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The Australian Physicist

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Manuscripts (original plus one copy) should deal with topics of interest to physicists in Australia, such as developments in the teaching or practice of physics and reports on lectures, conferences, Australian facilities, Institute Affairs, etc. They should be double-space typed on one side of the paper only, with margins 40 mm wide, and should follow the style used in this journal. The recommended length is up to 4 pages for articles (as printed with figures), up to 500 words for letters, and up to 250 words for Notes and News.

Deadline—15th of month prior to month of issue.

Figures—High contrast originals suitable for reduction to 80 mm width or, if essential, to 168 mm width. Half-tone illustrations should only be included if essential; they should be on white glossy paper and show a full range of tones with good contrast. Authors are asked to pay for block costs with the purchase of reprints.

References—are to be cited in the text thus:
[Brossel, 1947] or Brown [1971]
They should be arranged alphabetically at the end of the article and be presented thus:
(New York: Publisher).

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NOTES AND NEWS

NEW APPOINTMENTS

Dr. E. G. Bowen, formerly Chief of the CSIRO Division of Radiophysics, has been appointed Counsellor (Scientific) to the Australian Embassy in Washington, D.C., in succession to Professor H. C. Webster, who is retiring.

Professor A. R. Quinton, University of Massachusetts, is a Visiting Research Fellow in Nuclear Physics at AAECEC, Lucas Heights, until August 1973.

Dr. W. R. Blevin of the CSIRO National Standards Laboratories is shortly leaving for the USA to take up a one-year appointment as Visiting Expert on Radiometry with the National Bureau of Standards.

Dr. Blevin was recently awarded the degree of D.Sc. by the University of New England for his work in photometry and radiometry.

PROGRESS IN STANDARDS

Working standards of electromagnetic force will in future be maintained by referring them to the much more accurate standards of frequency by means of experiments based on the Josephson Effect. An interim value for the frequency-voltage ratio of 483.594 THz/V was adopted by a recent meeting at the Bureau International des Poids et Mesures in Paris.

Recent determinations of the speed of light carried out at the Boulder laboratories of the US National Bureau of Standards and elsewhere have reduced the previous uncertainty in the value of this constant by more than an order of magnitude. The technique used by K. Evensen and his colleagues involved measuring the frequency and the wavelength of infra-red radiation emitted by a stabilized helium-neon laser. The NBS value is $c = 299,792,456.2 \pm 1.1$ m/s.

AGENTS AND DISTRIBUTORS

Bourns Trimpot Products Division have appointed Tecnico Electronics Division of Pye Industries (Sales) Pty Ltd as exclusive Australian distributors.

Applied Photophysics Ltd of London, manufacturers of physical research equipment, have appointed Technical Services Tasmania Pty Ltd, 144 Collins Street, Hobart, Tasmania as Australian agents.

SUBSCRIPTIONS:

$5.00 is transferred to the Australian Physicist account from the annual membership subscription received for each financial Member, Student and Subscriber of the Institute to whom the Australian Physicist is issued. Copies so issued are intended solely for the recipient's personal use.

Non-members: $6.00 per annum (Australia), $6.50 per annum (Overseas).

Single issues: $0.60 (Australia), $0.65 (Overseas).

NEWS

Giant Balloons as Observation Platforms?

The French National Space Research Centre and associated organizations are developing large balloons (300-600 m in diameter) which will be maintained in fixed positions at 25 km altitude by means of motors driven by fuel cells. The balloons are intended for use as communication relays and weather observation stations.

New Examination Procedure for Ph.D.

The University of WA will introduce an alternative procedure for examining Ph.D. candidates. An expert committee will supervise and examine the work, in addition to the usual external examiner.

'Metric Practice'

The Metric Conversion Board will shortly publish a 56-page manual on SI units to assist industry in metric conversion. The manual will be distributed through the Board's comprehensive mailing list.

IOP NEWS

Conferences

Optical Properties of Thin Films, University of Southampton, 23-26 September 1973. Abstracts of proposed papers may be sent to Dr H. G. Jerrard, Department of Physics, University of Southampton SO9 5NH.


New Groups

A Neutron Scattering Group has been formed jointly by the IOP and The Chemical Society. A summer school is planned for September 1973. A Combustion Physics Group was formed in July, and a Quantum Electronics Group has also been established.

Further Details of Meetings

For information on meetings and Groups, contact The Meetings Officer, The Institute of Physics, 47 Belgrave Square, London SW1X 8QX.

All enquiries and correspondence concerning subscriptions to: Australian Institute of Physics, PO Box 52, Parkville, VIC. 3052.

Advertising space instructions—forward to the Advertising Manager: J. T. O'Mara, PO Box 39, Bondi Junction, NSW 2022; Telephone (02) 38-2696. (Deadline—6th of month of issue).


Copy deadline—15th of month prior to the month of issue.
Vacation School

14–18 MAY, 1973

The Vacation School will be held at the School of Physics, University of Melbourne. There will be 19 lectures with no parallel sessions. Guest speaker: Professor E. Vogt, University of British Columbia. Lectures will cover three topics:

INTERMEDIATE ENERGY PHYSICS

PARTICLE PHYSICS

APPLICATIONS OF NUCLEAR AND PARTICLE PHYSICS

Accommodation will be available in Queen’s College—bed and breakfast, $5.

Fees: Students $15
     Group Members $20
     Non-members $25

Anybody interested should contact:

Secretary, NUPP Vacation School, c/- AAECRE, Physics Division, Sutherland, NSW 2232
THE STRENGTH OF STEELS

W. J. McG. Tegart
BHP Melbourne Research Laboratories

An extract of a lecture presented to the AIP Summer School at Monash University, February 1972.

Steel has a long history of use by man and in looking to the future it is clear that steel will still remain a major material of the engineering, construction, packaging and appliance industries despite developments in competitive materials.

Fundamental Characteristics of Steels

Steels have been defined as impure iron-carbon alloys of low carbon content. Most steels contain from 0.1 to 1.5 per cent. C by weight and all industrial steels contain additional elements both metallic and non-metallic, some of which are added intentionally, whilst others are derived from the original ore or are introduced during the smelting or melting processes.

The basic feature that makes possible the wide range of properties of steels is the allotropy of iron and its attendant effects, particularly with regard to carbon solubility. This allotropy is retained in the presence of considerable carbon and other elements.

At low temperatures, iron crystallises with a body-centred cubic structure, known as α-iron or ‘ferrite’. This structure is stable up to about 900°C (there is some temperature hysteresis associated with the transformation) and then transforms to a face centred cubic structure, known as γ-iron or ‘austenite’. This structure is stable up to 1390°C above which temperature the stable structure is body centred cubic or δ-iron which persists to the melting point, 1536°C. As shown in figure 1 left, there are marked changes in lattice spacing (and hence in closest distances of approach) at the transformation temperatures. These changes lead to marked differences in solubility of interstitial elements, particularly C, N and O.

Under conditions of true thermodynamic equilibrium the phases expected in pure iron-carbon alloys would be the solid solutions of carbon in α-, γ- and δ-iron, together with pure graphite which would be present when the solid solubility limits are exceeded. In practice however the situation is complicated by the presence of metastable carbides of iron. Of these, ‘cementite’ (Fe₃C) is so stable that it persists unchanged for almost unlimited periods at the lower temperatures and in order to understand the structures and properties of steels it is necessary to consider the metastable system, iron-cementite, since commercial carbon steels are essentially dispersions of iron carbide in ferrite.

The iron-carbide system can be considered in terms of the metastable equilibrium diagram shown in figure 1, centre, where the regions of occurrence of stable phases are shown in terms of temperature and carbon content. It is seen that the solubility of carbon in α-iron is extremely small but on heating to the temperature for transformation to austenite an abrupt increase occurs, as shown in figure 1, right. The rate at which the carbon dissolves has nothing to do with this diagram which implies a close approach to equilibrium, a state that even in carbon steels may not be achieved fully in a matter of hours. To secure a complete conversion from ferrite and cementite to austenite requires heating into the shaded area of figure 1, centre. The austenite will revert to ferrite and carbide when cooled and by adjustment of the rate of cooling the structure

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Figure 1

Left: Effect of temperature on lattice spacings of iron. Centre: Temperature and composition limits for the formation of pure austenite (shaded). Regions for ferrite and heterogenous constitution are also shown. The diagram is representative of commercial compositions of carbon steel. Right: Solubility of carbon in iron as influenced by temperature. Composition is that of commercial steel rather than pure iron.
and hence the properties can be controlled. Depending on circumstances, iron carbide may form in plates or lamellar, intergranular cells or somewhat spherical particles over a range of sizes from a few to 10,000 nm.

If the austenite is slowly cooled then the resulting mixture of ferrite and cementite, formed in the range immediately below the transformation temperature has a characteristic lamellar structure, known as 'pearlite'. The lamellar spacing of the pearlite becomes finer as the temperature falls and also as the cooling rate increases. Pearlite is a metastable morphology and by heating for a sufficient time at just below the temperature for transformation from \( \alpha + \text{Fe}_2\text{C} \) to \( \gamma (\text{Fe}_2\text{C}) \) (approx. 700°C), the cementite can be ball-milled up into small globules and the pearlite is said to be 'spheroidised'.

By cooling sufficiently rapidly to a low temperature, e.g. quenching into water, the reversion to ferrite and carbide is suppressed and a supersaturated solid solution is produced. Because of the large amount of carbon held in solution, the structure produced is body centred tetragonal and is called 'martensite'. The transformation to this structure takes place by a sudden 'shear' mechanism and the resultant micro-structure is characteristically acicular and extremely strong. The variation of indentation hardness (which can be taken as a direct measure of strength) for varying microstructures over a range of carbon contents is shown in figure 2, left.

Besides being very strong, martensites are generally very brittle (the exceptions are extremely low carbon martensites which are relatively ductile) and for practical purposes it is necessary to soften the quenched structure by reheating to temperatures of say 300–600°C. This so-called 'tempering' leads to the formation of fine cementite particles and a cubic ferrite only slightly supersaturated with carbon. This microstructure is softer but more ductile than the martensite as quenched.

The transformation of austenite can occur in yet another way to those discussed above if the steel is not cooled continuously but is almost instantly cooled to any temperature before the austenite transforms and is then held at that temperature so that isothermal transformation occurs. In carbon steels the lamellar family of structures, as expected, is produced at constant holding temperatures (above about 550°C) and martensite quickly forms below a certain critical low temperature which depends on C content (say from 450°C for 0.1 per cent C to 200°C for 0.3 per cent C).

However at intermediate temperatures a new range of structures called 'bainites' is produced. They show a substantial variation in microstructure from the highest to the lowest temperatures of transformation, and are generally divided into upper and lower bainite. Upper bainite has a rather feathery microstructure while lower bainite is more acicular and similar to tempered martensite.

Since all the structures are mixtures of iron carbide and ferrite, the distinction between upper and lower bainite may seem artificial but there are major differences in mechanical properties as shown in figure 2, centre, for strength. As seen in the figure, over the range of bainite structures there is a linear relationship between strength and transformation temperature. Since the transformation to bainite on continuous cooling can be markedly altered by the addition of alloying elements, the strength of bainites in practice can be related to chemical composition. The ductility of bainite structures is roughly inversely related to strength; the higher the strength, the lower the ductility.

**Relationship of Strength to Microstructure**

Clearly a wide range of strengths can be achieved in steels by altering the microstructure. Detailed considerations of microstructure indicate four major parameters which contribute to strength, namely, grain size, amount of solute elements, nature and distribution of precipitates and dislocation density. The

---

**Figure 2**

Left: Approximate hardness of carbon steels in three microstructural conditions as a function of carbon content (top curve—fully hardened martensite; middle curve—lamellar structure as formed in normal cooling after rolling; bottom curve—carbide coarsely spheroidised, minimum hardness commercially available). Centre: Relationship between transformation temperature and strength for 0.1 per cent carbon steels. Right: Strength-grain size relationship for plain carbon steel and niobium containing steel.
strength is determined by the combination of these contributions and it has generally been assumed that they are additive although this assumption is open to criticism.

**Grain Size**

The strength of ferrite can be increased by reducing the grain size. A widely used relationship is that due to Hall and Petch, viz.:\[ \sigma_y = \sigma_0 + K_d d^{-1} \] (1)

where \( \sigma_y \) is lower yield stress,

\( d \) is mean grain diameter,

\( \sigma_0 \) is the friction stress required to move a dislocation through the iron lattice,

\( K_d \) is a grain boundary locking term.

