$$^{12}_{6}C + ^{1}_{1}H \rightarrow ^{7}_{4}Be + 3p + 3n.$$

Beryllium-7 has a long half-life of 53 days, so that its strength builds up over a long period. Now in the cyclotron it is necessary to shield the electrodes from the protons scattered from the targets being used in the experiments described previously. The cyclotron group decided to use carbon for this purpose, thus producing as much as 10^{-8} gm. of beryllium-7 every two months while the cyclotron is being used for its main programme. This beryllium-7 has been extracted by Dr. Butement and has been used as a target in further experiments. Dr. R. C. Hanna has shown that it absorbs slow neutrons very strongly ($\sigma = 10^4$ barn).

I will now describe another group of experiments carried out with high-energy quanta produced by the electron synchrotron at Harwell or by the 17·6- and 14-MeV. γ-rays produced by the well-known reaction of protons on lithium. The synchrotron produces electrons of about 23 MeV. energy, and these electrons produce quanta of X-rays when they strike a target. When these quanta enter a nucleus, they set the nucleus into vibration and transfer the energy of the quanta to it. The nucleus can then break up by emitting one or more particles.

To do this the Harwell workers in Mr. Goward's and Dr. Titterton's groups introduced various elements into the emulsion of the special nuclear photographic plates. The nuclei of these elements absorb a quanta and are disintegrated, and the tracks of the particles are made visible on development.

One group of experiments was devoted to the photodisintegration of light nuclei. They showed that in the photodisruption of the nucleus many different types of nuclei are flung out. They include neutrons, protons, deuterons, tritons, helium nuclei and beryllium nuclei. Dr. Titterton and Mr. Brinkworth exposed plates loaded with the separated light isotope of lithium, namely, lithium-6. When these were exposed to 17·6-MeV. γ-rays, V-shaped tracks were found. It appears that these are due to a neutron being ejected from lithium-6, leaving the radioactive nuclei of lithium-5 behind:

$$^{6}Li + h\nu \rightarrow ^{1}n + ^{5}Li.$$

This lithium-5 nucleus is known to have a very short life—of the order of 10^{-21} sec. It breaks up in flight into a proton and helium-4, producing a typical V track. A detailed study of the events shows that in some cases lithium-5 is found in a state having about 2·5 MeV. excess energy.

In another experiment, the plates were loaded with the lithium-7 isotope and again exposed to 17·6-MeV. radiation. Some of these showed the long track of an energetic proton and a very short track of a heavy recoiling nucleus. It appears, then, that the disruption of a quantum ejects a proton from the nuclei, leaving behind a nucleus of helium-6:

$$^{7}Li + h\nu \rightarrow ^{1}H + ^{6}He.$$

Then plates loaded with lithium-7 were exposed to these same 17·6-MeV. gamma-rays. In this case a triton was ejected from the lithium-7 nucleus:

$$^{7}Li + h\nu \rightarrow ^{4}He + T\text{; also } ^{11}B + h\nu \rightarrow T + ^{8}Be.$$

The fourth experiment, by Goward and Wilkins, studied the photodisintegration of carbon-12 nuclei. In this case the long track of a helium nucleus and heavy V-shaped tracks at one end were found. The ejection of the helium nucleus leaves behind a beryllium-8 nucleus which is unstable and immediately breaks up into two α-particles which recoil in opposite directions. The beryllium-8 nucleus is, however, moving at high speed before it breaks up, so that the two α-particles carry the momentum but diverge due to the mutual recoil.

The fifth experiment, using plates loaded with boron-11, shows a rather similar event. In this case the boron-11 nucleus breaks up into a triton and a beryllium-8 nucleus moving in opposite directions. The beryllium-8 nucleus then breaks up into two α-particles giving the characteristic V-shaped track.

In a sixth experiment, carbon and oxygen were irradiated with gamma-rays having energies up to 80 MeV. Carbon disintegrated into three α-particles and oxygen into four α-particles. On examining how the chances of these disintegrations vary with energy, Goward and Wilkins found that there were two prominent resonances in the energies at which they occur.

Conclusion

I have dealt mainly with the Harwell contributions to this new and exciting field of high-energy physics.

In this field the cosmic ray workers using high-energy particles provided by Nature have been the pioneers, and the schools of Bristol and Manchester have discovered the π-, the k- and τ- and the ν-mesons since the War. The high-energy machines are an essential complement to this work, since it is only by their help that we can investigate nuclear forces and the process of creation of mesons in sufficient detail to arrive at an understanding.

Work is proceeding in many laboratories in the United States and will soon be starting in Glasgow, Birmingham and Liverpool as their powerful new machines come into operation. We can be confident that we have at least a decade of work in front of us as the frontiers of our knowledge of the physical world are still further advanced.

OBITUARIES

Prof. A. L. Mellanby

Alexander Lawson Mellanby, emeritus professor of civil and mechanical engineering in the Royal Technical College, Glasgow, died at Bridge-of-Weir, after a short illness, on November 26.

He was born at Hartlepool on July 3, 1871, and was educated at Barnard Castle School. After an apprenticeship at the Central Marine Works, Hartlepool, he entered Durham College of Science, and graduated B.Sc. with honours. He was awarded an 1851 Research Scholarship and went to McGill University, where he carried out research on the reciprocating steam engine. Returning to Great Britain he was appointed chief technical assistant with T. Richardson and Sons, engineers, of Hartlepool, but after a year left industry to enter the academic profession, in which he remained for the rest of his professional life.

