Mirfield, F.R.A.S., Research Fellow, University of Melbourne.

1. Micro-photography with ultra-violet light

2. Improvements in the ruling of diffraction gratings


The Reflection of X-Rays

...The theory of X-Ray reflection was then discussed, particularly with respect to the following assumptions:

1. That the frequency of the incident X-rays is greater than that of the resonance electrons:

2. That the resonance electrons are the K electrons of the atoms of the mirror.

3. Approximations are made assuming that $\phi$ and $\mu - 1$ are both small.

It was shown that, in our experiments...the radiation is of less frequency than that of the resonance in the mirror...Also $\phi$ and $\mu - 1$ are not small so assumption (3) is invalidated....


Note on the Reflection of Homogeneous X-Rays

...The design of the apparatus used in the present investigation is described. It is completely enclosed in vacuo for the purpose of long wave length investigations...The intention is to go on to still longer wavelengths. The effect at an actual absorption edge, viz., anomalous dispersion, is also to be investigated.

Friday, 9.30 a.m. – 1 p.m.


Water Dispersions of Rubber

...When rubber is thoroughly softened on a rubber mill, sometimes in the presence of softening or depolymerising agents such as palm oil, pine tar or stearic acid, it may then be dispersed with water, provided that a proportion of such dispersing agents as glue, a natural clay known as "bentonite", casein, etc. be also added....
J. Bunnun, B.Sc., Radium Physicist to the Cancer Research Department, University of Sydney:

Notes on the Measurement of Radium
A γ-ray Electroscope for the measurement of quantities of Radium was described. The error in measurement is of the order of 1 part in 300.

A.H. Turner, M.Sc., Physicist to Commonwealth Health Department, Radium Treatment Branch, Melbourne.

1. Description of the Commonwealth Radium Laboratory
   The sources of danger to radium workers were also pointed out.

2. A Method of calibrating a set of Sub-Standard Radium Tubes

Z.A. Mirfield, F.R.A.S.

1. A new refractory ceramic material
2. The application of physical principles to the design of spark plugs for internal combustion engines

W.A. Baker, Wireless Research, University of Sydney (not attending)

1. Corrections to be applied to Field Strength Measurements with Loop Antenna
3. The Development of a Superheterodyne Type, Field Intensity Set and Reports on Measurements with it.

R.O. Cherry, M.Sc., Wireless Research, University of Melbourne

Intensity Measurements around some Australian Broadcast Stations
The simple loop, condenser and valve voltmeter method of measuring field intensities has been extended for use down to 1 mv/metre, no elaborate equipment being required.

R. Fallon, M.Sc., Physics Tutor, Newman College, University of Melbourne, J.L. Prowse, B.Sc., Research Student, Natural Philosophy, University of Melbourne and W.J. Wark, B.Sc., Research Student, Natural Philosophy, University of Melbourne.

Measurement of Frequency from Broadcasting Stations with Multivibrator

F.W. Wood, B.Sc., Assistant, Watheroo Magnetic Observatory (not attending)

Directional Recording of Atmospherics at Watheroo, W.A. (Progress Report)
Continuous records have been obtained since November 1, 1928, only about 5 per cent. of the total time having been lost through the breakdown or stoppage of some part of other of the apparatus.


Notes on Vectors and Vector Analysis

Friday, 2 p.m.
Fifth General Meeting of Australian Corporate Members of the Institute of Physics.

Others Present
Natalie C.B. Allen, M.Sc., Senior Demonstrator in Natural Philosophy, University of Melbourne.

H. Barkly, Assistant Director, Weather Bureau, Melbourne.

M.H. Belz, M.Sc., Senior Lecturer in Mathematics, University of Melbourne.

E.L. Blazey, Imperial Geophysical Experimental Survey.

T.M. Cherry, B.A., Ph.D., Professor of Mathematics, University of Melbourne.


N.A. Esserman, B.Sc., A.Inst.P., Senior Physicist, Defence Department Research Laboratories, Maribyrnong, W.3.