Typical results are shown in figure 2, right. Values of the constants for impure irons are \( \sigma_0 \approx 50-60 \text{ MPa} \) while \( K_d \) varies with heat treatment from about 0.8-0.9 MN/m\(^2\) for slowly cooled materials to about 0.1-0.25 MN/m\(^2\) for rapidly cooled materials. These variations in \( K_d \) reflect the strong influence of small amounts of C and N upon dislocation generation and motion.

A further important effect of reducing the grain size is an improvement in fracture resistance by reducing the temperature below which brittle fracture occurs.

**Amount of solute element**

The strength of ferrite can be increased by the addition of elements which form solid solutions. The theoretical relationship between yield stress and concentration (C) has the form:

\[ \sigma_y = K_d C^n \] (2)

where \( n \) has values of 1 or \( \frac{1}{2} \) depending on the model used and \( K_d \) is a constant. Annealed alloys seem to obey the former index while heavily worked structures and martensites obey the latter. For the former case, typical values of \( K_d \) in MPa per one weight per cent., are C and N, 55-90, Si 80, Cu 40, Mn 30, Mo 11. While interstitial elements are clearly extremely potent, only low amounts can be used in practice due to solubility restrictions (see figure 1, centre), to welding problems arising from high C and N contents and to a lowering of fracture resistance.

**Nature and distribution of precipitates**

The strength of ferrite can be increased by introducing precipitates. The effects vary depending on the nature of the precipitate, e.g. carbide or intermetallic phase, the interface between the particle and the matrix, e.g. coherent or incoherent and the size, shape and spacing. The theoretical relationship between yield stress and interparticle spacing (\( \lambda \)) has the form:

\[ \sigma_y = K_d \lambda^{-m} \] (3)

where \( m \) has values of 1 or \( \frac{1}{2} \) depending on the model used and \( K_d \) is a constant. The former index applies to strong, incoherent particles and appears to describe best a number of studies on alloy and iron carbides in ferrite. However other workers claim that the latter index best describes their data.

The effect of a dispersion of niobium carbide particles on the strength of a low carbon steel is shown in figure 2, right. The position of the lines for the Nb-containing steel above that for the grain size relationship is a measure of the amount of additional strengthening due to dispersion hardening.

**Dislocation density**

The strength of ferrite can be increased by increasing the dislocation density. The general relationship which is given by various theories has the form:

\[ \sigma_y = \sigma_0 + K_2 \rho^\lambda \] (4)

where \( \sigma_0 \) is the strength of a virgin material (annealed polycrystal; a single crystal with a low dislocation density) \( \sigma_0 \approx \sigma_i \) in Eq. (1), \( \rho \) is dislocation density and \( K_2 \) is a constant (found empirically to be 14 Gb for \( \sigma_y \) expressed in MPa, where G is shear modulus and \( b \) is Burgers vector). The dislocation density in steels can be increased by the internal stresses produced during transformation of austenite to martensite or bainite and by deformation.

**Combined Relationship**

Thus, assuming that the contributions are additive, a general relationship can be written as:

\[ \sigma_y = \sigma_0 + K_1 d^{-1} + K_2 C^n + K_3 \lambda^{-m} + K_4 \rho^\lambda \] (5)

However there are interrelations between these terms. Thus, the results of a recent study of iron-silicon alloys showed a good correlation between \( d^{-1} \) and \( \rho^\lambda \). This correlation is not surprising, since from Eqs. (1) and (4), when \( \sigma_0 \approx \sigma_i \), it follows that \( d^{-1} \propto \rho^\lambda \). This implies that all the dislocations are generated from, and associated with, grain boundaries. However, there is presumably a contribution from dislocation arrays within the grains which can be significant in certain cases. Additionally the additivity of the terms containing \( \lambda^{-1} \) and \( d^{-1} \) may not be valid because either one or the other of these parameters may control the strength in a given situation.

Clearly the contributions to the strength will vary from case to case and a general analysis seems difficult. However we will attempt to identify the major strengthening mechanisms underlying the development of new steels as we discuss these in the next sections.

**New Steels**

Considerable research has been directed to the problems of strength and ductility in very high strength steels and three developments are worthy of mention as possible new steels. These are thermo-mechanically processed steels, maraging steels and transformation induced plasticity steels.

**Thermo-mechanically Processed Steels**

Thermo-mechanical treatments combining both heat treatment and deformation can be applied to alloy steels in a variety of ways to give increased strength and toughness.
The best known of these is so-called ‘austempering’ in which steel in the austenitic condition is warm worked prior to its transformation to martensite. The heavy working of the austenite produces numerous sites for the precipitation of alloy (Mo, Cr, V) carbides during the austempering process. These carbides remain after the austenite transforms to martensite. Typical austempered steels contain 3 per cent. chromium, as well as 1–2 per cent. Ni, Si, Mn, Mo and V. The carbon content varies between 0.3 and 0.6 per cent. and the strength increases with increasing amounts of deformation and carbon content. Typical room temperature strengths vary between 1700 and 2400 MPa. High processing costs have limited the use of these steels but they are being used for critical engineering applications in vehicles in the US.

Maraging Steels

These steels develop a combination of high strength and ductility by combining a martensitic type of hardening of an iron–nickel alloy with precipitation hardening of the martensite. They contain between 15 and 25 per cent. nickel (generally 18 per cent.), a lower carbon content (0.03 per cent.), various percentages of cobalt (7–9 per cent.), molybdenum (3–5 per cent.) and small amounts of titanium and aluminium. The steels are slowly cooled from an austenitising temperature of 900–925°C to produce a low carbon martensite. This structure is then aged for several hours at 450 to 500°C and cooled back to room temperature. The high strengths of the steels (1400–2000 MPa) result from the precipitation of very fine alloy carbides and intermetallic compounds such as Ni₃Mo, Ni₃Ti and Fe₃Mo in the martensite during the ageing treatment. Maraged steels are significantly tougher than other steels when compared at the same strength level and are attractive as structural materials in heavy sections. However, the cost limits such uses to specialised applications, e.g. deep submergence vehicles.

Maraging steels are being used in smaller sections in the aerospace industry, e.g. in the undercarriage of the VC10 aircraft, in ejector seats for military aircraft and in rocket motor casings. The strength/weight ratio is equal to many of the commonly used titanium alloys and the steel is much easier to fabricate than either the titanium alloys or conventional low alloy quenched and tempered steels. Despite the higher cost of the maraging steels, components can be made at a lower cost than conventional low alloy heat treated steels because of the savings in machining costs of maraging steels. A further attraction of such steels is that since the ageing treatment leads to virtually no distortion, precision components such as tools and dies can be finish machined in the soft condition and then hardened as a final production step.

Transformation Induced Plasticity (TRIP) Steel

While the useful strength of steel can be improved by precipitation hardening and/or thermomechanical treatments, the limited elongation of ultra high strength steels restricts their use. Research work in the US has resulted in the development of a new class of steels (so called TRIP steels) which depend on strain-induced transformation to give strength and ductility.

These steels are essentially warm worked austenitic steels that transform to martensite with subsequent straining at service temperatures.

Typical compositions are in the range of 9–13 per cent. Cr, 8–9 per cent. Ni, 3–4 per cent. Mo, 2 per cent. Si, 2 per cent. Mn, 0.20–0.28 per cent. C. After warm working the room temperature yield strength of the fully austenitic steel is characteristically between 1400 and 1550 MPa.

The explanation of the yield strength of TRIP steels is similar to that discussed for austempered steels, namely that a contribution arises from the increased dislocation density introduced during the warm working but the major contribution arises from dispersion strengthening due to fine uniformly dispersed carbides. However, unlike the austempered steels, when the TRIP steels are deformed at room temperature, the metastable austenite transforms to martensite. This leads to a very fine scale acicular structure with an increased dislocation density. The consequence of this is to increase the strength of the steel at a rapid rate during plastic deformation. This higher rate of strain hardening enhances the ductility of the steel so that much higher elongations prior to fracture can be obtained for a given yield strength compared to conventional quenched and tempered steels. These materials have excellent fracture toughness since, in the plastic zone at the tip of a crack in TRIP steel, localised strain induced transformation occurs leading to K_{Ic} values roughly double that of conventional steels for comparable yield strengths. TRIP steels are being made in commercial quantities by Crucible Steels Corp. and have been processed to plate, sheet, rod and wire.

![Figure 3](image_url)

*The range of strengths obtainable in ferrous materials by alloying, thermal treatment and mechanical working.*
Conclusion

The range of strengths obtainable in ferrous materials by alloying, thermal treatment and mechanical working is shown in figure 3. It is interesting to note that despite all the developments discussed in this paper, the strongest ferrous material commercially available is piano wire. In terms of cost/unit strength, this is the cheapest high strength material available!

The strongest steel wire is made from 0.9 per cent. C steel containing about 0.4 per cent. Mn and 0.2 per cent. Si. The material is austenitized for a few minutes at 1000°C and then transformed at 500°C to a fine pearlite. (This process is known as 'patenting'). The patented wire is then heavily cold drawn at room temperature to reductions in area of up to 98 per cent. After drawing, the structure consists of 'cells' relatively free of dislocations with a high dislocation density in the 'cell' walls. These cells are very much elongated in the direction of the wire axis and the cell dimension transverse to the wire axis is 10-20 μm and decreases with increasing drawing strain. Since the spacing of the cell walls is related to the strength by a relationship of the form of Eq. (1), strength thus increases with increased drawing strain. The high strength of the patented wire is derived from the initially fine spacing of the cementite lamellae and hence an initially fine cell size. A feature of piano wire, in contrast to other ultra high strength materials, is that it still possesses appreciable ductility even at the highest strengths.

Such wires have strengths roughly \( \frac{1}{2} \) of the theoretical strength of iron so that there is still considerable scope for the ingenuity of the metallurgist pursuing the development of new and strong steels.

THE REGISTER

Changes in Membership from 6 October 1972 to 13 November 1972

Fellowship
New Election
Ramm, C. A. University of Melbourne, Vic.

Associateship
(a) New Elections
Baxter, A. M. Australian National University, ACT
Bracken, A. J. The University of Adelaide, SA
Morgan, P. A. Bureau of Meteorology, Vic.
Thomson, K. A. Avondale College, Cooranbong, NSW

(b) Transfer
Dunlop, R. E. Queensland Institute of Technology

(c) Resignation
Watson, W. R. (ACT)

(d) Removal from Register, Address Unknown
Mayfield, J. M.

Graduates
(a) New Elections
Day, T. W. La Trobe University, Vic.
Gilbert, N. B. Education Department of WA
Pavey, A. J. University of New South Wales

(b) Transfers
Drape, K. L. Education Department of Victoria

Stewart, I. C. F. University of Adelaide, SA
Warren-Smith, D. N. Weapons Research Establishment, SA
Winter, A. C. J. Queensland Education Department

(c) Resignation
Bentley, R. E. (NSW)

(d) Removals from Register, Address Unknown
Crawford, M. A. Hollis, G. L.
Newman, J. K.

Students
(a) New Elections
Blocham, C. J. (ACT) Scott, D. W. (Vic.)

(b) Removals from Register, Address Unknown
Knezevic, A. Kumar, Y.
Stumar, L. J.

Subscribers
(a) New Elections
Cousins, G. J. (NSW) Stace, R. R. (NSW)
Weinel, D. M. (SA)

(b) Removals from Register, Address Unknown
Johnston, C. R. MacBryde, J. W. G.
Radus, J. Walsh, B. J.
INSTITUTE AFFAIRS

21ST MEETING OF COUNCIL

The 21st Meeting of the AIP Council was held at Clunies Ross House, Parkville, on Thursday and Friday, 2 and 3 November, 1972. The President, Professor R. Street was in the Chair, and all Branch Chairman, as well as a representative of each Group attended.

General Policy

Several aspects of the recently-introduced Group membership fee were discussed. Two Groups had objected to the fee on the grounds that it might discourage Group membership. It was agreed that the fact that Students were exempt from the fee should be more clearly publicized.

One Group suggested that the money raised by the fee should be regarded as the property of the Groups to spend as they chose without any accountability to Council. That proposal was rejected, as Council must bear legal responsibility for all the Institute's financial transactions.

An interesting consequence of the imposition of the Group membership fee is the opportunity it offers to make Group membership available to members of other bodies who are not AIP members. A number of members of the New Zealand Branch of The Institute of Physics had expressed interest in joining the Nuclear and Particle Physics Group in this way, and details of such an arrangement are to be worked out.

