To justify such continuous operation many more experiments were necessary and these were being discussed with the National Institute for Research in Nuclear Science on behalf of several universities, and with other bodies with the view of operating continuously from 3–5 MW starting at some date in 1963. Unfortunately, the climate in the whole of the atomic energy field deteriorated rapidly, and in view of the grave uncertainty over external contracts it was decided that the reactor should be closed down.

T. E. ALLIBONE

[1] Allibone, T. E., *Nature*, 184, B.A. 11 (1959).

OBITUARY

Prof. Niels Bohr, For.Mem.R.S.

BY the death, on November 18, of Niels Bohr we have lost the most distinguished physicist of our time, the founder of the quantum theory of atomic structure, a natural philosopher whose profound insight enabled us to understand the complementary dual behaviour of atomic objects and who was a pioneer in explaining the internal behaviour of atomic nuclei.

Niels Bohr was born on October 7, 1885, the eldest son of Christian Bohr, professor of physiology in the University of Copenhagen. In his youth both he and his brother, Harald Bohr, the mathematician, were expert footballers. After taking his doctorate in 1911 he went to the Cavendish Laboratory at the time J. J. Thomson was putting forward his "plum pudding model" of atomic structure—a sphere with positive electricity distributed uniformly with electrons embedded in it. From the Cavendish, Bohr moved in 1912 to work for a few months with Rutherford, who in the previous year had published his theory of the nuclear atom. The difficulty of the theory was to understand why the electrons did not fall into the nucleus, and Bohr's profound contribution was to quantize the orbits of the electrons and, in particular, to show how the line spectra of hydrogen could be explained by quantized transitions between orbits. Rutherford's first reaction in March 1913 was to write, "Your ideas as to the mode of origin of spectra in hydrogen are very ingenious and seem to work out well; but the mixture of Planck's ideas with the old mechanics makes it very difficult to form a physical idea of what is the basis of it all". Bohr's ideas also explained how the physical and chemical properties of every element could be based on the atomic number, the number of units of positive charge in the nucleus. From this it also became clear how the emission of α- and β-rays from heavy nuclei would shift the nucleus two places down or up in the Periodic Table.

At the meeting of the British Association in the autumn of 1913, Bohr's ideas were discussed, and according to Bohr, Jeans's introductory survey of the application of the quantum theory to the problems of atomic constitution was "the first public expression of serious interest in considerations which outside the Manchester group were generally received with scepticism".

During the autumn of 1914, Bohr returned to Manchester with his wife, Margrethe, to succeed Darwin as Schuster's reader in mathematical physics, and for a time worked with Makower on building apparatus to investigate phenomena in the Franck–Hertz experiments on quantum phenomena in the excitation of atoms. However, the fine quartz apparatus built by a German glass-blower was ruined in an accident, and Bohr soon afterwards returned to a new chair of theoretical physics in Copenhagen. In 1920 he was appointed the first director of the newly created Institute of Physics. The Bohr Institute soon became a magnet for theoretical physicists from many countries—his visitors and students included Kramers, Heisenberg, Pauli, Darwin, Dirac, Fowler, Hartree, Mott, Landau, Peierls, and many others who in turn became leaders in their own country. Of this period Bohr has said that "a unique co-operation of theoretical physicists from many countries created, step by step, a logically consistent generalization of classical mechanics and electro magnetism and has sometimes been described as the heroic age in quantum physics. Many obstacles had to be overcome before this goal was reached and time and time again progress was achieved by some of the youngest of us".

In May 1930 Bohr visited Cambridge to give in the Scott Lectures an account of his ideas on the complementary nature of different aspects of behaviour of 'atomic objects'. He discussed how the interaction between the 'atomic object' and the measuring tools prevented unambiguous answers as to whether the atomic object was a particle or a wave. Bohr was always difficult to hear and understand, and I had the difficult task of writing a verbatim account of his lecture and sending it to him to be used for publication.

In 1936 Bohr invented the liquid drop model of the nucleus, which was later to have great importance in understanding the phenomenon of fission and of the different modes of excitation of nuclei when disturbed.

When the fission of uranium by neutrons was discovered in January 1939 and the physical character of fission elucidated by the experiments of Frisch and Meitner, Bohr was on his way to Washington and took part in the discussions on the fission phenomena. By February he suggested in a letter to the *Physical Review* that it was mainly the isotope U-235 which was fissioned by slow neutrons, while the U-238 isotope would usually absorb the neutrons without fission. This led to the realization that the isotope separation of U-235 would be necessary to produce a fast chain reaction.

When Denmark was invaded in 1940, Bohr felt it his duty to remain there to protect the refugee scientists at his Institute. In the autumn of 1943, however, it became known that Hitler's policy towards the Danish Jews was to change and that Bohr, whose mother was of Jewish stock, was to be arrested. He and his wife and four sons escaped in small boats to Sweden. In accordance with a pre-arranged British plan, he was then flown on October 6, 1943, in a Royal Air Force *Mosquito* to Britain; failing to get oxygen, he was unconscious for most of the flight. His son Aage, who was also a physicist and was to act as his personal assistant, arrived a few days later. Bohr was welcomed by Chadwick and many friends, including myself. Chadwick was about to depart for the United States to resume co-operation with U.S. scientists on atomic energy.