His first appointment in this field was as chief lecturer in engineering at Battersea Polytechnic in 1898. Shortly afterwards he was appointed to the Manchester College of Technology as assistant to Prof. J. T. Nicolson, and took a large part in designing and equipping the laboratories, workshops and power station of that College. In 1905 he was appointed to the chair of motive power engineering at the Royal

Technical College, Glasgow, and was in the service of the College until he retired in 1936. His success in this chair was such that first the Department of Applied Mechanics and later the Department of Civil Engineering were merged with his Department into a single Department of Civil and Mechanical Engineering and Applied Mechanics.

Prof. Mellanby was one of the first to realize the importance of experimental work in engineering courses, and, soon after his appointment to the Royal Technical College, he established a heat engines laboratory, outstanding at that time for its size, range and standard of equipment. In those days technical colleges suffered severely from financial and staff limitations; but Mellanby saw that, without adequate experimental facilities, the highest levels of teaching and research would never be reached. His own work lay mainly in the field of steam and internal combustion engines. Following on his early work on reciprocating engines he took up an intensive study of the flow of steam through nozzles, and was the author of many papers, some of which were in collaboration with Dr. Wm. Kerr, who later succeeded him in the chair. He took an important part in the work of the Marine Oil Engine Trials' Committee, a joint committee of the Institution of Mechanical Engineers and the Institution of Naval Architects, which carried out a series of authoritative trials on marine oil engines of different types. His services were widely sought as a consultant, and special reference was made to this when the University of Glasgow conferred the LL.D. degree upon him in 1936. He served as a member of Council of the Institution of Mechanical Engineers, and took an active part in the operation of the national certificate scheme for engineering students in Scotland. He was a firm believer in academic institutions maintaining close contact with the world of practice and, at an early stage, fostered the establishment of sponsored research projects for industry.

Intellectually a man of science and professionally an engineer, Prof. Mellanby had the sure instinct of the former for the fundamental factors in a complex problem, and the sound judgment of the latter on all practical issues. He deprecated narrow specialization, whether in courses of study, staff training, experimental method or technical authorship, holding that range was essential to quality of judgment. He made many contributions to technical literature, all of which kept in proper balance and perspective the fundamental and practical issues. He was deeply concerned with the welfare of his students and, long after they had left the College, he followed their careers with interest, always willing to give advice in the solution of problems or a helping hand towards further advancement. Few professors had more sympathy with the struggling part-time student, and nothing gave him greater pleasure than to pick out the really talented from this group and assist them to transfer to full-time courses.

Throughout the long period of his retirement, his activity of mind and body remained unimpaired almost up to the last, and his interest in matters educational and practical was unabated. In him human, social and professional qualities were not only fine but also finely balanced, and they were exercised with a quiet dignity and a true sense of duty and service. He will be very much missed in engineering and academic circles in Glasgow and the west of Scotland, and indeed over a much wider area.

DAVID S. ANDERSON

Prof. Rikiti Sekiguti

PROF. RIKITI SEKIGUTI, formerly director of the Tokyo Astronomical Observatory, Mitaka, near Tokyo, died suddenly from heart failure on August 10 at Kamakura.

Sekiguti graduated at the University of Tokyo in 1907, taking astronomy as his subject. He served in meteorological observatories—at a weather station in Korea, at the Marine Meteorological Observatory at Kobe, and for a time as the head of the Solar Section of the Central Meteorological Observatory. Meanwhile he was sent to Europe for study, and worked at Cambridge with the late Prof. H. F. Newall for about a year. In 1936 he was made a professor of astrophysics in the University of Tokyo and the director of the Tokyo Astronomical Observatory. He taught astrophysics to students of astronomy at the University for more than ten years until his retirement at the age of sixty in 1946. At one time he served in the Government as the head of the Special Education Bureau of the Ministry of Education, and took several important steps for the promotion of scientific research.

Sekiguti's main scientific work was devoted to meteorology and oceanography. He developed solar meteorology by applying Margules's theory to the solar atmosphere. He took part in the solar eclipse of 1936, using a small spectrograph of his own design, and announced the recognition of several new spectral lines.

Sekiguti was a good writer. He published several books in Japanese, "The Sun", "Astrophysics", "Introduction to Astronomy", etc. He was an enthusiastic and hard worker in any subject he took up. The Tokyo Observatory was damaged towards the end of the Second World War, and since then his health had declined. His daughter is married to Dr. Shinichiro Tomonaga, a well-known nuclear physicist.

Y. HAGIHARA

Dr. S. Hill

DR. SYDNEY HILL, who died as a result of a street accident on November 27, in his twenty-eighth year, was educated at Holt High School, Liverpool, and proceeded to the University of Liverpool, where he graduated B.Sc.(Hons.) in 1943 and was awarded the Campbell Brown Fellowship. He joined the staff of Peter Spence and Sons, Ltd., in 1943 and was granted leave of absence during 1945–48 to take up the Fellowship, and was awarded a Ph.D. in 1948 for research work in electrochemistry. This work was the subject of several papers published jointly with A. Hickling in the *Transactions of the Faraday Society* and the *Journal of the Electrochemical Society*. Dr. Hill returned to industrial work and at the time of his death was engaged in further electrochemical investigations. His tragic death at an early age closes a career that held great future promise. He was unmarried.

WE regret to announce the following deaths:

Lord Addison, K.G., P.C., chairman in 1948 of the Medical Research Council, on December 11, aged eighty-two.

Prof. H. S. Raper, C.B.E., F.R.S, dean of the Medical School and professor of chemical physiology in the University of Manchester, on December 12, aged sixty-nine.