Finance

The Honorary Treasurer presented preliminary financial statements for the year to 30 September 1972. The Council-controlled funds had met with a deficit of $1483, against the originally budgeted figure of $1500.

The work of budgeting in detail for 1972-73 then commenced. A draft budget was tabled, and the items were discussed one by one throughout the Meeting. When it was finalized, the budget projected a surplus of $5000 after allowing for considerably increased grants to Branches and to "The Australian Physicist". This change from a deficit to a surplus budget followed the subscription increases which become effective in 1973.

Membership

The Honorary Registrar reported that corporate membership stood at 1422 and total membership at 1516, plus 25 Company Subscribers. This represented a steady growth rate of about 7 per cent. per annum.

Council received the report of the special committee, chaired by the President, which had looked into certain membership matters. One recommendation, concerning the proportion of physics content in courses acceptable for Graduateship, was adopted. Further recommendations, for revision of the grade structure and renaming of grades, were deferred for publication and discussion among the general Institute membership before any decision is taken.

It was decided to make an AIP tie available to members, and the design for the tie was adopted. It will feature the AIP symbol in gold repeated against a green background.

"The Australian Physicist"

The recently-appointed Editor, Dr J. R. Bird, was welcomed to the Meeting.

He reported that the supply of copy was adequate, with the exception of short news items which were scarce owing to the inactivity of many Branch and Group correspondents.

The shortage of advertising continued to be a worsening problem. The Editor urged that all Institute members assist in this regard by drawing the attention of their suppliers to the value of advertising in the journal, and by ensuring that all job vacancies for physicists are advertised there also.

Conferences, etc.

The Pawsey Memorial Lecture for 1973 was to be held in Tasmania.

The 1973 Summer School was to be held at the University of Queensland on 5–9 February. The Annual General Meeting of the Institute was included in the programme, at 4 pm on 8 February.

A Summer School in February 1974 was to be organized by the WA Branch in conjunction with the University of WA Extension Summer School. The main topic was to be exploration geophysics. The Second International Conference on Geophysics of the Earth and the Oceans, being organized by the NSW Branch on 15–19 January 1973, promised to be a very successful event.

Plans were in hand for a National AIP Conference in 1974, to be organized by the SA Branch.

Group Activities

The Biophysics Group reported on the 12th Annual Conference on Physics and Engineering in Medicine and Biology, held in Hobart on 21–25 August 1972.

The Education Group had been active in Project Physics trials at Macquarie University, and also in cooperation with the Centre for Advancement of Research by Science Teachers.

The Vacuum Physics Group reported on its participation in the International Union for Vacuum Science, Technique and Applications. At the end of 1972, the Group secretariat was expected to move from SA to ACT.

The newly-formed Nuclear and Particle Physics Group was officially constituted. Its first major activity was to be a Vacation School in Melbourne on 14–18 May 1973.

22nd Council Meeting

The next Council Meeting was scheduled for 10–11
GENERAL

During 1972 the financial situation was a source of serious concern to the Council of the Institute. Cost increases since the last subscription adjustment six years earlier had brought about deficits which threatened to increase alarmingly. After extensive analysis, the decision was taken to increase the subscription rates by about 50% as from 1973, corresponding to an inflation rate of 72% compound over the six years. In addition, a Group membership fee was introduced.

Membership continued to increase at a steady rate. Corporate membership increased by 5.1% to 1433, and overall membership by 4.7% to 1692. Company Subscription declined from 26 to 25.

Recent developments in tertiary education, and in particular the multidisciplinary courses offered by many colleges of advanced education, have required a rethinking of "what is a physicist". A special committee chaired by the President recommended fresh guidelines which were accepted by Council as standards for Graduate Membership. Further recommendations affecting the Institute's grade structure are being published for discussion by members before any decision is taken.

FINANCE

The accounts for the year ended 30 September 1972 are presented in the same form as last year. The consolidated accounts comprise the individual accounts of the Branches, Groups, Council-controlled funds and "The Australian Physicist". The Benevolent Fund is separate from Institute funds and is reported separately. Members should have received financial statements separately from the Branches and Groups to which they belong.

The consolidated Institute accounts show a deficit of $1383 which resulted from deficits totalling $2082 for Council-controlled funds and "The Australian Physicist", offset by a surplus of $695 on the operations of the Branches and Groups.

Income received by the central office from subscriptions and other sources under the control of Council was disbursed as follows:

<table>
<thead>
<tr>
<th>1971</th>
<th>1972</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>377 Branch &amp; Group activities 26% 5478</td>
<td></td>
<td></td>
</tr>
<tr>
<td>278 &quot;The Australian Physicist&quot; 34% 7200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>178 Administration - office 17% 3505</td>
<td></td>
<td></td>
</tr>
<tr>
<td>128 other 10% 2205</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48 Council meetings 9% 1831</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58 Transferred to reserve funds 4% 858</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total disbursed 21758
Deficit 1383
Income Received 19875

Since this accounts for the major part of the Institute's income it broadly reflects the operations of the Institute as a whole.

The deficit of $1383 in Council-controlled funds was close to the budget estimate of $1500 as a result of fortuitous balancing of unforeseen contingencies. On the one hand the grant to "The Australian Physicist" was $1200 above the budget estimate and on the other Council's share of income from Branch and Group activities, in the form of exhibitions, summer schools and conferences, was $680 more than budgeted, while

the most important remaining component was the holding of administrative expenses at the previous year's figure although a $600 increase had been allowed when budgeting.

The operations of "The Australian Physicist" resulted in a deficit of $700, making the cost to the Institute $7900 for the year. This cost has increased by 20-30% annually in recent years and accounts for a major part of the Institute's expenditure.

It became obvious early in the year that a subscription increase was inevitable for 1973 if the Institute's activities were to be maintained and the effect of inflation offset. The Branches were consulted as to whether an increase of 25% would be acceptable. All agreed that it would be, and one Branch suggested that 50% might be more appropriate. Then on the basis of new financial information which became available, and not having time for further consultation with the Branches, Council adopted a set of increases averaging about 50%. Council also introduced a fee of $2 for Group membership as from 1 January 1973 in order to put the Groups on a sound financial basis. This was also expected to have other administrative advantages.

A surplus of approximately $5000 has been budgeted for 1973 as the first year following a subscription increase and to offset the likely effects of inflation in the following years.

MEMBERSHIP

The Institute records with regret the deaths of Dr L. M. Fitzgerald (Fellow), Mr A. L. Franklin (Associate), Mr D. J. Norris (Associate) and Mr L. Suhaneck (Associate).

The membership figures at the end of 1972 are given in Table I and changes during the year are summarized in Table II. Both recruitment and overall growth were greater than in 1971. It is regretted that the names of 20 corporate members and 21 non-corporate members had to be removed from the Register for non-payment of subscriptions.

During 1972 Dr J. L. Rouse, assisted by Miss A. P. Booth, dealt with 56 enquiries regarding the assessment of overseas professional qualifications in physics. An attempt by Council to establish reciprocal recognition of The Institute of Physics and AIP grades of membership was unsuccessful.

An ad hoc committee was formed by Council to consider qualifications for Graduate Membership in relation to multidisciplinary courses and its recommendations were accepted by Council. Consideration was also given to possible revision of the naming and structure of grades and the relevant part of the Committee's report has been circulated to Branches and Groups for discussion and comment.

OFFICE

The joint office shared with The Australian Institute of Refrigeration Air Conditioning and Heating (Inc.) and the International Solar Energy Society operated satisfactorily without change of staff. The Institute is fortunate in having such excellent people to carry out the administrative work.

The Australian Physicist, January 1973
### TABLE I - REGISTER AS AT 31 DECEMBER 1972

<table>
<thead>
<tr>
<th></th>
<th>ACT</th>
<th>NSW</th>
<th>QLD</th>
<th>SA</th>
<th>TAS</th>
<th>VIC</th>
<th>WA</th>
<th>OS*</th>
<th>UWA</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hon. Fellow</td>
<td>2</td>
<td>1</td>
<td>10</td>
<td>20</td>
<td>5</td>
<td>64</td>
<td>10</td>
<td>15</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Fellow</td>
<td>19</td>
<td>64</td>
<td>54</td>
<td>58</td>
<td>9</td>
<td>164</td>
<td>33</td>
<td>43</td>
<td>11</td>
<td>209</td>
</tr>
<tr>
<td>Associate</td>
<td>37</td>
<td>160</td>
<td>54</td>
<td>58</td>
<td>9</td>
<td>164</td>
<td>33</td>
<td>43</td>
<td>11</td>
<td>594</td>
</tr>
<tr>
<td>Graduate</td>
<td>44</td>
<td>167</td>
<td>33</td>
<td>82</td>
<td>9</td>
<td>165</td>
<td>47</td>
<td>46</td>
<td>12</td>
<td>625</td>
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<td>102</td>
<td>412</td>
<td>98</td>
<td>160</td>
<td>23</td>
<td>414</td>
<td>95</td>
<td>104</td>
<td>25</td>
<td>1453</td>
</tr>
<tr>
<td>Student</td>
<td>14</td>
<td>52</td>
<td>20</td>
<td>10</td>
<td>1</td>
<td>46</td>
<td>19</td>
<td>4</td>
<td>12</td>
<td>178</td>
</tr>
<tr>
<td>Subscriber</td>
<td>9</td>
<td>24</td>
<td>2</td>
<td>12</td>
<td>-</td>
<td>20</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>81</td>
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<tr>
<td><strong>GRAND TOTAL</strong></td>
<td>125</td>
<td>488</td>
<td>120</td>
<td>182</td>
<td>24</td>
<td>480</td>
<td>120</td>
<td>110</td>
<td>43</td>
<td>1692</td>
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<tr>
<td>Company</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>10</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>Subscriber</td>
<td>2</td>
<td>19</td>
<td>5</td>
<td>5</td>
<td>-</td>
<td>21</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>56</td>
</tr>
</tbody>
</table>

* Overseas  
* Unattached

### TABLE II - CHANGES IN REGISTER DURING 1972

<table>
<thead>
<tr>
<th>GRADE</th>
<th>GAINS</th>
<th>Loses</th>
<th>NET INCREASE</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>New</td>
<td>Transfers</td>
<td>From</td>
</tr>
<tr>
<td>Hon. Fellow</td>
<td>10</td>
<td>-5</td>
<td>-4</td>
</tr>
<tr>
<td>Fellow</td>
<td>39</td>
<td>35</td>
<td>4</td>
</tr>
<tr>
<td>Associate</td>
<td>50</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>Graduate</td>
<td>56</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>101</td>
<td>70</td>
<td>36</td>
</tr>
<tr>
<td>Student</td>
<td>55</td>
<td>-34</td>
<td>-34</td>
</tr>
<tr>
<td>Subscriber</td>
<td>5</td>
<td>-34</td>
<td>-34</td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
<td>161</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

"THE AUSTRALIAN PHYSICIST"

The resignation in May of the Foundation Editor, Dr J. L. Symonds, was accepted with thanks for the service he rendered to the Institute during his eight years in office. Dr J. R. Bird was appointed to succeed Dr Symonds.

The cost of "The Australian Physicist" has been a cause of increasing concern to Council. Journals of comparable size and nature have suffered greatly from loss of advertising and increases in costs over the last few years. A number have ceased publication, whilst others struggle to survive. Size of membership, lack of economic stability and inflation are factors which have influenced such publications adversely. The editorial staff needs the support of members in understanding the need for financial support, in supplying material for publication and in seeking sources of advertising revenue.

INSTITUTE, BRANCH & GROUP ACTIVITY

The Ninth Annual General Meeting of the Institute was held at the Australian National University, Canberra, on 26 January 1972. The President was in the Chair and 16 other members were present. The unconfirmed minutes of this meeting were published in "The Australian Physicist" in April 1972.

Two Council meetings, each lasting two days, were held in May and November; five Executive meetings were held during the year.

The Eighth Pawsey Memorial Lecture, entitled "Photons and Stars", was delivered by Professor R. Hanbury Brown to an audience of over 200 on 18 March at the University of Sydney and was published in the July issue of "The Australian Physicist".

The Summer School and Conference was held at the Australian National University on 24-28 January. It was jointly organized by the ACT Branch with the Astronomical Society of Australia and The Australian Society of Exploration Geophysicists. Over 150
delegates and speakers participated in two concurrent series of lectures and joint lectures on topics of geophysics and astronomy, a film evening and social activities. The Ninth Annual General Meeting of the Institute was held during the School.

