# EDUCATION GROUP OF THE INSTITUTE OF PHYSICS

## ANNUAL CONFERENCE

At the annual conference of the Education Group of the Institute of Physics, held in London during April 5–6, the topic on the first day was the teaching of atomic and nuclear physics. On the succeeding day the conference discussed the adequacy of the Advanced Level examinations of the General Certificate of Education as criteria for university selection.

Opening the first session, Prof. P. B. Moon and Prof. W. E. Burcham (University of Birmingham), in a joint paper read by the latter, described the modern physics content of their honours physics courses at Birmingham. At school, the student would have acquired some awareness of the applications of nuclear physics and would use the concepts of atom and electron in chemistry, but with no detailed knowledge of quantum theory. The university course aims at showing the development of modern physics from the basis of classical physics, withholding the more difficult concepts until the student is mature enough to grasp them—quantum mechanics, for example, belonging to the postgraduate courses. The inter-relation of physics with other studies, such as chemistry and engineering, means that the courses must be planned in co-operation with other faculties; and the inter-relations between various parts of physics can provide analogies to introduce modern concepts, since the main difference between atomic physics and ordinary classical physics is simply one of scale. The first year of the honours physics course at Birmingham is a consolidation of school work, without any particular emphasis on physics itself.

The second-year course includes ionization, radioactivity and spectroscopy as an introduction to the Bohr-orbit atom. Descriptive lectures on nuclear physics are given in the third year, with some advanced lectures on special topics such as luminescence and high-energy machines; and some of the practical work at this stage is done as an assistant to a research team. A good deal of formal instruction is given in the postgraduate courses, during which time the student's capacity for original thinking is developed.

Mr. A. L. Chick (Associated Electrical Industries, Ltd., Aldermaston) spoke of the training of the research worker as an individual, and the creation of a research team as a unit. The modern research laboratory is also a teaching institution, and the lecture courses at Aldermaston include mathematics, electronics, vacuum work, and nuclear physics. Mr. Chick described how a research group convened to design and operate a small research reactor was trained on a project of almost comparable scale, the erection of a Van de Graaff generator and its use on a programme of fundamental research on the spin and parity of nuclear energy levels. While valuable results were obtained incidentally, the real aim was to train the team in the techniques they will apply to the reactor.

The chairman of the Education Group, Dr. J. Topping (principal of Acton Technical College), gave, with his colleague, Dr. J. W. Warren, an outline of the part-time day-release courses at Acton. Among special topics in the syllabus are instrumentation, heat transfer, the use of boiling liquid metal coolants, the properties of materials at high pressures and temperatures, the effects of radiation on materials, the processing of active material, and health physics. Practice in numerical computation and some experimental work are also included. The whole outlook of the course is practical, differing entirely from that given at a university where the ambient atmosphere is one of preoccupation with fundamental research. Indeed, as Dr. Warren added, the only theory really needed is the mass–energy relationship.

The next speaker, Mr. W. O. Peacocke (St. John's School, Leatherhead), then described the work he has been doing with sixth-form boys, using apparatus very largely made by the boys themselves. Given a Geiger counter, a scaling unit and suitable radioactive sources, several good demonstrations to illustrate the historical development of nuclear physics can be presented. The dozen or more class experiments, as performed by boys using microcurie quantities for safety reasons, were impressive in the extreme. Mr. Peacocke, like Joule and Tyndall, is able to relax even amid the rigours of an Alpine holiday and enjoy a little physics; and, having taken his nuclear emulsion plates to a mountain-top, he gave his pupils an excellent project of plate-searching and mosaic-building which produced fine photographs of cosmic ray events. Enterprise of this kind, while enriching the experience of a few fortunate pupils, has a far wider effect in opening the eyes of other teachers to the possibilities available.

Dr. J. M. A. Lenihan (Western Regional Hospital Board, Glasgow) gave his personal impressions of the Geneva Conference on the Peaceful Uses of Atomic Energy. He felt that the participating countries had really laid down their cards, and seemed in fact to have been following almost the same lines independently. In the United States, a long-term programme to discover the most efficient type of reactor is being planned; the U.S.S.R., some way behind, seems urged rather by the propaganda value of the achievement than the actual need for power. Great Britain, he said, urgently needs power to supplement coal resources and is committed to a rather unsophisticated type of reactor to yield results reasonably soon.

The discussion on the adequacy of the Advanced Level examinations of the General Certificate of Education as a guide to university selection was opened by Miss K. E. Parks (North London Collegiate School) and Mr. J. A. Ratcliffe (Cavendish Laboratory, Cambridge). Remarking that the examination was never intended as a university entrance test, Miss Parks suggested that both the syllabus and the number of questions to be answered should be reduced. General fitness for further education might be tested separately, say by means of an essay; and a clearing-house system like that of the teacher-training colleges might simplify matters. Final selection for entry into a special honours course might well be postponed until the end of the first university year; and, whether or not future promise can be assessed beforehand, the actual progress made

by a student when he is there depends on the effectiveness of the tutorial guidance at the university. Mr. Ratcliffe also expressed a preference for a shorter syllabus, and a more intelligently searching kind of question. From the point of view of the university, which aims at training people to think, he felt it unfortunate that so many students go up having done physics at school; for they arrive completely misunderstanding the fundamentals, complacently superior towards the important simple things, and loving mathematical proofs for their own sake. After naming specific topics which he would like to see omitted from the Advanced Level syllabus, he said that he regards electricity as the most satisfying part of the work, since it compels a logical treatment; and he noted with interest the Science Masters' Association report on "The Teaching of Electricity", with its logical treatment quite different from the usual historical approach.

