

Quantum Mechanism in the Atom.

AT a meeting of the Royal Society of Edinburgh on May 8 Prof. E. T. Whittaker read a paper on the quantum mechanism in the atom (since published in Proc. Roy. Soc. Edin., vol. xlii. pp. 129-142).

Prof. Whittaker shows that it is possible to explain quantum phenomena satisfactorily in terms of the classical electrodynamics without postulating any structure in the atom beyond that by which it is customary to explain induced magnetisation. The author considers the effect of an approaching electron in producing a "magnetic current" in the atom; up to a certain velocity of approach the electron does not get beyond the atom but suffers an "elastic impact" which repels it without loss of energy. When, however, the velocity of approach exceeds this critical value the electron passes through the magnetic atom and gives to it energy of exactly that amount or quantum which corresponds with the critical velocity. The transformation of this energy into radiant energy can be explained by generalising the conception; thus the magnetic current becomes equivalent to a charged condenser, partaking of the nature of a Hertzian oscillator. By a simple mathematical process, combined with the assumption that the oscillators in the atoms are similar to each other in structure and differ only in scale, the equation $h\nu = U$ can be established, giving Planck's relation connecting the frequency, ν , of the emitted radiation with the amount of kinetic energy, U , absorbed from the bombarding electron. A more definite form to the quantum mechanism is given by linking a conducting circuit with the magnetic structure. Photo-electric phenomena can be interpreted on the basis of this theory, and Bohr's theory of series-spectra likewise finds an explanation.

Sir Alfred Ewing suggested that instead of following Prof. Whittaker in leaving the magnetic atomic model at a certain point there is perhaps an advantage in not dropping the model, especially as it seems to give an immediate explanation of the manner in which oscillations are set up as the electron parts with its quantum of energy. In the Ewing magnetic model the central magnetic system or wheel is controlled by an outer system or ring. When an electron passes through and escapes it gives an impulse producing relative angular displacement of

inner wheel and outer ring, and the mutual magnetic forces tend to restore the original configuration. Oscillations are set up which expend their energy in emitted radiation. Conversely, in an atom in which oscillations are going on, an electron may be ejected (photo-electric effect). In being ejected it exerts an angular impulse which stops the oscillation and deprives the atom of the quantum of energy originally absorbed through resonance.

Dr. H. S. Allen directed attention to the fact that in Prof. Whittaker's "calamoids," or four-dimensional tubes of electromagnetic force, as well as in the Ewing magnetic model, magnetic forces rank on an equality with electrostatic forces. The number of magnetic tubes associated with Prof. Whittaker's magneton must be an integral number of times the unit quantum tube of magnetic induction. More satisfactory is a modified form of the quantum mechanism, in which two ring electrons are placed near together on the same axis, the electromagnetic force between them being repulsive. Such models cannot, in Dr. Allen's opinion, "reconcile" quantum dynamics with classical dynamics.

Dr. R. A. Houstoun suggested the advisability of testing Prof. Whittaker's theory by an appeal to numerical calculation, introducing, for example, definite values of the frequency and calculating the corresponding size of the molecule. The results appear to be satisfactory considering the simple nature of the assumptions made. It seems that the reciprocity which exists between electric and magnetic quantities in the electromagnetic wave must be extended to atomic structure.

Prof. Peddie remarked that the value of Prof. Whittaker's idea does not lie in its being an "only possible" one, for other possibilities exist. Its importance rests on the fact that the idea is a new one, giving for the first time an action on an electron which is not reversed in direction when the electron passes through an atom. A "perfectly elastic" collision seems to be attainable only by implicitly denying collisional radiation, which leaves part of the essential mechanism undescribed. The interactions of the atomic charges, ether and the "magnetic currents," may perhaps introduce difficulty regarding atomic subjection to the Newtonian first law of motion.

The Second Royal Society Conversazione.

THE second conversazione of the Royal Society this year was held in the rooms of the Society at Burlington House on the evening of June 20, when the president, Sir Charles Sherrington, with Lady Sherrington, and the officers of the Society, received a large number of fellows and guests. Many interesting scientific instruments and specimens were shown, several of which were exhibited at the first conversazione held on May 17, and some were briefly described in NATURE of May 27, p. 693. Below are brief descriptions of other noteworthy exhibits.

Some selections from the contents of large pre-historic cooking-places at Buckenham, Tofts Park, Norfolk, were shown by Miss Nina F. Layard. The specimens were found by Miss Layard and Miss M. F. Outram in 1921-1922, and they include hearth-stones, heating-stones, bones and teeth of animals, fragments of pottery, flint flakes and implements. Mrs. Clayton exhibited a Roman bronze measure of capacity, made under Domitian, which was found during draining

works in the vicinity of the Roman Wall, three miles east of Gilsland, Northumberland.

A simple form of respiration meter was exhibited by Mr. H. F. Pierce. Two bellows are mounted on a vertical shaft, one of which measures the volume of inspired air, the other the volume of expired air. The latter is measured at a temperature of 37.2°C . to avoid error due to condensation of contained moisture. Respiration is recorded quantitatively upon a smoked drum. The moving parts are made very light and valves are operated electrically.