J.A. Feeley, B.Sc., Assistant, Melbourne Observatory.

W.M. Holmes, B.Sc., Melbourne Observatory, S.E.I.


H.F. Johnston, Observer-in-Charge, Watheroo Magnetic Observatory, Western Australia.

Sir T.R. Lyle, M.A. D.Sc., F.R.S., Emeritus Professor of Natural Philosophy, University of Melbourne.

T.N. Mirfield, B.E., Lecturer in Mechanical Engineering, University of Melbourne.

D.A. O'Donnell, M.Sc., Research Laboratory, Chief Engineer's Branch, PMG's Department.

E.J.G. Pitman, M.A., B.Sc., Professor of Mathematics, University of Tasmania.

W.L. Price, B.E., B.Sc., Research Laboratory, Chief Engineer's Branch, PMG's Department.

A.D. Ross, M.A., D.Sc., F.Inst.P., F.R.S.E., F.R.A.S., A.M.I.E.E., Professor of Physics, University of Western Australia, Perth.


W. Stone, Formerly Chief Engineer, Victorian Railways, 1 Selborne Road, Kew, E.4.

H.M. Trollope, B.Sc., Research Officer, Weather Bureau, Melbourne.


E.P. Wright, B.Sc., Research Laboratory, Chief Engineer's Branch, PMG's Department.
BOOK SECTION

BOOK RECEIVED


BOOK REVIEWS


Reviewed by G.L. Braglia, University of Parma, Italy.

This book, published in the Wiley Series in Plasma Physics edited by S.C. Brown, is an excellent review of theoretical and experimental studies of the motion of slow electrons in a field in a gas. The authors have made important original contributions to this field of physics, particularly in the last twenty years. As a consequence the book is full of first-hand results which gives this publication a particular value.

The volume is in two parts. Part one, of almost three hundred pages, deals with theoretical problems. The theory is based on the Boltzmann equation but the treatment is rather original and particularly appropriate in the context of the arguments which are considered throughout the book. The authors consider first diffusion and drift in a d.c. field for the simple case in which the effects of density gradients on the velocity distribution function can be neglected. The theory is then extended to include more general fields, density gradients, inelastic collisions and attachment. There is also one chapter specifically devoted to the application of the theory to experiments designed to measure drift velocities and diffusion coefficients. An interesting chapter deals with the free path method, an approach with which the authors have had considerable experience and which has been found very useful, in these last years, for the study of the approximations involved in theoretical calculations.

Part two is concerned with experimental studies. A critical survey of the most important experimental techniques for the measurement of drift velocities and diffusion coefficients is presented, with great care, in two chapters. We also find a chapter on the techniques for measuring attachment coefficients. The last part of the book is devoted to the important problem of the determination of low energy electron cross sections from transport data, almost without exception the only way we have at present of obtaining reliable data at very low energies. There is a chapter on the analytical methods and one on the experimental results for both electron transport coefficients and derived cross sections.

This book is recommended to all who are interested in low energy electron behaviour in gases. It is a good and adequately complete account of the present status theory, experimental techniques and results, in the field of drift and diffusion of slow electrons in gases.


Reviewed by G.J. Aitchison, Canberra College of Advanced Education.

This book must almost qualify for a mention in the Guinness Book of Records. Fincham's Optics first appeared in 1934; the 8th edition, now with a second author, just 40 years later. How many undergraduate Physics texts achieve such longevity?

A comparison of the latest edition with the first and seventh would be interesting. Not even the National Library could produce either of these, and the best that I could manage was a comparison with the sixth edition of 1951. In most chapters the changes were few and trivial; but the two chapters on Interference and Diffraction have been largely rewritten, partly in order to introduce substantial sections on thin-film interference and modern interferometers, and holography, respectively. There has been some updating; the trichromatic coefficients now appear in the section on colour, Bunsen's grease-spot has given way to more sophisticated present-day photometers, and so on. But overall the book has not changed greatly over the last 23 years.

