

that the magnetic scattering reaches a maximum there, and that that phenomenon is analogous to 'critical opalescence'.

The scattering of neutrons by crystalline solids can be described in a relatively exact fashion because the positions of the atoms are relatively well defined. However, Dr. Elliott continued, when more complex substances such as liquids are considered, the scattering is described in terms of a pair distribution function (that is, the distribution of atoms in the liquid as seen from an atom at the origin). For X-ray scattering, only the dependence of the pair distribution function upon the distance between atoms is measured, but for neutron scattering the dependence upon time as well is important. The detailed behaviour of the pair distribution function with respect to time and distance can be found by measuring the differential scattering cross-section per unit solid angle and unit interval of the energy of the scattered neutron.

Again, detailed study of this kind is not yet feasible; but a preliminary experiment on the scattering of  $14^\circ$  K. neutrons by solid and liquid lead was described by P. A. Egelstaff (Harwell). The object of the work was to compare the interaction of the neutrons with the thermal vibrations of the solid and liquid. It was shown that the chief features of the experimental data can be explained by assuming that the liquid is "a solid with the atoms placed at random positions". However, some features of the forward scattering require a more detailed model for their explanation.

Limitation of space does not permit a detailed review of all the contributions to the meeting, but mention should be made of the subject of very short half-lives. Prof. S. Devons described the work at the Imperial College of Science and Technology, London, on measurements of absolute gamma transition probabilities by the Doppler shift of the gamma-rays emitted by a recoiling compound nucleus. Here, unexpectedly, the chief unknown has proved to be the rate of slowing down of the heavy particles in the material into which they recoiled. Information is being sought from the recoil of  ${}^7\text{Be}^*$  into varying thicknesses of copper: it was noted that the experimental values of the absolute transition probabilities for  ${}^7\text{Be}^*$  and  ${}^7\text{Li}^*$  lie respectively above and below the values predicted by intermediate coupling theory. C. F. Coleman (Harwell) described a method of determining half-lives down to  $10^{-11}$  sec. by means of fast coincidence techniques. The method depends on  $\beta\gamma$  coincidences between two identical detectors placed at  $180^\circ$  with respect to the sample, and differing only in the absorber screening the gamma detector. Alternating the absorber between the detectors enables small delays between the detectors to be cancelled out. The life-times observed (in units of  $10^{-12}$  sec.) are: magnesium-24,  $30 \pm 2$ ; titanium-46,  $7 \pm 4$ ; nickel-60,  $8 \pm 5$ ; selenium-76,  $25 \pm 10$ ; tellurium-122,  $196 \pm 5$ ; and tellurium-124,  $13 \pm 12$ .

M. A. Grace (Oxford) described experiments on the alignment of cobalt-57 at very low temperatures. The determination of polarization correlation with aligned nuclei enabled him to determine the degree of  $E_2$  and  $M_1$  admixtures in the 123-keV. gamma-ray. R. Batchelor (Harwell) described a helium-3 spectrometer for use in the 100–1,000 keV. neutron range. The cross-section of helium-3 in the  ${}^3\text{He}(n,p)\text{T}$  reaction has given results in good agreement with those derived from detailed balancing, and the instrument has been used for determining the intens-

ity and angular distribution near threshold of the  ${}^7\text{Li}(p,n){}^7\text{Be}^*$  reaction. Of the  $\text{Cu}(n,p)$  reaction at 14 MeV. neutron energy, D. L. Allan (Harwell) showed that the number of protons below the conventional Coulomb barrier at 7 MeV. is far in excess (85 per cent of the total) of those expected, and bears a general resemblance to the distribution observed by Graves and Rosen of the neutrons from the parallel  $\text{Cu}(n,n)$  reaction. Finally, the redetermination of the slow-neutron capture cross-section of hydrogen was reported by C. H. Collie and R. E. Meads (Oxford). Neutrons from a pulsed D–D source were slowed down in a tank, and the gamma-rays from their capture were detected in a scintillation counter. The life-time, obtained from the decay-rate of the gamma-ray yield integrated over the tank, was  $203 \pm 2$   $\mu\text{sec.}$ , corresponding to a capture cross-section of 0.335 barn for a neutron velocity of 2,200 m./sec.