Another summer school, organized by the Victorian Branch, was held at Monash University on 14-18 February. More than 40 delegates participated in five technical sessions, a visit to the Australian Atomic Energy Research Establishment and social activities.

The Einstein Lecture was delivered by Sir Mark Oliphant in Adelaide on 12 October. The Lecture was entitled "The Physics of Australia" and was organized by the SA Branch.

The 12th Annual Conference on Physics and Engineering in Medicine and Biology, organized jointly by the Biophysics Group and the Australian Regional Group of the Hospital Physicists' Association, was held in Hobart on 21-25 August and was attended by 49 delegates. Publication of the Australasian Bulletin of Medical Physics and Biophysics continued.

The Education Group in NSW co-operated with the Committee for Advanced Education by Science Teachers and planned support for teachers undertaking physics projects.

The Vacuum Physics Group's Third Symposium and Exhibition was held at the SA Institute of Technology. The Levels, from 28 February to 1 March. Although attendance was disappointing, these activities were successful. A representative of the Group attended a meeting of the International Union for Vacuum Science, Technique and Applications in Italy.

A Nuclear and Particle Physics Group was established during the year. The Group's first major activity will be a vacation school in May 1973 at the University of Melbourne.

Training & Employment of Physicists

A subcommittee of the NSW Branch, using the services of a firm of management consultants, circulated questionnaires to universities, colleges of advanced education, employers and physicists late in 1971 as the first phase of a survey to attempt to determine the supply of and demand for physicists. During 1972 replies were collated by working groups within the Branch and the statistical results, analyses and conclusions on some aspects of the Survey formed the basis of a first report published in the November issue of "The Australian Physicist".

Further reports on the first phase of the Survey and on the attitude survey about to be undertaken are awaited with interest.

Benevolent Fund

Members' contributions to the Benevolent Fund are gratefully acknowledged. The Fund stood at $3557.79 at 30 September and no payment was made during the year.

Co-operation with Overseas Physicists' Organizations

The President of The Institute of Physics, Dr J. W. Hunter, visited Australia in February when he opened the Victorian Branch Summer School. The occasion was marked by the presentation to him of a gold-plated representation of the AIP symbol mounted on jarrah. This is now displayed in London with the donation made to the IOP when the Australian Institute was formed.

Professor Street made a similar presentation to the AIP Council in May for retention by successive AIP presidents.

An expression of interest by nuclear physicists of the New Zealand Branch of the IOP in membership of the Nuclear and Particle Physics Group of the AIP was welcomed by Council as an opportunity to foster closer co-operation between physicists in both countries. Action to make this possible has been initiated.

Amendments to Articles & By-Laws

The Ninth Annual General Meeting of the Institute approved an amendment of Clause 9(a) of the Articles of Association in respect to degrees awarded by colleges of advanced education and physics degrees other than bachelor of science. A number of By-Laws were amended as follows:

9(3) to obviate consideration of membership applications by Branch Committees;
28 to discontinue the payment of entrance and transfer fees after 30 September 1972;
29(1) to increase subscriptions for Fellows, Associates, Graduates and Students to $30, $20, $13 and $3 respectively; and to introduce a Group annual subscription of $2;
64(2 & 3) to provide for the introduction of the Group fee.

Membership of Council for 1972

The following members of the Executive took office in February 1971 and complete their term at the conclusion of the Tenth Annual General Meeting in 1973:

President : Professor R. Street
Vice-President : Dr F. J. Jacka
Hon. Registrar : Dr R. D. B. Fraser
Hon. Treasurer : Dr J. K. Mackenzie
Hon. Secretary : Dr J. G. Campbell

Mr A. F. A. Harper held office on Council, ex officio, as Immediate Past President.

Each Branch was represented on Council by its Chairman, who held office until 31 December as follows:

ACT Branch : Mr J. C. Dooley
NSW Branch : Professor C. D. Ellyett
Qld Branch : Dr D. J. Wardsworth
SA Branch : Dr E. R. Johnson
Vic. Branch : Dr A. J. Dyer
WA Branch : Dr J. G. Swan
Tas. Branch : Dr M. V. Waterworth

Officers of the Institute

Secretary : Dr J. G. Campbell
Assistant Secretary : Mrs J. A. Mackenzie
Editorial Committee "The Australian Physicist":
Editor (to June) : Dr J. L. Symonds
(From July) : Dr J. R. Bird

The Australian Physicist, January 1973
Editorial Committee (Cont'd):

Assistant Editor (to June) : Dr J. R. Bird
(from July) : Mr B. V. Denhe

Book Reviews : Mr G. A. Bell
Secretary : Dr G. R. Hogg
Circulation : Mr E. G. Thwaite

Mr P. E. Ciddor, Dr J. S. Dryden, Mr A. F. A.
Harper, Dr W. H. Steel, Dr J. L. Symonds

Associate Editors : Dr A. J. Mortlock,
Dr T. M. Sabine, Professor F. D. Stacey, Mr
W. S. Boudry, Dr B. J. H. Scott, Dr R. L. Segall,
Dr J. R. de Laeter, Professor B. Malsbridge.

Auditor : Gordon Quinn & Company

Trustees for Institute : Dr R. D. B. Fraser
Dr A. C. Hurley, Mr J. J. McNeill, Mr T. P. MacRae,
Professor R. Street.

Trustees for Benevolent Fund: Dr J. K. Mackenzie
(Chairman, ex officio), Dr A. Walsh, Mr A. F. A.
Harper, Dr J. G. Campbell, Mr F. J. Lehany

Returning Officer : Professor B. M. Spicer

Membership Committee
Chairman (ex officio) : Dr R. D. B. Fraser
Mr R. D. B. Fraser, Mr R. J. Mackenzie

Finance Advisory Committee: The Executive

AIP Representatives on Joint Office Management
Committee: Dr J. G. Campbell (Chairman),
Dr R. D. B. Fraser, Dr J. K. Mackenzie

Industry Liaison Officer : Mr C. F. S. Malseed

BRANCH & GROUP COMMITTEES

ACT BRANCH: Mr J. C. Dooley (Chairman), Dr R. V.
Crompton (Vice-Chairman), Mr D. M. Finlayson
(Hon. Secretary), Mrs E. M. Richardson (Hon.
Treasurer), Mr J. W. Bissett, Mr A. R. Brown,
Mr D. C. Ceregh, Mr K. C. Lang, Mr J. P. Rayner,
Mr P. B. Tracey

NSW BRANCH: Professor C. D. Ellyett (Chairman),
Dr J. J. McFarlane (Vice-Chairman), Dr T. M.
Sabine (Hon. Secretary, to April), Professor
H. J. Goldsmith (Hon. Secretary, from April),
Dr J. R. Bird (Hon. Treasurer, to June),
Mr D. B. Flett (Hon. Treasurer, from June),
Mr E. G. Thwaite, Mr A. J. Segal, Dr R. Hewitt,
Mr R. J. Cordia, Mr D. Paix

QLD BRANCH: Dr D. J. Wordsworth (Chairman),
Dr J. S. Mainstone (Vice-Chairman), Mr K. L. Jones
(Hon. Secretary), Dr P. E. Monro (Hon. Treasurer),
Dr R. B. Gardiner

SA BRANCH: Mr E. R. Johnson (Chairman), Mr E. H.
Hirsch (Vice-Chairman), Mr W. S. Boudry (Hon.
Secretary), Dr R. D. Campbell (Hon. Treasurer),
Dr B. N. Briggs, Mr R. Walker, Professor H. A.
Blevin, Dr E. R. Sandercock, Mr J. Mohyla

TAS. BRANCH: Dr M. D. Waterworth (Chairman),
Dr B. I. H. Scott (Vice-Chairman), Dr P. M. McCulloch
(Hon. Secretary, to February), Dr J. R. Fox (Hon.
Sec., from February)

VIC. BRANCH: Dr A. J. Dyer (Chairman), Professor
H. C. Bolton (Vice-Chairman), Mr J. V. Sullivan
(Hon. Secretary), Dr J. L. R. Hough (Hon.
Treasurer), Mr J. D. Bunting, Dr J. G. Jenkins, Mr R. J. de
Groot, Dr C. F. S. Malseed, Mr D. L. Swingler

WA BRANCH: Dr J. B. Swan (Chairman), Mr B. W. Thomas
(Vice-Chairman), Dr B. H. O'Connor (Hon.)

Secretary-Treasurer), Dr J. H. Chute, Mr T. J.
Edwards, Mr P. E. F. Fleay, Dr J. Graham,
Mr B. King, Mr R. E. Price

BIOPHYSICS GROUP: Dr B. I. H. Scott (Chairman),
Dr H. G. L. Foster (Vice-Chairman), Mr F. P. J.
Robotham (Hon. Secretary-Treasurer), Mr B. W.
Worthley, Mr K. H. Clarke, Professor D. G.
Lampard, Dr J. E. Maloney

EDUCATION GROUP: Mr J. E. Shaw (Chairman),
Professor R. E. B. Makinson (Vice-Chairman),
Mr P. E. Ciddor (Hon. Secretary-Treasurer),
Dr J. E. Gluromich, Mr D. N. H. Henderson,
Dr I. D. Johnston, Dr B. A. McInnes, Miss P. M.
Simpson, Mr W. A. Miller

VACUUM PHYSICS GROUP: Mr J. Ward (Chairman),
Mr R. Walker (Vice-Chairman), Mr J. McK. Nobbs
(Hon. Secretary), Mr F. C. Gillespie (Hon.
Treasurer), Mr E. Mihill

NUCLEAR & PARTICLE PHYSICS GROUP (Interim Committee):
Professor H. H. Bolotin, Dr R. B. Taylor,
Dr R. Mackintosh, Dr B. G. Kenny, Dr J. R. Bird,
Dr H. J. Kenny (Secretary)

REPRESENTATION ON OTHER BODIES

Council gratefully acknowledges the services of those
members of the Institute on the councils or committees of other bodies: they were:

ANZAS: Professor C. D. Ellyett
Australian Journal of Physics Advisory Committee:
Professor D. Muggleston
Australian UNESCO Committee for Natural Sciences:
Dr J. R. Philip
National Association of Testing Authorities:
Mr L. W. Davies
Australian National Committee on Illumination:
Mr J. E. Shaw
Australian Institute of Radiography:
Mr J. F. Richardson
Acoustics Standards Committee of Standards Association
of Australia: Dr R. W. R. Muncey
Australian Academy of Science National Committee for
Physics: Professor R. Street

ANNUAL FINANCIAL STATEMENTS

The annual financial statements follow. For the
year ended 30 September 1972 a deficit of $1386.00
was incurred including a deficit of $693.35 made by
"The Australian Physicist"

For the purpose of the Companies Act your Council
reports that the financial results have not been
materially affected by items of abnormal character
and no circumstance has arisen which renders adherence
to the existing method of valuation of assets or
liabilities misleading or inappropriate. Since the
period covered by our last report no contingent
liability has been entered into. No contingent
liability will fall due for payment during the next
12 months which will affect the ability of the
Institute to pay its liabilities as they fall due.