It has not really needed to change greatly. Perhaps this is because of the greater emphasis on geometrical optics than in most books of similar size and standard. Of the 19 chapters, 14 are essentially "geometrical"; and some topics, notably Aberrations, are dealt with in greater detail than in most undergraduate texts. But the book is nevertheless not deficient on the "physical" side.

The Australian Physicist, February 1975
At the end of each chapter there is a goodly supply of examples (with some additions but few changes since 1951), some descriptive, many numerical, with answers to all of the latter; and a comprehensive index.

There are some notable omissions. One might have expected to find, *inter alia*, some reference to optical length standards, more than 5 lines on photoelasticity, a mention of the Kerr cell, and in a book that does not baulk at Bessel functions, a quantitative use of Laplace transform in the treatment of diffraction.

But in any book one can find omissions to criticise. The very period of the survival of Fincham's book testifies to its quality; and for any second year tertiary optics course in which geometrical optics is to be emphasised, the book must be regarded as a serious rival to such standard works as Longhurst and the time-honoured Jenkins and White.


Reviewed by Geoffrey I. Opat, School of Physics, University of Melbourne.

In April 1970 a distinguished group of physicists met at the University of Texas in Austin to take stock of the developments in elementary particle theory during the decade 1960–1970. In some 20 seminars they reviewed the state of the art, covering all the various aspects of the subject, albeit unevenly. The proceedings of this symposium were published in the *Journal Fields and Quanta* 1 Numbers 1–4, and 2 Numbers 1–4 (1971 and 1972). This book is a republication of the same material, complete with typographical errors. Nevertheless the successes of the decade are well and authoritatively covered.

In strong interactions analyticity, dispersion relations, Reggeism, group symmetry and particle spectroscopy dominated the scene for much of the sixties, and each has a seminar by a major exponent. The enormous expansion in our understanding of weak interactions in terms of current — current theory are reviewed, as is the CP-violation puzzle. Aspects of field theory are treated by several speakers giving attention to the role of special and general relativity in field theory. The most forward-looking article on field theory is that of Nambu on the now raging topic of broken symmetry.

Electromagnetic interactions are somewhat under-represented considering their advancement in that decade. Fortunately Feynman saved the day with his most readable account of partons.

This book is of current interest to novices in High Energy Physics, and will be of interest to future historians of that fertile decade.


This book is a new version of that written by the author in 1964 under the more general title of "Low Temperature Techniques", the change being made to emphasize the present volume's concentration on the use of liquid helium in the laboratory. Nevertheless it can be recommended just as strongly to people preoccupied with cryogenic engineering as to those working in the laboratory environment.

The material in the book has been divided roughly into two main areas. The first part concentrates on the use of normal liquid helium, *4*He, covering temperatures above 1 K. Considerable detail is given on a wide range of techniques for establishing and controlling and measuring temperatures in this region. There is a slightly historic air about some of the text but it makes good reading for the experimental cryogenist.

The second part dealing with the use of *3*He as a refrigerant and in the dilution refrigerator is excellent. The advantages of using *3*He and the use of simple techniques to gain temperatures down to 0.2 K are spelt out in detail. The information on the dilution refrigerator is one of the better explanations on how this process works and the author has gone to the extent of giving a trouble-shooting section on such refrigerators. Although no book can be right up to date in a rapidly developing field, anyone using or contemplating using a dilution refrigerator should read this one.

The book concludes with a short but useful appendix on the more common properties of cryogenic fluids and the materials used for cryogenic construction. A list of suppliers of materials and equipment is given which is too heavily slanted to Great Britain for the Australian reader and even this information is somewhat out of date.