During the discussion, Dr. H. R. Lang (secretary of the Institute of Physics) said that physics could certainly be started at the university, and the new transfer scholarship scheme of Imperial Chemical Industries, Ltd. (see *Nature* of March 31, p. 606) would soon be promoting this. This scheme, incidentally, may miss some of the best boys, since those who have never done science at school might be unaware of the satisfactions it offers.

At the final session of the conference a short paper on sandwich diploma courses, by Prof. M. R. Gavin (University College of North Wales, Bangor), explained the aims and organization of the four-year courses that he had inaugurated at Birmingham, the standards expected, and the award to be given at the end. This was followed by some figures on specialization in the sixth forms of grammar schools, collected by Dr. N. Thompson (University of Bristol). He felt that the proportion of the time allotted to specialist subjects was excessive; but schoolmasters in the discussion were divided on the point, since the really relevant matter is the way the remaining time is used.

G. R. NOAKES

## ENRICO FERMI AND HIS CONTRIBUTIONS TO PHYSICS

HALF of an issue of the *Reviews of Modern Physics* (27, No. 3, 249; 1955) is dedicated to the memory of the late Prof. Enrico Fermi, one-time president of the American Physical Society, who died on November 29, 1954, and consists of the proceedings of the memorial symposium held at the Washington meeting of the Society on April 29, 1955, over which Prof. H. A. Bethe presided. It contains addresses by F. Seitz, E. J. Konopinski, E. Segré, W. H. Zinn and H. L. Anderson, together with photographs of sample pages from Prof. Fermi's numerous notebooks which are now being preserved in the Harper Memorial Library of the University of Chicago. The speakers were introduced individually by Prof. Bethe, who referred, in his opening remarks, to Fermi as "unique among the great physicists of the twentieth century in being one of the greatest in experimental physics and at the same time being one of the greatest theoretical physicists. He was unique also in the width of contributions. He may have been one of the last physicists who knew almost all of physics and used it in his research".

Prof. Seitz spoke about Fermi statistics and its applications, and Prof. Konopinski about Fermi's theory of beta-decay, and these two lectures illustrate how two small theoretical articles originally contributed by Fermi to the *Zeitschrift für Physik* in 1928 and 1934, respectively, came to have such tremendous influence on the progress of physics in recent years. Profs. Segré, Zinn and Anderson deal with different aspects of Fermi's experimental work during the past twenty years. Prof. Segré gives an interesting description, including many personal reminiscences, of the work on neutrons performed by Fermi and his school in Rome during 1934–35 and for which Fermi was awarded a Nobel Prize in 1938. Early in 1939, just about the time when the news of uranium fission reached America, Fermi arrived in the United States and became engaged on the work—atomic energy—which was to occupy his attention for the rest of his life. Prof. Zinn, in describing the part played by Fermi in the atomic energy project, considers three separate periods: the first, January 1939 to May 1942, when Fermi's work was centred on Columbia University; the second, May 1942 to the winter of 1943–44, when Fermi's work was mainly directed towards bringing about the self-sustaining chain reaction and the construction and operation of the production piles at the Hanford Engineering Works of the Manhattan District; and the third, after May 1944, when Fermi transferred to the Los Alamos Laboratory in New Mexico and finally to Chicago.

In Chicago Prof. Anderson was actively associated with Fermi and was engaged on scattering experiments using intense beams of mesons obtained from a large synchrocyclotron. Prof. Anderson describes in his talk the close personal interest, even to the actual construction with his own hands of several pieces of apparatus and the observation of various instruments, that Fermi took in the experiments. The object of the investigation was to uncover the part that $\pi$-mesons play in the nuclear interaction; and though Fermi did not live long enough to see all his predictions verified, his clear understanding of this, in addition to many other similar problems, pointed the way to the present knowledge of the pseudoscalar nature, strong coupling, short-range interaction, charge independence and causal behaviour of $\pi$-mesons.

## THE BOSE INSTITUTE, CALCUTTA

THE thirty-eighth anniversary meeting of the foundation of the Bose Institute was celebrated on November 30, when (the late) Dr. Sunder Lal Hora delivered the seventeenth Acharya Jagadish Chandra Memorial Lecture. He chose as his subject "Conflict versus Co-operation as Factors in Evolution".

The director, Dr. D. M. Bose, in his report reviewed the activities of the Bose Institute for the past year. He said that the Institute had submitted to the Central Government plans and estimates for expansion of activities during the second five years. All the plans for expansion of the research activities of the Institute depended on the provision of additional buildings for laboratory accommodation. For this purpose additional land for building purposes is necessary, as there is very little land available in the present location of the Institute. He pointed out that to the west of the Institute the Corporation of