Other contributors were L. E. Beghian (Oxford) on gamma-rays from fast-neutron scattering; D. B. Gayther and K. P. Nicholson (Harwell) on neutron total cross-sections at intermediate energies; M. J. Poole (Harwell) on the spectrum of neutrons from a water moderator by time-of-flight analysis; P. C. Price (Cambridge) on the radiative capture of alpha-particles in nitrogen; E. R. Rae and J. E. Lynn (Harwell) on the analysis of levels in uranium-238 with a time-of-flight spectrometer; T. H. R. Skyrme (Harwell) on the alpha-particle and shell models of the nucleus; and J. F. Turner (Harwell) on the low-intensity radiations in the decay of cobalt-60.

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## MATERIALS FOR RADIO VALVES

AT a meeting of the Radio Section of the Institution of Electrical Engineers on March 21, a discussion was opened by Dr. R. O. Jenkins on the subject of "Materials for Valves". He stated that, historically, the technique of valve-making was derived from that of lamp-making, so that valves tended to use materials originally developed for lamps. With recent advances, however, modern valves require different and, in some cases, new materials; and since the quantities required are relatively small, it has not always been easy to persuade the supplier of materials to meet the very stringent specification of the valve manufacturer.

In addition to the opening speaker, nine others participated in the discussion. It was generally agreed that most of the materials used in valve manufacture are capable of great improvement, and it was suggested that the preparation of idealized specifications would encourage the supply of satisfactory materials in adequate quantities. The subject was surveyed under the three main headings of cathodes and heaters; other electrodes; and envelopes of both insulators and metals.

It was recognized that in Britain the use of cathode cores made of nickel with a low silicon content has avoided many of the difficulties due to interface troubles experienced in the United States and on the Continent of Europe, where a nickel of high silicon content has been used. The usual material in Britain is a pure commercial nickel with a low sulphur content and 0.05–0.10 per cent of magnesium as a reducing agent. In more recently developed types of valves, however, even the low quantity of silicon

present in pure nickel made it unacceptable for cathode cores, and a possible solution to the problem is the use of a 40 per cent tungsten-nickel alloy. Among the merits claimed for this is that a marked improvement in the ultimate strength can be obtained by a heat-ageing process which does not affect the ductility of the alloy. The low thermal conductivity of this alloy is also an advantage.

Grids in receiving valves are usually made by winding either fine molybdenum-tungsten or 5 per cent manganese-nickel alloy wire on to heavier supports of copper, nickel, alloys of these metals or nickel-plated iron. Molybdenum is, however, brittle and expensive; and it can cause poisoning of oxide cathodes if it becomes oxidized. On the other hand, 5 per cent manganese-nickel is not strong enough for many grids. Dr. Jenkins inquired as to the hope of a high-temperature nickel-alloy becoming available to ease this situation. For very fine grid wires, less than 0.001 in. in diameter, tungsten seems likely to be the only suitable material.

Other speakers referred to the difficulty experienced in preventing secondary emission from grids made of molybdenum and tungsten, and suggested that this might be overcome by gold-plating the helix wire; it is difficult, however, to obtain a non-porous plating and one which would still be satisfactory after the swaging of the grid to its support wires.

Receiving valves have relied mainly on envelopes of lime-soda glass, while those parts through which metal connexions are sealed are of lead glass. Increasing use is now being made, in cooled-anode transmitting valves, of the iron-nickel-cobalt alloy matched to a borosilicate glass: this is a very satisfactory combination in that the expansion match is correct over a wide range of temperature.