For and on behalf of the Council:

R. Street
PRESIDENT

4 January 1973
### 1971 INCOME

<table>
<thead>
<tr>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Members' Subscriptions for 1972</td>
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<tr>
<td>Members' Subscriptions for 1971</td>
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<tr>
<td>Entrance fees &amp; Sundry Income</td>
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<tr>
<td>Bank &amp; Investment Interest</td>
<td>1397.61</td>
</tr>
<tr>
<td>10P Administrative Fee</td>
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<td>Exhibitions &amp; Summer Schools</td>
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<tr>
<td>Returned Grant, Rad. Dom. Conf.</td>
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<tr>
<td>Geophysics Group Funds</td>
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### 1971 EXPENDITURE

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</thead>
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<tr>
<td>Administrative</td>
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<td>Salaries &amp; Wages</td>
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<td>Sundries &amp; Bank Charges</td>
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<td>Depreciation</td>
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<td>Audit &amp; Accountancy</td>
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<td>Design of Symbol</td>
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<td>Legal Expenses</td>
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<tr>
<td>Council &amp; Executive Expenses</td>
<td>1831.42</td>
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<tr>
<td>Service Leave, leaving a net deficit of 1480.33</td>
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### COUNCIL FUNDS - BALANCE SHEET AS AT 30 SEPTEMBER 1972

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<td>Cash in Hand or Transit</td>
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<tr>
<td>Employment Survey</td>
<td>180.00</td>
</tr>
<tr>
<td>Subscriptions in advance</td>
<td>458.19</td>
</tr>
<tr>
<td>Reserve Funds (see table)</td>
<td></td>
</tr>
<tr>
<td>Fixed assets &amp; cost less dep.</td>
<td>13973.03</td>
</tr>
<tr>
<td>Operating Liabilities of Council</td>
<td>14376.64</td>
</tr>
<tr>
<td>Excess of Assets over Liabilities (including Council Res. Funds)</td>
<td>6759.49</td>
</tr>
</tbody>
</table>

### AIP INVESTMENTS AT COST

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAGA Ltd</td>
<td>72% 15.772</td>
</tr>
<tr>
<td>Mutual Acceptance Ltd</td>
<td>30.673</td>
</tr>
<tr>
<td>AGC Ltd</td>
<td>31.1273</td>
</tr>
<tr>
<td>Alliance Holdings Ltd</td>
<td>5.974</td>
</tr>
<tr>
<td>Associated Securities Ltd</td>
<td>5.575</td>
</tr>
<tr>
<td>BP ($1000)</td>
<td>72% 28.277</td>
</tr>
<tr>
<td>BHP ($1700)</td>
<td>72% 1.480</td>
</tr>
<tr>
<td>($300)</td>
<td>72% 1.1081</td>
</tr>
</tbody>
</table>

**The Australian Physicist, January 1973**
AIP RESERVE FUNDS 1 OCTOBER 1971 TO 30 SEPTEMBER 1972

<table>
<thead>
<tr>
<th>BRANCHES</th>
<th>Balance 1.10.71</th>
<th>Less Withdrawn</th>
<th>Add Undrawn Grants</th>
<th>Profit from Activities</th>
<th>Annual Interest</th>
<th>Balance 30.9.72</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>792</td>
<td>150</td>
<td>-</td>
<td>-</td>
<td>51</td>
<td>693</td>
</tr>
<tr>
<td>NSW</td>
<td>1942</td>
<td>500</td>
<td>510</td>
<td>-</td>
<td>120</td>
<td>2072</td>
</tr>
<tr>
<td>Qld</td>
<td>401</td>
<td>-</td>
<td>96</td>
<td>-</td>
<td>32</td>
<td>529</td>
</tr>
<tr>
<td>SA</td>
<td>1374</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>110</td>
<td>1484</td>
</tr>
<tr>
<td>Tas.</td>
<td>258</td>
<td>-</td>
<td>88</td>
<td>-</td>
<td>21</td>
<td>367</td>
</tr>
<tr>
<td>Vic.</td>
<td>4452</td>
<td>350</td>
<td>-</td>
<td>-</td>
<td>332</td>
<td>6474</td>
</tr>
<tr>
<td>WA</td>
<td>805</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>64</td>
<td>869</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11032</td>
<td>1340</td>
<td>832</td>
<td>330</td>
<td>803</td>
<td>11657</td>
</tr>
</tbody>
</table>

COUNCIL FUNDS

| Subscriptions | 400 | 400 |
| Stationery    | 1000 | 1000 |
| Long Service Leave | 100 | 100 |
| TOTAL         | 1500 | 1600 |

AIP BENEVOLENT FUND

<table>
<thead>
<tr>
<th>Balance 1.10.71</th>
<th>2924.68</th>
<th>Held in Bank Account</th>
</tr>
</thead>
<tbody>
<tr>
<td>Member Contributions &amp; Interest</td>
<td>633.11</td>
<td>AIP General Account</td>
</tr>
<tr>
<td>Less payments</td>
<td>3557.79</td>
<td>Investments &amp; Cost</td>
</tr>
<tr>
<td>TOTAL</td>
<td>995.29</td>
<td></td>
</tr>
</tbody>
</table>

AIP BENEVOLENT FUND INVESTMENTS AT COST

<table>
<thead>
<tr>
<th>Investments at Cost</th>
<th>500.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commonwealth Special Bonds Series T to 31.5.72</td>
<td>5.2%</td>
</tr>
<tr>
<td>31.5.71</td>
<td>5.6%</td>
</tr>
<tr>
<td>31.5.77</td>
<td>6.0%</td>
</tr>
<tr>
<td>Commonwealth Bonds ($500) 42% 1.8.72 Redeemed</td>
<td>492</td>
</tr>
<tr>
<td>Commonwealth Bonds ($500) 5% 1.8.75 496.50</td>
<td>496</td>
</tr>
<tr>
<td>MMMB Debentures ($500) 5% 1.10.75 491.00</td>
<td>-</td>
</tr>
<tr>
<td>SEC Loan 6.2% 1.12.79 500.00</td>
<td>500</td>
</tr>
<tr>
<td>SEC Loan 7.2% 1.9.80 500.00</td>
<td>500</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2488</td>
</tr>
</tbody>
</table>

"THE AUSTRALIAN PHYSICIST"

INCOME & EXPENDITURE STATEMENT FOR YEAR ENDED 30 SEPTEMBER 1972

<table>
<thead>
<tr>
<th>1971 INCOME</th>
<th>$</th>
<th>1971 EXPENDITURE</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant from AIP</td>
<td>7200.00</td>
<td>Publication Costs</td>
<td>9522.00</td>
</tr>
<tr>
<td>Advertising</td>
<td>1762.00</td>
<td>Distribution Costs</td>
<td>1936.00</td>
</tr>
<tr>
<td>Sales &amp; Subscriptions</td>
<td>2029.00</td>
<td>Accountancy &amp; Clerical</td>
<td>250.00</td>
</tr>
<tr>
<td>Bank Interest</td>
<td>61.00</td>
<td>Postage &amp; Stamp Duty</td>
<td>30.00</td>
</tr>
<tr>
<td>Printing &amp; Stationery</td>
<td>9</td>
<td>6.00</td>
<td></td>
</tr>
<tr>
<td>Sunstr</td>
<td>1.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>11751.36</td>
<td>9801</td>
<td>11751.36</td>
</tr>
</tbody>
</table>

14 The Australian Physicist, January 1973
"THE AUSTRALIAN PHYSICIST"

BALANCE SHEET AS AT 30 SEPTEMBER 1972

<table>
<thead>
<tr>
<th>1971 CURRENT ASSETS</th>
<th>$</th>
<th>$</th>
<th>1971 CURRENT LIABILITIES</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash in Hand</td>
<td>1.77</td>
<td>7.89</td>
<td>Account payable</td>
<td>1978.95</td>
</tr>
<tr>
<td>Bank Accounts</td>
<td>1511.00</td>
<td>1512.77</td>
<td>Subscriptions in advance</td>
<td>137.67</td>
</tr>
<tr>
<td>Accounts recoverable</td>
<td>492.85</td>
<td>-</td>
<td>Income received in advance</td>
<td>63.60</td>
</tr>
<tr>
<td>1384</td>
<td>2005.62</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

ACCUMULATED FUNDS

| 1294 Balance @ 1.10.71 | 524.76 | - | - | - |
| 769 Deficit for year   | 699.36 | - | - | - |
| (555) Net deficiency (surplus) | 174.60 | - | - | - |
| 860                    | 2180.22 | 860 | 2180.22 | 2180.22 |

AUSTRALIAN INSTITUTE OF PHYSICS

CONSOLIDATED INCOME & EXPENDITURE FOR YEAR ENDED 30 SEPTEMBER 1972

1971 $2006 Deficit arising from year's activities 1386.73
after making the following charges

| 517 Audit & Accountancy Fees | 492.00 | - | - | - |
| 113 Depreciation of Fixed Assets | 111.00 | - | - | - |
| 854 Interest on Reserve & Benevolent Funds | 838.00 | - | - | - |

CONSOLIDATED BALANCE SHEET AS AT 30 SEPTEMBER 1972

<table>
<thead>
<tr>
<th>1971 CURRENT ASSETS</th>
<th>$</th>
<th>$</th>
<th>1971 CURRENT LIABILITIES</th>
<th>$</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash in Hand at Bank</td>
<td>3418.88</td>
<td>440</td>
<td>Council Funds</td>
<td>661.45</td>
<td></td>
</tr>
<tr>
<td>NSW ACT Branch</td>
<td>246.94</td>
<td>789</td>
<td>&quot;The Aust. Physicist&quot;</td>
<td>1978.95</td>
<td></td>
</tr>
<tr>
<td>Qld &quot;</td>
<td>232.88</td>
<td>30</td>
<td>NSW Branch (Audit Fee)</td>
<td>30.00</td>
<td></td>
</tr>
<tr>
<td>SA &quot;</td>
<td>58.88</td>
<td>40</td>
<td>Tas. &quot; (FST C'tee)</td>
<td>40.00</td>
<td></td>
</tr>
<tr>
<td>Tas. &quot;</td>
<td>432.86</td>
<td>-</td>
<td>WA &quot; (Air Fares)</td>
<td>283.50</td>
<td></td>
</tr>
<tr>
<td>Vic. &quot;</td>
<td>537.99</td>
<td>-</td>
<td>Subscriptions in Advance</td>
<td>2993.90</td>
<td></td>
</tr>
<tr>
<td>WA &quot;</td>
<td>301.33</td>
<td>191</td>
<td>Members' Subscriptions</td>
<td>458.19</td>
<td></td>
</tr>
<tr>
<td>Biophysics Group</td>
<td>9.35</td>
<td>70</td>
<td>&quot;The Aust. Physicist&quot;</td>
<td>595.86</td>
<td></td>
</tr>
<tr>
<td>Education &quot;</td>
<td>75.30</td>
<td>-</td>
<td>Income received in advance by</td>
<td>137.67</td>
<td></td>
</tr>
<tr>
<td>Vacuum Physics Group</td>
<td>133.45</td>
<td>-</td>
<td>&quot;The Aust. Physicist&quot;</td>
<td>121.60</td>
<td></td>
</tr>
<tr>
<td>SA SSPC Fund</td>
<td>231.60</td>
<td>221</td>
<td>Unexpended grants (SA SSPC Fund)</td>
<td>231.60</td>
<td></td>
</tr>
<tr>
<td>&quot;The Australian Physicist&quot;</td>
<td>1512.77</td>
<td>1781</td>
<td>TOTAL LIABILITIES</td>
<td>3884.96</td>
<td></td>
</tr>
<tr>
<td>Prepayments</td>
<td>-</td>
<td>-</td>
<td>ACCUMULATED FUNDS</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Accounts recoverable by</td>
<td>-</td>
<td>-</td>
<td>General Accumulated Funds</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Council Funds</td>
<td>63.75</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&quot;The Australian Physicist&quot;</td>
<td>492.85</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>NSW &quot; (Geo. Conf.)</td>
<td>10764</td>
<td>(2006)</td>
<td>LESS Deficit for 1972</td>
<td>1386.73</td>
<td></td>
</tr>
<tr>
<td>Investments @ cost (see table)</td>
<td>8259.04</td>
<td>(100)</td>
<td>Appropriation for Reserves</td>
<td>100.00</td>
<td></td>
</tr>
<tr>
<td>Fixed assets</td>
<td>14882.50</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Plant, Furniture, Fittings</td>
<td>1371.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1500 Council</td>
<td>11032</td>
<td>1500</td>
<td>Branches &amp; Groups</td>
<td>11657.00</td>
<td></td>
</tr>
<tr>
<td>10030</td>
<td>12533</td>
<td>-</td>
<td>Council</td>
<td>1600.00</td>
<td></td>
</tr>
<tr>
<td>22371</td>
<td>24312.54</td>
<td>22371</td>
<td>RESERVE FUNDS</td>
<td>13257.00</td>
<td></td>
</tr>
</tbody>
</table>

The Australian Physicist, January 1973 15
AUDITOR'S REPORT

TO THE MEMBERS OF THE AUSTRALIAN INSTITUTE OF PHYSICS:

In our opinion:

(a) the accompanying balance sheet and statement of income and expenditure are properly drawn up in accordance with the provisions of the Companies Act 1961, as amended, and so as to give a true and fair view of the state of affairs of the Institute at 30 September 1972 and of the results for the year ended on that date; and

(b) the accounting and other records (including registers) of the Institute examined by us are properly kept in accordance with the provisions of the Companies Act 1961, as amended.