Niels and Aage Bohr joined the British Group in December 1943, and Niels was known as Mr. Nicholas Baker and his son as Jim Baker. They were provided with guards by the Manhattan Project wherever they went in the United States. The guards turned out to be most useful in preventing Niels Bohr crossing the streets against the traffic lights. Bohr paid extensive visits to Los Alamos, where he took considerable interest in the theory and design of the atom bomb and acted as a father confessor or tranquillizer to the high-powered and sometimes temperamental physicists.

As soon as Bohr heard how far the development of the bomb had gone he was struck by the political implications. He saw it not only as a great threat to the world but also as a great opportunity to bring about a saner international order. He discussed this with Sir John Anderson, who was in charge of the British atomic energy project, and in May 1944 he had an unfruitful interview with Mr. Winston Churchill. Later, in August of that year, he obtained through Mr. Justice Frankfurter an interview with President Roosevelt and urged him to inform the Russians about the existence of the bomb though not the details, "in an effort to achieve international control and to head off a fateful arms race". Drs. Vannevar Bush and J. B. Conant were also thinking at this time about the establishment of an International Control Agency with Russian membership. When the President and Prime Minister met on September 18, 1944, they considered Bohr's suggestions but decided that the project should continue to have the utmost secrecy.

The idea of the international control of atomic energy was, however, pursued by Bush and Conant and led to the Acheson–Lilienthal proposals for international control, which in the end came to nothing in the face of Russian opposition in the United Nations.

In his later years Bohr continued to devote a great deal of thought to these problems and I have on several occasions walked round and round the grounds of his "House of Honour" at Gamle Carlsberg hearing about his discussions with Sir John Anderson and an account of his interviews with Sir Winston Churchill and President Roosevelt.

During this period Bohr was a founder member of CERN and took a great interest in its development. A meeting at his Institute decided what type of accelerator should be built, and the Theoretical Physics Group of CERN was first located in Copenhagen.

The 1962 Lindau Conference was saddened by Bohr's having a minor attack of the illness which finally led to his death.

Throughout his life Bohr was greatly helped by his wife, Margrethe, a daughter of the mathematician Prof. Norlund, who presided over the "House of Honour"—a hospitable house where innumerable Institute parties were held in the great conservatory with music and talk and barrels of Carlsberg beer provided by the science-loving brewery.

Bohr received the Nobel Prize in 1922 and was elected a Foreign Member of the Royal Society in 1926. He received the highest Danish honour of the Order of the Elephant and the Atoms for Peace Award in 1953.

We will remember him above all for his humanity and his great friendliness to, and encouragement of, young scientists. JOHN COCKCROFT

NEWS and VIEWS

Wykeham Professorship of Physics, Oxford: Prof. R. Peierls, C.B.E., F.R.S.

PROF. RUDOLF PEIERLS, professor of mathematical physics in the University of Birmingham, has been elected to the Wykeham professorship of physics in the University of Oxford, and will take up his new position in October 1963. He succeeds Prof. W. E. Lamb, jun., who has been appointed Ford professor of physics in Yale University. Prof. Peierls was born in Berlin in 1907, and received important parts of his education at the Universities of Berlin, Munich, Leipzig and the Technical High School in Zurich. When he went to Manchester as Research Fellow in 1933 he was already very well known for his pioneering researches on the quantum theory of thermal conductivity and other solid-state phenomena, and for his work with Landau on quantum electrodynamics. He was at the Mond Laboratory, Cambridge, during 1935–37, where important contributions to the theory of co-operative phenomena and nuclear reactions were made. Except for a period during the War when he was engaged on the atomic energy project in the United States, Peierls has been at Birmingham since 1937, first as professor of applied mathematics, and then as professor of mathematical physics. Under his guidance and stimulating leadership a very important school of theoretical physics has developed at Birmingham.

Peierls was awarded a C.B.E. in 1946 and was elected a Fellow of the Royal Society in 1945, receiving its Royal Medal in 1959. He is a member of the Governing Board of the National Institute for Research in Nuclear Science. Besides numerous research papers in many different branches of theoretical physics, Peierls has written two highly regarded books, *Quantum Theory of Solids* (1955) and *The Laws of Nature* (1956). His transfer to Oxford is a very favourable development for that University, where the activities in experimental physics cover a wide range, which, however, is fully matched by the breadth of the new professor's interests and talents.

Zoology at Edinburgh: Prof. J. M. Mitchison

DR. JOHN MURDOCH MITCHISON, at present reader in zoology in the University of Edinburgh, has been appointed to the chair of zoology at that University. This chair, which is in addition to the chair of natural history occupied by Prof. M. Swann, has not been filled since Prof. J. H. Ashworth was transferred in 1927 to the chair of natural history. The appointment will take effect from January 1. Dr. Mitchison's undergraduate career at Trinity College, Cambridge, was interrupted by war service spent in Army Operational Research, in which he attained the rank of major. Nevertheless, he added in 1946 a first-class honours in Part 2 of the Natural Science Tripos to the first-class honours in Part 1 which he had gained in 1941. He spent the period from 1947 until 1953 in research in the Department of Zoology at Cambridge, and was awarded the degree of Ph.D. in 1950. In the same