Mr. G. C. Robson had an exhibit showing that a highly differentiated character which appears discontinuously in the parthenogenetic gastropod, *Paludestrina jenkinsi*, does not reappear in two generations bred from parents showing this character. There is evidence that this character cannot be compared with an ordinary "fluctuating" variation. The Royal Botanic Gardens, Kew, showed a double coconut, or Coco de Mer, from the Seychelles, which

was germinating. The massive cotyledonary tube emerges from the nut, carrying the plumule and radicle out of the seed, and later the plumule pushes through the tube and grows up into the air. Specimens of the tubers of Ecanda rubber (*Raphionacme utilis*, Brown and Stapf) from Angola, which sometimes weigh as much as 15 lbs., and contain valuable rubber, were also shown.

Mr. W. Barlow exhibited some models of organic substances which are based on the law of valency-volumes and are in harmony with the Bragg structure found in the diamond. The valency-volume unit-cell appropriate for the carbon compounds is a rhombic-dodecahedron. The fundamental valency of carbon is expressed by a close tetrahedral group formed of four of the cells—that of nitrogen by three cells triangularly arranged, that of oxygen by two cells in face-contact, and that of hydrogen by a single cell. By fitting together appropriate numbers of these cells representing the composition and constitution of various compounds, structures can be made representing molecules which present internal symmetry closely corresponding with that of the crystal forms of these organic substances.

The Research Department, Woolwich, had an exhibit showing the time reaction in the colour change of Congo red in organic solvents. The change from red to blue which occurs during titration is associated with its flocculation from the colloidal condition and forms a time reaction related to the concentration of H ions and other properties of the solvent. There were also exhibits from the Air Ministry (Instru-

ment Section), among which was a radiator temperature outfit: designed to determine the temperature distribution at different points on an aero-engine radiator and its connecting pipes. A six-junction thermocouple is used, and each set of junctions measures the temperature relative to that of the atmosphere. Another exhibit was a Filon aneroid dial for indicating to the pilot the height of an aeroplane above the ground. The scale is coiled into a spiral groove so that it can be adjusted to meet daily changes in temperature and barometric pressure. A metallic oxygen container was also shown in which a small quantity of silica-gel has been used successfully for cleaning up residual gases.

Mr. A. A. Campbell Swinton demonstrated the recording of wireless telegraphic messages. A short aerial on the roof of the building was connected through a tuner to a thermionic three valve amplifier, which in turn was connected to a 1 to 3 valve note magnifier. A moving coil siphon recorder was used, connected to the note-magnifier, either through a Brown relay, or through a very low frequency thermionic amplifier tuned to respond to the frequency of Morse signals. For the reception of continuous wave signals a separate thermionic heterodyne oscillator is employed which renders the high frequency signals audible by means of musical "beats." Dr. H. E. Hurst and Mr. D. A. Watt exhibited an interesting model, on a scale of 1:50, of the sluice of Aswan dam which is used for calibration purposes. The relation between Q , the discharge of the actual sluice, and q the discharge of the model is given very closely by $Q/q = n \cdot 5/2$, where n is the scale ratio.

Psychical Monism.

THE Journal of the Washington Academy of Sciences of March 19 contains a communication from Mr. L. T. Troland of Harvard University entitled "Psychophysics as the Key to the Mysteries of Physics and Metaphysics." The article is interesting as a revival of the once famous theory of mind-stuff put forward by W. K. Clifford in his lecture on "The Nature of Things in Themselves." Mr. Troland connects it with several recent philosophical theories of psychical monism and brings it forward with particular reference to the consequences of adopting the principle of relativity and the quantum theory in physics, both of which, he contends, demand the recognition of the ultimate psychical nature of physical reality.

The essence of the mind-stuff theory is that it supposes mind to be constituted and articulated, not merely on the analogy of physical reality but on one and the same principle, so that a parallelism runs throughout the universe between mind and matter. Every electron or proton has not only a psychical aspect but in its ultimate nature is a constituent of mind, a bit of mind-stuff. Just as the unit of physics, the electric charge, enters into combination in atoms, molecules, and their more or less stable compounds, acquiring thereby the various

physical and chemical properties of things, so the mind-stuff combines to acquire the various sensational, emotional, and intellectual properties of personalities.

Mr. Troland's argument is interesting but scarcely convincing. He thinks by the theory to get over Berkeley's difficulty that no qualities of things, primary or secondary, are independent of the observing individual. The new realists, though they have recently attached Berkeley, have not, he thinks, succeeded as yet in developing an explanation of the universe which is either simple or plausible.

The difficulty of Mr. Troland's theory, however, if offered as a support of Einstein, would seem to be that it misses the essential difference between the activity of the observer co-ordinating events in space-time systems and the intersecting world-lines which present the events co-ordinated. The theory of knowledge we are waiting for in science as well as in philosophy is one which will give full meaning to the subjective and objective factors without sacrificing either to the other. Psychical monism seems to be no more successful than physical monism as a key to the mysteries of physics and metaphysics, but we commend Mr. Troland's argument, which includes in its scope recent physiological research as well as the new physical theories.

Technical Education.

THE annual conference of the Association of Teachers in Technical Institutions was held on June 5-7 in London, and in the course of his presidential address, Mr. J. Paley Yorke claimed very strongly that technical education is definitely education and is as essential as any other branch of educational activity. He said that technical education is essentially scientific education, and urged

that the advance of scientific knowledge and the development of the applications of science to industry and manufacture have been so tremendous that the time has arrived when a special committee of inquiry should be appointed to investigate the whole field of technical education in relation to industry and to education generally. It is now forty years since there has been any national inquiry on technical