MELBOURNE : 12 December 1972
Gordon Quinn & Company
CHARTERED ACCOUNTANTS

STATEMENT OF DIRECTORS

WE, James Kenneth Mackenzie and James Gordon Campbell, being two of the Directors of the AUSTRALIAN INSTITUTE OF PHYSICS, do hereby state that, in the opinion of the Directors, the accompanying statement of income and expenditure is drawn up so as to give a true and fair view of the affairs of the Institute for the period ended 30 September 1972, and the accompanying balance sheet is drawn up so as to exhibit a true and fair view of the state of affairs of the Institute as at the end of that period.

MELBOURNE : 12 December 1972
FOR AND ON BEHALF OF THE BOARD
J. K. Mackenzie
J. G. Campbell

DECLARATION BY THE SECRETARY

I, James Gordon Campbell, Secretary of the AUSTRALIAN INSTITUTE OF PHYSICS, do solemnly and sincerely declare that the accompanying balance sheet and statement of income and expenditure are, to the best of my knowledge and belief, correct,

and I make this solemn declaration conscientiously believing the same to be true and by virtue of the provisions of an Act of Parliament of Victoria rendering persons making a false declaration punishable for wilful and corrupt perjury.

DECLARED AT MELBOURNE IN THE STATE OF VICTORIA
THIS 12TH DAY OF DECEMBER 1972

Signed : J. G. Campbell
Before me : Alex G. Gillon, J.P.
May 1973, subject to confirmation by the Executive closer to the time.

At the closing of the Meeting, the retiring office-bearers were thanked for their contributions to the Institute.

MEMBERSHIP GRADES

Following a resolution passed at the 20th Council Meeting held in May 1972 an ad hoc Committee was formed to consider Institute policy regarding multidiscipline courses and also to consider possible amendments to the naming or structure of membership grades. The Committee consisted of the President, Professor R. Street, who acted as Chairman, Professor H. C. Bolton, Dr J. G. Campbell, Mr K. H. Clarke, Dr A. J. Dyer, Dr R. D. B. Fraser, Dr J. K. Mackenzie and Dr J. L. Rouse, and meetings were held on 16 August and 9 October 1972. Suggestions made by Branch Committees and by members of this Committee were discussed and a report presented to the 21st Council Meeting, held in November 1972. The report was accepted with minor amendments, and a resolution was passed clarifying the interpretation of the academic requirements for Graduateship as follows:

It is resolved that the title and standard of the Graduate grade be retained, but that the requirement of Clause 9 (a) of the Articles of Association

“... have obtained the degree of bachelor with physics as a major subject...”

be interpreted as requiring a minimum content of physics around one half with a significant proportion at an advanced level. In applying this criterion to particular cases recognition should be made of the fact that subjects such as electronics or geology have a physics content.

A second topic dealt with in the report concerned the possible revision of grade structure and renaming of grades and it was resolved by Council that the suggestions put forward by the ad hoc Committee should be circulated as widely as possible amongst the membership for discussion and comment. The relevant section of the amended report is as follows:

1. General

It is proposed that the present corporate membership grade structure be retained but that the name of the present grade of Associate be changed to Member of the Australian Institute of Physics (MAIP). At the same time a non-corporate grade of Associate Member should be created, primarily designed to accommodate persons holding tertiary academic qualifications who were not eligible for Grad.AIP or MAIP. The grade of Associate Member would include newly-qualified physics graduates gaining the experience required by Clause 9 (b) for Grad.AIP and also professional persons qualified and engaged in disciplines other than physics. Other types of experience that might be considered appropriate are listed in Section 3.

2. Proposed Annual Subscriptions

<table>
<thead>
<tr>
<th>Present Grade Structure</th>
<th>Subscription $</th>
<th>Revised Grade Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fellow (FAIP)</td>
<td>30</td>
<td>Fellow (FAIP)</td>
</tr>
<tr>
<td>Associate (AAIP)</td>
<td>20</td>
<td>Member (MAIP)</td>
</tr>
<tr>
<td>Graduate (Grad.AIP)</td>
<td>13</td>
<td>Graduate (Grad.AIP)</td>
</tr>
<tr>
<td>Non-Corporate</td>
<td></td>
<td>Non-Corporate</td>
</tr>
<tr>
<td>Subscriber</td>
<td>6</td>
<td>Subscriber</td>
</tr>
<tr>
<td>Student</td>
<td>3</td>
<td>Student</td>
</tr>
</tbody>
</table>

3. Summary of Acceptable Qualifications

In this summary “experience” refers to experience in the practice or teaching of physics at a level appropriate to the grade. Where academic degrees are mentioned these refer, in the case of a bachelor's degree, to a degree satisfying Clause 9 (a) of the Articles and, in the case of higher degrees, to physics or to a branch of physics such as geophysics or biophysics.

CORPORATE GRADES

Fellow (unchanged)

(a) DSc
(b) PhD plus five years' experience
(c) MAIP plus six years' experience
(d) Grad.AIP plus ten years' experience
(e) Fellow of the Institute of Physics

Member (unchanged from present Associate)

(a) PhD
(b) MSc plus two years' experience
(c) Grad.AIP plus four years' experience
(d) Person practising physics at an appropriate level and for an appropriate time regardless of academic qualifications
(e) Member of The Institute of Physics

Graduate (unchanged)

(a) Honours Bachelor's Degree
(b) Bachelor's degree or equivalent plus one year's experience
(c) Associate Member of The Institute of Physics

NON-CORPORATE GRADES

Non-corporate grades are not open to persons eligible for corporate membership.

Associate Member

(a) Qualification satisfying Clause 9 (a) of the Articles, but insufficient experience in physics for Grad. AIP
(b) Tertiary qualification in disciplines other than physics
(c) A sufficiently high standard of experience in physics without an academic qualification satisfying Clause 9 (a) of the Articles.

Subscriber

Restricted to persons with insufficient professional
qualifications or experience in physics to qualify for Associate Member.

Student
Restricted to persons working towards the attainment of qualifications acceptable for Graduate or Associate Member. Upon attainment of a tertiary academic qualification Student members would be expected to transfer to Associate Member or, if eligible (as in the case of an Honours degree in Physics) to Graduate.

R. D. B. Fraser
Hon. Registrar

IUPAP—THE FIRST FIFTY YEARS

J. S. Dryden,
Chairman, Australian National Committee for Physics

In order to help re-establish international links in science which had been broken by World War I a group of leading scientists formed an International Research Council in 1919. This Council gave birth to several International organizations, one of which was the International Union of Pure and Applied Physics, formed in 1922. Therefore, the recent General Assembly (the fourteenth) of the Union held in Washington from September 20–24, 1972, commemorated the fiftieth anniversary of the Union. It is therefore an appropriate time to review how the International Union carries out its objectives of encouraging and aiding international cooperation in the field of Physics. For a history of IUPAP and of Australian participation in IUPAP see Boas (1967).

Delegates to the Assembly were welcomed by Dr. Handler, President of the National Academy, who expressed the opinion that the reaction by the public against science was not as strong as was commonly believed. Dr. David, Scientific Adviser to the US President, mentioned the recent voluminous report of Bromley on the future planning of Physics in the USA and of recent major undertakings financed by the US Government such as the meson factory at Los Alamos, the commencement of work on a large-array radiotelescope and the particle accelerator at Batavia, Illinois. This latter construction has two pleasing features, the energy of the beam (300 GeV) is higher than the original design and the cost was within the budget.

Membership
There are 38 member countries of IUPAP. In most cases the affiliation, as in Australia, is through a national academy of science (or equivalent) but in some countries the affiliation is through the national equivalent of the AIP. No new members were admitted at this Assembly but it is of interest to us that New Zealand was represented. Although New Zealand joined the Union in 1954 the country has taken no part since then in the affairs of the Union. It may be possible on some future occasion to arrange two International Conferences on closely related topics—one in New Zealand and one in Australia—to the mutual benefit of both countries with regard to the number of overseas participants.

The following motion was passed unanimously—"Considering the importance for the work of IUPAP of having as national member the People's Republic of China, the 14th General Assembly of IUPAP authorizes within the framework of the IUPAP statutes, its Executive Committee to take all measures which the Committee deems necessary to achieve this goal". The Republic of China is at present a member of the Union and several delegates from Taiwan were present at this Assembly.

Commissions
Much of the work of IUPAP is done by Commissions which have been established over the years as the need arose. There are now fifteen specialist commissions plus the unique International Commission for Optics (ICO)—unique in the sense that ICO exists both as an independent entity and as an affiliated commission of IUPAP. Recent assemblies have been cautious about creating new Commissions, because it is undesirable to fragment the subject too far, and it is undoubtedly easier to create a Commission than to dissolve one. However this Assembly did ask the Executive to consider the formation of a Commission on Quantum Electronics.

Through its Symbols, Units and Nomenclature (SUN) Commission the IUPAP has, in collaboration with various other international bodies, contributed much to the standardization of units and the uniformity of symbols and nomenclature. Recent activities have included the preparation of new lists of recommended symbols for physical quantities in use in (i) Solid State Physics and (ii) Plasma Physics. These will be included in a revised edition of the IUPAP booklet 'Symbols, Units and Nomenclature in Physics' to be ready for submission to the next Assembly to be held in 1975. The Commission has also prepared a revised Appendix on Systems of Quantities and Units in Electricity and Magnetism for the same booklet.

The Publications Commission, as its name implies, has interested itself in publication policy and has worked towards obtaining uniformity in the format of references and other matters in the primary journals of Physics. The Commission has collaborated with the Abstracting Board of the International Council of Scientific Unions (ICSU). There has been much activity of recent years in the development of scientific and technological information systems and the IUPAP has taken part in the international cooperation which has resulted in the production of some of these systems. The Publications Commission had noted an arrangement proposed recently by one of the Particle Physics Laboratories for the distribution of preprints to subscribers for an annual subscrip-
tion and a publication charge to authors. The Commission considered this would constitute an unedited and unreviewed publication and would be a serious departure from accepted practice.

Conferences

The major activity of the other Commissions is the organization of conferences. However, one Commission, that on Atomic Masses and Fundamental Constants, has the responsibility of both arranging conferences within its subject area and of evaluating data. For example they have recently established a task group on γ-ray calibration energies and are in the process of completing a new evaluation of the fundamental constants.

During the Assembly the Commissions reported on the 75 conferences which had been held under the auspices of the IUPAP during the three years under review, 53 of these had been given financial support. There was unfortunately one failure reported—a conference on 'Teaching of Physics to Students in Physics, Related Sciences and Professions' planned for West Germany in July 1972 was abandoned because of insufficient financial support from within the host country. Some Commissions, e.g. Cosmic Rays and Acoustics, hold one large conference every two or three years which covers the entire field. Others, e.g. Solid State and Spectroscopy, organize several conferences each of which covers only a limited part of their specialist area. The Acoustics Commission sent a document to the Stockholm Conference on the Environment calling for resolutions to be adopted on Noise Pollution.

Two of the conferences being reported were held in Australia. One of these was a large conference on Cosmic Rays in Hobart (August 1971) and the other a small conference in Sydney on Transport Properties in Solids (August 1970), a satellite conference to the large Low Temperature Conference in Kyoto. The Cosmic Ray Commission reported very favourably on the local arrangements made for the Hobart Conference.

In addition to its role of arranging and sponsoring conferences one of the important roles of IUPAP is judging when not to hold them. The Nuclear Physics Commission had actively discouraged the holding of a large conference on Nuclear Physics during the three years under review because previously there had been too many.

It is probably desirable to interpolate here a paragraph about IUPAP sponsorship for an International Conference. The Union may give moral support or it may even give financial help. In any case rather strict rules as to the scientific value of the proposed conference, its international character and its organization have to be fulfilled. The proposal to hold a conference may be sent to the relevant Commission of IUPAP directly but it is preferable for this to be done through the Australian National Committee for Physics or even through the Academy. The IUPAP Commission will then make a recommendation to the Executive. Since the Union Executive meets in late September each year and then decides sponsorship and grants, the details of the proposed conference should be submitted to the Union Commission by April of the year preceding that in which the conference is to be held. Informal discussion with the relevant Union Commission before the formal application is made is advisable to ensure that the date and subject proposed for the conference are not already booked for another conference. Some work done by physicists is of course covered by other International Unions such as those of Astronomy or of Biophysics.

