BRITISH SCIENTIFIC INSTRUMENTS IN PARIS

EARLY last year an exhibition of French scientific instruments was held in the Science Museum, South Kensington. It aroused so much interest that M. René Varin, of the French Embassy, suggested to the British Council that a similar exhibition of British instruments in Paris would have a like success. Thanks to the co-operation of French scientific men and the willingness of British industry, universities and government research organizations to collaborate, the British Council was able to arrange an exhibition during May 11–17 at the Sorbonne. The rooms made available for this purpose adjoined those in which the French Physical Society was holding its annual exhibition of scientific instruments, and visitors could circulate freely from one exhibition to the other.

The new venture was an undoubted success. The exhibits, all selected for their excellence and topical interest, were 'live' in the sense that they showed the products of the instrument maker in use as research tools. In this way the French visitor not only saw up-to-date equipment both in the development and finished stages, but was also afforded a direct insight into the research work of some of the leading and most productive laboratories of Great Britain. The exhibits were explained by enthusiastic demonstrators familiar with their subjects, and whenever language difficulties arose bi-lingual representatives of the British Council and of French scientific research laboratories were ready to help. A descriptive catalogue in French gave details of the thirty-nine exhibits and of the nature of the work with which they were associated. Explanatory display cards were also provided.

A complete list of exhibits would be out of place here; but it would be true to say that all evoked much interest, while the almost permanent congestion about some marked them out as 'high-lights' from the French point of view. Among these were the micro-manipulators, the Geiger counters and cathode-ray tubes, and the electron diffraction and metal evaporating equipments. The cosmic-ray photographs shown by University of Bristol workers and those taken on the Pic du Midi by University of Manchester students and illustrating the disintegration of *V*-particles were outstanding attractions. The demonstration from King's College (London) of the application of the reflexion microscope in biology, the galvanometers used at University College (London) in physiological research, and the vacuum torsion balances of the British Electrical and Allied Industries Research Association all attracted much attention. Among exhibits from government laboratories, the electronic calculating machine from the National Physical Laboratory, the Radio Research Station's automatic ionosphere recorder (which functioned throughout the run of the exhibition without a hitch), the Atomic Energy Research Establishment's machine for producing quartz fibres, the Telecommunications Research Establishment's millimetric wave spectrometer and the 2,000-channel frequency-generator and automatically recording resistance extensometer of the Royal Aircraft Establishment aroused eager and continual interest and discussion.

There was a time when the man of science could keep abreast of the work of his colleagues by private correspondence and through publication. This is no longer possible. Enormously increased scientific activity and growing complexity of experimental methods have so swollen the literature that direct interchange of ideas and experiences is now vital to progress. This is made all the more necessary by the breaking down of the compartmentation within science owing to the rapid expansion of the borderline fields of research between two or even more disciplines. The need is only partially met by international conferences, which touch but lightly on techniques and methods, being more concerned with results and conclusions. But the ways by which results are obtained are no less important, and here the mutual interchange of visits to laboratories is of the greatest possible value. This exhibition of British scientific instruments and research is a step in the right direction in that, to some extent at least, it opened the laboratory of the British experimental scientific worker to inspection by his French colleagues, just as, during their week's stay, British visitors were given facilities to see the laboratories of the leading scientific organizations in France. It is to be hoped, therefore, that this kind of exhibition exchange between the two countries may become a regular event. There is no room for isolationist nationalism in the development of instruments and techniques for scientific research.

The exhibition was opened by Prof. E. N. da C. Andrade, and during the week lectures were given by him, Dr. V. E. Cosslett and Prof. G. I. Finch on recent work carried out in their laboratories. Yet another link between French and British science was forged by the award to Sir Thomas Merton on May 15 of this year's Holweck Prize given jointly by the Société Française de Physique and the Physical Society.

The following French scientific bodies gave valuable assistance in the organization of the exhibition: the Centre National de la Recherche Scientifique, Office National d'Études et de Recherches Aeronautiques, Commissariat à l'Énergie Atomique and the Société Française de Physique.

G. I. FINCH

TELEVISION STATION AT BIRMINGHAM

AT a meeting of the Radio Section of the Institution of Electrical Engineers on May 9, a symposium of three papers was presented on the technical features of the television broadcasting station at Sutton Coldfield, near Birmingham, which was opened for public service on December 17, 1949.

The first paper, presented by P. A. T. Bevan and H. Page, described the design, construction and service performance of the Sutton Coldfield station, which was built by the British Broadcasting Corporation as a first step in the extension of its television service to the provinces. By adopting vestigial sideband transmission for the vision programme, in place of the double sideband method installed at Alexandra Palace, London, before the Second World War and still in use there, it has been possible to provide five independent channels within the band 41–68 Mc./s. allocated to the television service in Great Britain. At Sutton Coldfield, there are two very-high-frequency transmitters—a 42-kW. vision transmitter and a 12-kW. sound transmitter, operating on carrier frequencies of 61·75 and 58·25 Mc./s., respectively. The station site is 550 ft. above sea-level, and both the sound and vision signals are radiated from the same aerial system, comprising two tiers of four vertical half-wave folded dipoles, erected at the top of a mast 750 ft. high. The design and method of feeding this aerial system from the transmitter are such as to give a horizontal radiation-pattern, which is substantially uniform in all directions and over the required band of frequencies. A field-strength survey from the new station has been carried out by the B.B.C., and this has shown that, up to a range of about fifty miles, the field strength is generally greater than 0·5 mV./m. Based on experience of viewing conditions, it is considered that reception within this area will be good, but may be subject to interference where local conditions are severe. A useful signal of 0·1 mV./m. or more can be received at distances up to sixty-five miles from the transmitting station, but this may be subject to severe interference and to some fading. Viewing conditions at greater distances, while still possible, will depend markedly on the terrain between transmitter and receiver and on the occurrence of favourable weather conditions.