**BOOK NOTICE**


The first three chapters of this book deal with the elasticity and plasticity of solids, particular emphasis being given to the elastic relationships of importance when considering engineering metals. The chapter devoted to the plasticity, in contrast, is qualitative and very brief. Chapters 4 and 5 contain a treatment of liquid and gases respectively, while Chapter 6 deals with the subject of vacuum physics.
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SA Branch: Dr R.T. Cahill, School of Physics, Flinders University, Bedford Park, SA 5042.

Tas. Branch: Dr J.R. Fox, Dept of Physics, University of Tasmania, GPO Box 252C, Hobart, Tasmania 7001.

Vic. Branch: Mr J.D. Bunting, Applied Physics Dept, RMIT, 124 La Trobe Street, Melbourne, Vic. 3001.

WA Branch: Dr M.J. Lynch, Dept of Physics, WAIT, Hayman Road, Bentley South, WA 6102.

Biophysics Group:

Education Group: Dr C.F. Gauld, School of Education, UNSW, Kensington, NSW 2033.

Nuclear and Particle Physics Group: Dr R.F. Barrett, RSPhysS, ANU, PO Box 4, Canberra, ACT 2600.

Vacuum Physics Group:

Biophysics Group: Mr L.D. Oliver, Physical Sciences Dept, Prince of Wales Hospital, High Street, Randwick, NSW 2031.

LATE NEWS
New President

Dr James G. Campbell, Managing Director of Engelhard Industries Pty Ltd, has been elected President of the AIP following terms as Honorary Secretary from 1967 to 1973 and Vice-President from 1973 to 1975.

Dr Campbell, aged 48, was educated at Geelong Grammar School and the University of Melbourne. He has previously held positions as Senior Research Physicist and Paper Mill Superintendent at Australian Paper Manufacturers Ltd, Director of the Australian Wool Testing Authority, and Managing Director of Perkin-Elmer Pty Ltd.

Professional Scientists Award

The Arbitration Commission has handed down an Award for laboratory chemists, physicists, biochemists and other scientists engaged in commercial research. The award provides for a minimum salary of $6500 for graduates, on leaving university or college, and $8820 after six and a half years of experience.

The Association of Professional Scientists of Australia has been instrumental in gaining this award covering 400 employers. Further negotiations will seek a 20% rise in salary levels, the introduction of a 17% holiday loading and four weeks annual leave. All this must be good news for professional scientists unless they have already been retrenched.

ANZAAS

The 46th ANZAAS Congress was held in Canberra on 20-24 January 1975. The main theme of the Congress was Science Government and the People—reflecting the aim of ANZAAS to form a bridge between science and society. How did physics fare amongst the lobbying with politicians and the manipulation of the media?

The public might well conclude, along with one speaker on TV, that “physics is on the way out”. In fact, Dr A.J. Mortlock and Dr A.M. Baxter of ANU-SGS arranged a very successful program in physics including topics such as: low temperatures, mathematical modelling of physical systems, physics and geology, planetology, radiation and the environment.

Overseas Visitors

Professor D. Tabor (Cavendish Laboratory) is visiting universities and research establishments in Australia during February. He will lecture to the NSW Branch on 25 February, on the topic “Measurement of Van der Waals Forces”.

Professors M. Gellman (Caltech) and W. Turchinetz (MIT) will be lecturing at the NUPP Group's Summer School being held at Goolwa, SA from 17-20 February.
AUSTRALIAN INSTITUTE OF PHYSICS
NUCLEAR AND PARTICLE PHYSICS GROUP
SUMMER SCHOOL
GOOLWA, FEB. 17-20, 1975

The Summer School will be held at the Goolwa Conference Centre, which is near the beach and the lakes at the Murray mouth.
Accommodation is at the conference centre or the nearby motel.
Professor M. Gell-Mann has agreed to be the principal lecturer.
Sessions will be in the mornings and evenings. Afternoons will be free for informal activities or for participation in organized entertainment.

Registration fees: $20.00

For further details please write to the local organizer
Professor I. E. McCarthy,
Department of Physics,
Flinders University of South Australia,
Bedford Park, S.A. 5042.

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