Elections

It is clearly important to have Commissions which are both competent and balanced with regard to representation from different countries. The previous practice was for the Executive of IUPAP to call for nominations from National Committees and from the Commissions and after discussion propose a slate of nominations for consideration by the General Assembly. But there has been no formally defined procedure for these elections and at previous General Assemblies last minute nominations from the floor have produced, in some instances, imbalanced Commissions. Rules were adopted at this Assembly which cover the electoral procedure for the Executive and for members of the Commissions. Briefly these rules fix the number of members in each Commission, limit the members of a particular Commission who can come from the one country and spell out the timing and methods of nomination. Reaching agreement on detailed rules such as these is not always easy at international gatherings but after thorough discussion and several amendments these rules were adopted unanimously.

Prof. H. Maier-Leibnitz (West Germany) was elected President for the next three years. Dr C. C. Butler (Director, Nuffield Foundation UK), who was Secretary-General from 1965–72, was elected First Vice-President and is consequently President-elect. Prof. L. Kerwin (vice-Rector, Laval University, Canada) formerly Associate Secretary-General was elected Secretary-General and Dr J. Nilsson from Sweden, Associate Secretary-General.

Australian Representation

During the past six years we have been well represented in the inner councils of the Union by Dr W. Boas who has been a Vice-President. We have been represented on the Solid State Commission since 1963, also in the person of Walter Boas. Dr Boas was Chairman of this Commission during the period 1969–72.

Dr Walsh has been a member of the Spectroscopy Commission since 1969 and was re-elected for a further three year term at this Assembly (six years is the maximum term of office, except in very exceptional circumstances). Prof. R. Street was elected to the Magnetism Commission and Dr G. K. White to the Solid State Commission. Australia is now represented on more Commissions than ever before but if the number of units which we have in the Union is taken as an accurate
indication of our ‘physics rating’ we are still under-represented.

Visas and other Matters

If a conference is to carry the label ‘international’ then clearly it is improper to exclude a physicist from attending merely because of his nationality and IUPAP, in common with other international scientific unions, has always endeavoured to see that this does not occur. However, there are cases where physicists have failed to obtain visas to attend international conferences.

The Israeli delegate raised the question of Jewish scientists being restricted in their opportunities to migrate from the USSR and the tax imposed by the USSR. These points were answered at length by the USSR delegation.

Cooperation with Other International Bodies

IUPAP is represented on about a dozen inter-Union Commissions. Some of these, such as the Upper Mantle Project—now completed—are established to supervise a particular international scientific project. One of the inter-Union Commissions which deserves to be better known among physicists is CODATA (Commission on Data for Science and Technology) which was established in 1966 and regularly publishes a Bulletin containing data which has been critically assessed by working groups.

Scientific Sessions

In order to commemorate the fiftieth anniversary, five scientific sessions were interposed between the business sessions and in these scientific sessions lectures were delivered by twelve distinguished physicists. The first lecture of the series was delivered by Prof. Amaldi (University of Rome), who is a former IUPAP President. His talk was entitled ‘The Unity of Physics’, in which he discussed both the unity of the subject of Physics and Physics as an international undertaking. The unity of the subject of Physics was taken up by other lecturers. The lectures will be published as a book and in this article it is possible only to mention briefly some points in these lectures which most interested me.

Dr K. Thorne (Caltech, USA) (Gravity Theory) discussed the state of technology and of experimental art with regard to experiments designed to test theories of gravitation, and predicted that there will shortly be many experimental workers in this area which has up till now been the province of theorists. He also talked about black holes, space where the gravitational attraction is so great that no light can escape, and such interesting laws as the second law of dynamics of black holes, viz. “the area of a black hole must either remain constant or increase”.

In the course of his lecture ‘Physics and Society’ Dr H. Casimir (Eindhoven) discussed in detail the relationship between research in universities and in industry, particularly the things which industry should not expect of universities. Dr Casimir is well suited to lecture on this topic, his outstanding career as an academic theoretical physicist was followed by a long period in a very senior position in an industrial organization. I shall look forward to seeing this lecture in print. Casimir believes that no physicist in a university should be associated with military technology. Prof. V. Weisskopf answered the question ‘What is an Elementary Particle?’, by saying that there is conditional elementarity, conditional on the scale of the physical phenomena being studied. He pointed out that 1912, 1932 and 1952 were years in which outstanding developments occurred in atomic and particle physics and made the obvious comment about expectations for the current year. Weisskopf doubted if quarks would be found.

In a lecture entitled ‘Solid State Physics: Accomplishments and Future Prospects’ Prof. J. Bardeen combined an excellent outline of the major stages in the development of solid state physics with some reminiscences of the early work on semiconductor devices. He gave examples of several applications of superconductivity which have reached fairly advanced stages of development. Other lectures were given by R. Gould (AEC, USA) on ‘Plasma Physics’ a subject in which there has been extensive international collaboration and Prof. W. Gentner on ‘International Cooperation in Physics’. Prof. Gentner, from Heidelberg, was on the staff of Melbourne University for a brief period and has served on the governing body of CERN. He conjectured on the reasons why CERN has been more successful than other international research organizations in Europe and suggested one reason was that most of the workers at CERN retained strong links with their home university or institution. The remaining lectures were delivered by G. Toraldo di Francia (Florence) on ‘Optics’, J. T. Wilson (Toronto) on ‘The Physical Study of the Earth and the Scientific Revolution it has Caused’, F. Hoyle ‘Astrophysics’, A. Bohr (Copenhagen) on ‘The Many Faces of the Nuclear Structure’ and G. Herzberg (Ottawa) on ‘Spectroscopy and Molecular Structure’.

The arrangements for the Assembly made by the hosts, the US National Committee, were excellent, both with regard to the business meetings and social functions. The Australian delegation to this Assembly consisted of Dr J. S. Dryden, Dr W. Boas (a retiring Vice-President) and Prof. H. C. Webster (Counsellor (Scientific), Australian Embassy, Washington).

Reference

THE CALENDAR

February 1973
5-9 Physics of the Upper Atmosphere, Semiconductor Principles and Applications, Environmental Physics, Qld Uni. Summer School (Qld-AIP).
8 AIP Annual General Meeting (during Qld Summer School).
12-14 9th AINSE Plasma Physics Conference, Lucas Heights, NSW.

May

August
13-17 45th ANZAAS Congress, Perth, WA.

BOOK REVIEWS

Reviewed by P. Mitchell, School of Physics, University of N.S.W.

The topics dealt with in this book are the fairly conventional ones covered in ‘Modern Physics’ textbooks—Relativity, Introductory Wave Mechanics, the Schroedinger equation and its application to atomic structure and the solid state, Quantum Statistics and Nuclear Physics. However these topics are treated at a somewhat higher level and in more detail than in most comparable textbooks, the treatment being appropriate to a higher third year level course in many cases. Included, for example, are detailed discussions of angular momentum and radiative transitions in atoms. The book raises the question of whether, at this level, a combined course is a suitable alternative to the more conventional separate courses on topics such as Spectroscopy, Solid State Physics and Nuclear Physics. The impression gained is that there is not quite enough about such topics for a student completing a degree.

The author brings a fresh approach to many topics and maintains interest by including detailed sections on recently developed areas of physics such as lasers and the Mössbauer effect. Numerous references to original papers are included and the book as a whole is free of the oversimplifications which occur in many similar textbooks.

Reviewed by P. J. Jennings, School of Physics, University of N.S.W.

The author’s intention is to provide an approach to modern physics through its concepts and mathematical framework instead of the more conventional historical and phenomenological approach. However, to fully understand this book, the student would need to have had an introductory descriptive course in modern physics plus preparation in classical mechanics, Maxwell’s equations, differential equations and complex function theory.

This treatment of modern physics is not mathematically rigorous or complete but it aims instead to cover all of the basic concepts and some of the mathematical apparatus used in the treatment of special relativity, quantum mechanics and statistical mechanics. The broad scope of the book has advantages in unifying diverse fields of physics but the consequence of this is that many topics are not covered in sufficient detail for the student to gain mastery of the subject.

The most appealing feature of the book is its emphasis on precise definitions of the basic concepts of modern physics and the logical development of the theories from the concepts and a set of basic postulates. It therefore effectively bridges the gap between an introductory descriptive course in modern physics and the more advanced mathematical treatment of the various branches of theoretical physics. This book could be suitable as a text for a first course in mathematical physics at the third or fourth year undergraduate level or as a reference book for an introductory modern physics course.

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

The provision of electron accelerators in the GeV range of energies, together with the associated storage rings has given experimenters a powerful set of tools for the analysis of electromagnetic processes in particles and nuclei. The theoreticians have been blessed by a reliable set of equations—the quantum mechanical synthesis of the work of Dirac and Maxwell—which have enabled these tools to be fully understood; and the many significant discoveries to be interpreted.

Nowhere is the story of this work better told than in the above book. The basic formalisms are introduced by Dr. N. Dombey, the hadronic symmetries, current algebras and the quarks models by Professor H. Joos.

The Australian Physicist, January 1973
Professor Donnachie now leads us through excited states of the nucleon with clarity and ease. Regretfully Donnachie's lecture was a little too early to include the scaling discovery of Bloom and Gilman. Professor Leith now introduces the ideas of vector dominance and the exciting field of rho-meson interactions with nuclei. Finally Professor Harari integrates our knowledge with general hadron phenomenology.

It is clear that this book continues the high standards of documentation of those excellent Scottish Summer Schools. It is a volume of great interest to researchers in particle physics and their young graduate students in particular. Regrettably the high price of $34.00 will prohibit personal ownership, but that is no excuse for the librarians.


Reviewed by B. A. McInnes, Director of First Year Courses in Physics, University of Sydney.

This introductory year text-book is unusual in that it is written by an Australian author and published by an American publisher. Now retired, Reimann has spent many years closely associated with first year teaching at the University of Queensland. The book essentially represents the product of these later years of his career spent close to the introductory-level student.

Many will remember when proselytes of Physics were instructed by the graven tablets (or was it, worshipped at the golden calf) of Booth and Nicol or of Lemon, Ferrance and Stephenson. Since those days, introductory texts have multiplied. Many of these books have a polished, yet slick, approach that deludes students into thinking that physics is a subject that can be studied, understood and even developed by sitting at a desk and sagely nodding one's head.

Not so with Reimann's text. The book is dominated by the demands of rigour and logic. It is painstaking but not pedestrian. The problem sets at the end of each chapter are superior to any similar collection known to this reviewer. But the book has to be judged, not only on its undoubted intrinsic worth but also on how it fits into the overcrowded introductory-year market. It is here that I have marked reservations as to the book's value.

In spite of the statements to the contrary in the book's foreword, I very much doubt if it has any relevancy for the large number of students taking terminal one-year courses. Even for those students aiming at a course in or allied to the physical sciences, I fear that much of the detail and developments of this text would be in vain. Too many of these students come ill-prepared and seemingly incapable of appreciating any subtleties at this stage of their careers. Perhaps the best value could be obtained from this book by requiring potential honours students to read it during the long vacation, with the instruction to go away and study it and see on what the physics they have been learning is really based.

In summary, although I do not believe that the author has produced the answer to the introductory-year physics text problem, he has produced an extremely good physics book.


Reviewed by W. H. Steel, National Standards Laboratory.

Although books on holography are appearing thick and fast, this one is to be specially recommended to those who read French. It stands out for its simplicity of presentation and wealth of practical detail. The treatment is elementary, with any mathematics collected into supplementary chapters. Under applications is a thorough survey of hologram interferometry and optical data processing.


Reviewed by G. J. Bowden, National Standards Laboratory, Sydney.

This book is divided into six chapters all of which, as the authors state, could be expanded into separate review articles.

In the first chapter the authors lay the foundations of the subject by examining the properties of rare earth ions in the isolated and solid state. Most EPR workers will be familiar with this text since it is essentially a brief review of the work that has been carried out, mostly at Oxford, over the past two decades.

The next few chapters are devoted, almost exclusively, to the properties of rare-earth metals and alloys. The peculiar stacking arrangements which occur in the crystal structures are reviewed in chapter two together with the Hum-Booth rules for alloying rare-earth metals. Chapter three contains a useful discussion of the band structure calculations and it is a pleasure to find an extensive critique of the OPW, APW and RAPW methods and results. The next two chapters are given over to the magnetic and transport properties of the rare-earths. Much space is devoted to the RKKY interaction which is used to explain a wide variety of phenomena ranging from temperature dependent spiral spin configurations to the more recent NMR results on holmium-gadolinium alloys. The chapter on transport properties also includes a discussion of the anomalous ferromagnetic Hall coefficient and a small section on thermoelectric effects.