Probably the most important advance in the field of envelopes is in the use of vacuum-tight ceramics brazed to expansion-matching metals. Originally developed in Germany, this technique is being used extensively in the United States, and will undoubtedly be used in Britain for high-power valves for use at very high and ultra-high frequencies (30-3,000 Mc./s.) in the future. One other important material is pure copper for anodes of transmitting valves and for the blocks of magnetrons and klystrons. So far, it has been found essential to import the necessary high-quality copper; but it is much to be hoped that a satisfactory supply can be established in Britain.

Improvements in radio valves of all types are very dependent on new or improved materials; and this discussion should help towards obtaining these by encouraging co-operation between those engaged in fundamental research on materials, the suppliers of materials, and the valve manufacturers.

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## PHYLOGENY OF THE BASIDIOMYCETES

UNDER this title, D. B. O. Savile (*Canad. J. Bot.*, **33**, 60; 1955) has contributed an essay in which he first of all sets out a series of "phylogenetic principles", thirteen in all, including some that are original and have a particular application to the fungi.

Each principle is enunciated and then discussed. The first of these may be cited as an example. "New

major groups are never derived from climax groups of the parental stock, but always from unspecialized lower groups of great genetic plasticity; for it is only among the latter that revolutionary changes, usually fatal but occasionally a startling success, are to be expected." From this follows the author's second principle that, since new groups spring from plastic ancestral groups, most of the connecting links perish.

A further principle adopted by the author, though often viewed with caution by botanists, is the well-known one that ontogeny recapitulates phylogeny. That elaborate sexual mechanisms and self-sterility are, in general, of great antiquity appears to be borne out by primitive algæ and fungi. Parasitism is not to be regarded as a recent development.

His last principle states that, in cases of strict parasitism, the antiquity of the host reflects that of the parasite and *vice versa*, in that hosts and parasites evolve more or less together.

The application of these principles has led the author to the view that it is difficult to accept any starting point for the Basidiomycetes other than a primitive Ascomycete, very close to *Taphrina* and parasitic upon ancient ferns. The ancestral Basidiomycete gave rise to two main lines, one leading to the rust fungi; the other, by way of the parasitic Auriculariaceae, to the remaining Heterobasidiomycetidae and the Homobasidiomycetidae.

The second line has been characterized by a trend towards increasing saprophytic ability, increasing frequency of clamp connexions, and increasing complexity of fruiting body. The author's views as to the probable phylogenetic relationships are depicted in a number of diagrams. He is emphatic that the phenomenon of parasitism, far from being a recent development and derived from an antecedent saprophytism, is generally ancient in the fungi. The view is advanced that the Ascomycetes originated from parasitic, aquatic Phycomycetes. Saprophytism, in general, takes its place as a derivative condition from an antecedent parasitism.

## WORLD CONGRESS OF MEDICAL PRACTITIONERS FOR THE STUDY OF PRESENT-DAY LIVING CONDITIONS

A CONGRESS of medical practitioners, representing thirty countries, was held in Vienna during May 23-25, 1953, with the object of studying present-day living conditions, and the report of the Congress has now been published\*. The report begins with the opening address of the honorary president, Prof. E. Stransky, emeritus professor of neuro-psychiatry in the University of Vienna, who accepted the honorary presidency on condition that its proceedings should be non-political; but he was compelled by ill-health to hand over the direction of the Congress to the president, Prof. P. Verga, director of the Institute of Anatomy and Pathological Histology of Naples, and director of the Cancer Research Institute in that city.

The main part of the report is divided into three parts: Part I is devoted to forty-two addresses given

\* Reports and Proceedings of the World Congress of Doctors for the Study of Present-Day Living Conditions—Vienna, 23-25 May, 1953. Pp. xvi+384. (Vienna: Congrès Mondial des Médecins; London: Caversham Centre, 23 Caversham Road, N.W.3.) 10s. 6d.