The paper by Bevan and Page includes a description of the layout of the station and equipment at Sutton Coldfield, the power supplies and control mechanism, and the aerial and transmission-line system. The vision transmitter itself was described in more detail in the second paper, by E. A. Nind and E. McP. Leyton, in which it is pointed out that in some respects the new transmitter resembles that of the London station erected in 1936. In both cases high-level modulation is used; but in order to reduce liability to amplitude distortion, the output radio-frequency amplifier of the Sutton Coldfield transmitter is cathode-driven, whereas in the former case grid-drive was used. The description of the transmitter given in this paper is general where the technique is well established, but is more detailed where novel parts of the equipment are concerned.

The third paper presented at the meeting, that by E. C. Cork, describes the design, construction and performance of the vestigial sideband filter circuit installed at the Sutton Coldfield station. The basic design formulæ relevant to the filter network are given, together with a description of the practical circuit and construction adopted. The results of measurements of the attenuation characteristics of the filter show that there is good agreement between its performance and that of the idealized network.

These three papers form a very good and useful record of the design, construction and equipment of the first high-power television broadcasting station to be built in the world.

INSTABILITY OF SMALL PLANETARY CORES

Two papers, by W. H. Ramsey and M. J. Lighthill, respectively, "On the Instability of Small Planetary Cores", have recently been published (*Mon. Not. Roy. Astro. Soc.*, 110, 4; 1950). Previous papers by Ramsey on the subject, to which reference has been made in *Nature*[1], suggested that the large jump in density at the boundary of the earth's core is not due to the appearance of new material but to a phase transition under pressure. Variation of density within the earth is, then, primarily due to the influence of pressure, and seismology provides the pressure–density relationship for the material. On the assumption that the other terrestrial planets have the same chemical composition as the earth, their mean densities can be computed, and Ramsey's results have been published[2]. In the course of the calculations it was found that very small cores are unstable and for this reason would not occur in Nature—a direct consequence of the main assumption that the jump in density at the boundary of the core is controlled by pressure.

A more comprehensive treatment of the subject is given in the two latest papers; in the first one, by Ramsey, it is assumed that the planets are composed of a material which is incompressible, both above and below the critical pressure, and in the second paper, by Lighthill, it is shown that the main conclusions of Ramsey's paper are valid also in the case of a compressible material. The problem is beset with many difficulties and, as Ramsey admits, in its more general form is mathematically cumbersome, but the assumption of incompressibility adds considerably to a simplified treatment of the subject. It is impossible in this article to do more than merely indicate some of the conclusions attained.

It is shown that the mass M is normally an increasing function of the pressure P, that is, dM/dP is normally positive. If the mass be M_0 when the critical pressure p_c is attained for the phase transition at the boundary of the core, the derivative dM/dP is discontinuous, and Lighthill shows that the derivative alters by a factor $(2\lambda - 3)/\lambda^2$, if the density jumps from ρ_0 to $\lambda\rho_0$ at the critical pressure, so that the derivative becomes negative if λ exceeds 1·5. Hence the mass decreases below M_0, attains a maximum value M_1, and then increases again. As a consequence of this a planet can exist in three different equilibrium states if its mass lies between M_0 and M_1, which Ramsey denotes by A, B and C. State A has no core and states B and C have cores, that in state C being the larger. While states A and C are stable, state B is unstable, and a transition from A to C or from C to A is prevented by the energy barrier separating them. But if the mass is M_0 or M_1, a transition is possible; in the former case A and B coalesce, C being the only stable state; in the latter case B and C coalesce and A is the only stable state. As the masses M_0 and M_1 depend on the thermal condition of the planet, and as the mean internal temperature of a planet may have changed by 10,000° C. or more during its evolution, M_0 and M_1 could alter by about ten per cent. This possibility is important, because it is not essential that a planet should be in the critical mass range M_0–M_1 during its entire history. Moreover, this possible variation in temperature is not based on any theory of the origin of the solar system.

For the terrestrial planets M_0 is about 0·80 M_E, where M_E is the mass of the earth. While this is smaller than the mass of Venus by about 2 per cent, it is conceivable that M_0 could have changed by this amount during geological time, and hence Venus might have undergone a transition by this amount in this period; but Venus and the earth are the only planets to which this could have happened. A planet crossing the critical range, passing from one configuration to another, would release energy of the order 10^{37} ergs and could remove 0·1–1·0 per cent of the mass from the surface, and blast-waves and vibrations of the planet as a whole would shatter the material, fragments flying off into space. It is