The last and largest chapter of the book deals with the properties of rare-earth compounds. The oxides, sulphides, pnictides, intermetallics etc., are all reviewed and references are given to over three hundred original papers in this chapter alone. My only complaint, about this part of the book, is that certain sections have a distinct 'air of impermanence'. However I recommend this book both as a basic text and as a source reference to all those people currently working with the 'step-children' of the periodic table.
SUPERPARAMAGNETISM

A. H. Morrish

Department of Physics, University of Manitoba, Canada
On leave at Physics Department, Monash University
Extract of paper presented at AIP Summer School,
Monash University, February, 1972

It is useful to recall some characteristics of paramagnetism in order to see its relationship to superparamagnetism. Consider a gas of paramagnetic atoms, N per unit volume, each with a (permanent) dipole moment μ. When a magnetic field H is applied, the dipoles tend to become oriented in the field direction. However, thermal agitation will oppose this alignment, and thermal equilibrium will be quickly reached via collision processes. The magnetization achieved is then found by averaging over the Boltzmann distribution, and it is found that

\[ M = N g μ B(y) \]  \hspace{1cm} (1)

where \( B(y) \) is the Brillouin function, \( J \) is the angular momentum quantum number, and \( y = JgμBH/kT \). For small \( H/kT \), the expression reduces to Curie’s Law. The only good experimental example is oxygen gas, which even so is diatomic. It is fortunate that Curie did his 19th century work on this system; otherwise he would not have discovered Curie’s Law.

A single-domain particle is defined as one in which the magnetization is uniform. Sufficiently small particles of ferromagnets will be in this state, since the introduction of domain walls to reduce the magnetostatic energy will raise the total free energy. If these particles are suspended in a liquid so that a colloid is formed, then thermodynamic equilibrium can be achieved in the presence of a magnetic field by physical rotation of the particles. Since the number of dipoles per particle is large (\( \sim 10^{19} \)), the magnetic moment per particle is large, \( J \to \infty \), and equation (1) becomes

\[ M = N x L(x) \]  \hspace{1cm} (2)

where \( L(x) \) is the (classical) Langevin function and \( x = μH/kT \). This type of behavior was observed by Elmore [1938] for a colloidal suspension of magnetite (Fe₃O₄) in water (H₂O). The rate of approach to thermal equilibrium is determined by the viscosity of the liquid. Although such a system could well be defined as superparamagnetic, this is not the normal custom. Instead the term is usually confined to materials in the solid state.

Next, recall that rare-earth ions in ionic solids act as though they are almost free, and follow the behavior given by equation (1). Essentially the reason is because the \( 4f \) electrons (responsible for the paramagnetism) are located well inside the ions’ outer electron orbitals. Most iron-group ions can also be treated as though they are free provided \( J \) is replaced by \( S \). Thermal equilibrium is established by the ability of the magnetic moments to change direction under the action of the applied field and thermal agitation. An analogous situation can occur for single-domain particles.

Consider a single-domain particle with uniaxial anisotropy. The variable part of the free energy is given by

\[ F_T = \frac{1}{2} CV \sin^2 α \]  \hspace{1cm} (3)

where \( C = (D_a - D_b)/M^2_a \) for shape anisotropy,
\( C = 2K'/2 \) for crystalline anisotropy,
and \( C = 3λ_0σ \) for strain anisotropy.

Here \( V \) is the volume of the particle, \( α \) is the angle between the magnetization \( M_a \) and the easy direction, \( D_a \) and \( D_b \) are the demagnetization factors for the principal directions in a prolate ellipsoid, \( λ_0 \) is the saturation magnetostriiction, \( σ \) is a simple tension, and \( K' \) is a constant characterizing the material. The geometrical interpretation of equation (3) is shown in figure 1. The directions of minimum energy (\( α = 0, π \)) are separated by an energy barrier of height \( \frac{1}{2} CV \). If \( V \) is large enough, the single-domain particle is stable, and the magnetization will lie along \( α = 0 \) or \( π \). For small enough \( V \), thermal agitation will rotate \( M_a \) from \( α = 0 \) to \( α = π \) and from \( α = π \) to \( α = 0 \).

\[ \text{Figure 1} \]

To illustrate the energy barrier (\( \frac{1}{2} CV \)) in a ferromagnetic single-domain particle with uniaxial anisotropy.

The process may be characterized by a relaxation time \( τ \). For an aligned uniaxial powder, fully polarized in one direction, the magnetization (after removal of an applied field) will decay as

\[ M = M_0 e^{-t/τ} \]

For \( τ \) large, the system is stable. For \( τ \) sufficiently small, \( M \) tends towards zero in the time of the measurement.

Actually, \( t/τ \) is the sum of the probabilities for a single transition from \( α = 0 \) to \( π \) plus that for \( α = π \) to \( 0 \).
Hence

\[
\frac{1}{\tau} = f_0 e^{-CV/(kT)}
\]

(4)

where \(f_0\) is a frequency factor.

For a given temperature and particle shape the relaxation time \(\tau\) changes from a fraction of a second to several years when the volume changes by a relatively small amount. For example, with \(C = 10^6 J m^{-3}\) at \(T = 300 K\), \(\tau = 10^{-6} s\) for a radius \(R = 17 \AA\) (1.7 nm) and \(\tau = 10^6 s\) for \(R = 22 \AA\) (2.2 nm). Only over a very narrow range of sizes is \(\tau\) the order of the time of an experiment. Hence, there exists a critical size, above which the magnetization is stable, and below which thermodynamic equilibrium exists (the superparamagnetic state).

However the critical size depends on the experiment performed, since the material is superparamagnetic only if \(\tau\) does not exceed the time-constant of the apparatus. Thus for magnetization measurements \(\tau \approx 1 - 100\) seconds, whereas for Mössbauer measurements \(\tau \approx 10^{-8}\) s, the nuclear Larmor precession time. However, the two criteria are not completely disparate since \(\tau\) depends exponentially on \(V\).

It is customary to define a blocking temperature, \(T_B\), where \(\tau\) is equal to the characteristic measurement time. Thus, if \(\tau = 10^2 s\) \(1/4 CV \approx 25 kT\). For iron with \(T_B = 300 K\), the critical radius is \(125 \AA\) (12.5 nm); for \(\tau = 10^{-8} s\), \(1/4 CV \approx 2.3 kT\) and \(r = 57 \AA\) (5.7 nm). Hence, for a particle size of \(100 \AA\) (10 nm), the iron powder would be superparamagnetic in a magnetization measurement but stable in a Mössbauer measurement.

The criteria for the detection of superparamagnetism depend on the technique used. In practice complications occur because all powders contain a distribution of sizes and also often of shapes. For magnetization measurements, the following ideas are employed.

1. The magnetization, measured as a function of \(H/T\), should follow the Langevin function.
2. The coercive force is zero for those particles that are superparamagnetic.
3. The remanence is zero for all particles below the critical size, and becomes non-zero and increases with decreasing temperature since the number of particles above the critical size then increases.

These criteria can be used to determine the particle size distribution either for a powder or for precipitated particles in an alloy. For a powder at least, the results can be compared with distributions obtained with electron microscope observations or from X-ray line broadening.

In Mössbauer spectra, the superparamagnetic particles give rise to a central peak, i.e. there is no hyperfine splitting. For a distribution in size, there is a temperature range in which there is a central peak superposed on the hyperfine pattern.

For a temperature at which only a paramagnetic absorption is observed, the application of a field will increase the barrier energy, and a hyperfine pattern may then be observed. Frequently near the Curie and Néel points a central peak is observed in a Mössbauer spectra. If it is due to the presence of a superparamagnetic component, the application of a sufficiently large field will remove this peak. If the peak remains, it may have quite a different origin. Namely, in a mixed compound the nearest neighbours and hence the exchange interactions may differ, and ordering may take place at different temperatures. The molecular field cannot predict such an effect, and no quantum mechanical treatments appear to have been published to date.

Finally, it is interesting to mention an additional complication in antiferromagnetic and ferromagnetic systems. The number of planes of atoms may be odd, and if so there is an unbalanced sheet of magnetic moments. Then an antiferromagnetic particle would possess a spontaneous moment, and a ferromagnetic particle will have an additional distribution of moments that must be considered in analyzing experimental data.

Reference

Figure 2
Mössbauer spectra of cubic Fe₃S₄ powder with a mean diameter of 91 Å (9.1 nm) at about room temperature. (a) No applied external magnetic field. Note there is a hyperfine (split) pattern with a superposed large central (paramagnetic) peak. (b) \(H = 90 kOe\). Some of the superparamagnetic particles of (a) are now stabilized and exhibit a six-line pattern. The central peak is reduced from 48 to 35 per cent. of the total. The remaining central peak is due either to extremely fine Fe₃S₄ particles, or else to another phase, possibly Fe₄S₄-f0--formed at B-site vacancies. The latter possibly is considered to be the more likely.
Summer School
5-9 FEBRUARY, 1973

The Summer School will be held at the University of Queensland and concurrent courses (each having about 14 lectures) will provide a general survey of three topics:

PHYSICS OF THE UPPER ATMOSPHERE
SEMICONDUCTOR PRINCIPLES AND APPLICATIONS
ENVIRONMENTAL SCIENCE

Accommodation will be available in one of the colleges at the University campus—bed and breakfast, $6.

Fees: AIP Student Members $15
AIP Members $20
Non members $25

Anybody interested should contact:

AIP Summer School Convener,
c/- Department of Physics,
University of Queensland,
St Lucia, Brisbane, Qld 4067

PHYSICS ARCHIVE
—established in October 1972, with support of the A.I.P. Council, by the N.S.W. Branch—

TO ASSIST IN THE PRESERVATION OF MATERIAL RELATING TO THE HISTORY OF AUSTRALIAN PHYSICISTS AND PHYSICS IN AUSTRALIA . . . .

The Physics Archive aims to provide safe-keeping of items of historical value and, by liaison with other organizations (libraries, museums, archives . . .) will endeavour to ensure that both storage and access are arranged in the way most appropriate to each item.

Reproduced below is the recent 'Plea to Scientists for Historical Source Materials' published by the American Institute of Physics, who have established a 'Center for History and Philosophy of Physics' with similar aims to the above.

"It is our hope that scientists will give careful consideration to the deposition of personal correspondence, photographs and motion picture films, drafts, notebooks, manuscripts, and other documents, as well as scientific instruments with records on their construction. These materials are of far greater importance to scholars in the history and sociology of science than their owner may think. The best time to arrange for their preservation is while they are still in your hands and before they are dispersed. We urge that you do this.

Such action on the part of individual physicists will provide the source materials for scholarly studies so necessary to the understanding of developments in physics, its institutions and its impact on society in the 20th century. Arranging for the preservation of your personal papers is an acknowledgement that every scholar's work is a link, not only to the past but also to the future."

Were such a plea to reach the ears of all Australian Physicists, both present and past, we may hope for a reasonably comprehensive Archive. Because it is not possible to obtain such a distribution we do urge all readers to think of any work related to the field of Australian Physics which may be of interest, whether or not they were personally involved, sending details of any information or people who might be contacted.

Documents, information, offers of assistance and enquiries to:

Mrs S. W. Hogg, Archive Officer AIP,
Physics Dept., NSWIT,
Thomas St., BROADWAY,
A.I.N.S.E.
RESEARCH FELLOWSHIPS

ANNOUNCEMENT

A.I.N.S.E. Research Fellowships are offered by the Australian Institute of Nuclear Science and Engineering for suitably qualified persons wishing to undertake research projects within the Institute's field of interest. Candidates for these awards must be nominated by an Australian University or the Australian Atomic Energy Commission. The closing dates are 28th FEBRUARY and 31st AUGUST each year, and all nominations received by the Institute after one closing date, will be considered together after the next closing date.

Research Fellowships are intended for scientists and engineers who have qualifications equivalent to the Degree of Ph.D. and are at a relatively early stage of an independent research career. Minimum tenure is two years, and the award may be extended for a third year. Emolument will be within the range of $6,304 per annum to $8,984 per annum, (Australian currency), and the Institute may contribute to the costs involved in travelling to and from Australia.

A research project within the field of nuclear science and engineering of interest to the Institute, must be proposed in the nomination after agreement between the candidate and the nominating organisation. Usually it is expected that a Research Fellow's project will require some use of the specialised facilities located within the Australian Atomic Energy Commission Research Establishment at Lucas Heights, near Sydney, N.S.W.

Further information may be obtained from—

The Executive Officer,
Australian Institute of Nuclear Science and Engineering,
Private Mail Bag,
Post Office,
SUTHERLAND, 2232, N.S.W. Australia.