Reg. 4th June. 05

## RADIUM.

### PROFESSOR RUTHERFORD INTERVIEWED.

Auckland, June 6.

Professor Rutherford, formerly a New Zealand University graduate, but now of the McGill University, Montreal, and famous as an investigator of radium, is visiting the colony. In an interview he said that a little work had been done recently on the Continent on this subject. Investigations at Montreal and elsewhere showed that radium passed through eight successive transition stages, each of these temporary forms in succession showing some or all of the characteristics of uranium. It now appeared proved that uranium was the parent substance from which radium was derived. One development of radium from uranium was purely atomic and spontaneous, and could not be effected by any known chemical or physical means. Polonium, a radio-active substance, discovered by Madame Curie, was now shown to be one of the temporary phases through which radium passed. The transformation of radium was a unique illustration of the disintegration of matter, and was of transcendent scientific interest.

As to the reported cure of cancer, Professor Rutherford regarded the evidence as promising, but the experiments so far were too limited and brief to be conclusive.

Ad. 9th June. 05.

## WONDERFUL RADIUM.

### THE ALPHA PARTICLE.

### RESEARCHES BY PROFESSOR BRAGG.

The December number of the Philosophical Magazine contains two papers on the properties of radium, one by Professor Bragg, Professor of Mathematics and Physics at Adelaide University; the other by Professor Bragg and Mr. R. D. Kleeman, B.Sc. They relate to the properties of the alpha rays, and describe research work which has been carried on in the physical laboratory at the University. The alpha particle is an atom of a known substance, helium, and immense interest has been aroused in the world of physical science by the discovery that an atom of one substance, viz., radium, can and does break up into two atoms of other substances, one of which was already known. The other substance, hitherto unknown, that which remains after the expulsion of the alpha particle, also disintegrates in its turn, and ejects an alpha particle like the first—the remainder being an atom of another new substance. Nor does the process end here. No fewer than seven successive changes are now known, implying as many new substances, most of which are radio-active, and are, of course, descendants of the original radium. Most of these discoveries have been made by Professor Rutherford and Mr. Soddy.

The work of Professor Bragg and Mr. Kleeman has resulted in the disentangling from each other of the various streams of alpha particles. They show how these streams penetrate the air above the radium, and can be distinguished from each other by the different degrees of penetration. They show also how it can be proved from their results that the disintegration of a radium atom always results in the ejection of an alpha particle of identically the same velocity, thus implying that the action was the result of some event in the radium atom which was always the same. It was the original theory of Dalton, the famous founder of the atomic theory, that the atoms of any one substance were all exactly alike. The new results have shown that the atoms of radium are all alike even to this, that when they do eject alpha particles they always eject them at the same speed.

#### A Most Severe Experimental Test.

We have before us the annual report (1904) of the Chemical Society of London. To this Mr. Soddy has contributed a special report on the progress made during the year in the knowledge of radio-activity, and we extract from the description of the work of Professor Bragg and Mr. Kleeman the following paragraph:—"Thus the Daltonian conception that the atoms of the same element are all exactly alike applies even to the velocity with which they eject radiant particles on disintegration. This is probably the most severe experimental test to which this conception has ever been subjected, for it might be imagined hardly possible for any two systems, so extraordinarily complex as the heavy atoms are known to be, to be so absolutely alike that exactly the same velocity should be impressed in each case on the fragments during their explosive disruption."

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#### The Researches Extended.

The interesting researches which have been conducted by Professor Bragg and Mr. Kleeman are still being supplemented by them, and excellent results are being obtained. At the Royal Society's meeting in Adelaide on Tuesday evening Professor Bragg described his most recent work, and the discoveries he has made. In particular, an account was given of the phenomena which have been under investigation at the University of Adelaide during the past year. These include the extraordinary powers which are possessed by the alpha rays of passing, when projected at sufficient speed, through material substances such as thin metal plates. As the alpha rays are atoms of matter, probably helium, the mode in which they succeed in passing through other atoms without any deflection from their course is very curious and interesting. All this work is absolutely new to science.

#### Interest Attracted in England.

Professor J. J. Thomson, D.Sc., F.R.S., who next to his great namesake, now Lord Kelvin, is the greatest man in the world in respect to physical science, and who holds the position of Cavendish Professor of Experimental Physics at Cambridge University, was much interested in the earlier discoveries of Professor Bragg and Mr. Kleeman, which were recently discussed by the Philosophical Society at Cambridge. Other papers in continuation of these discoveries are being contributed by Professor Bragg and Mr. Kleeman to the Philosophical Magazine, London, which is the principal serial in physical science in the English-speaking world. Like the articles which have preceded them, they are bound to attract considerable attention to the work being done in the laboratories of the Adelaide University in respect to the elucidation of the properties of a substance which is fascinating the understanding as well as the imagination of the scientific world. The original papers sent to the Philosophical Magazine received a very wide circulation, as that particular issue was sold out. The scope of enquiry and investigation is infinite, and when so many great scientists in different parts of the world are prosecuting researches in respect to radium it is indeed a matter of pride that the work done at Adelaide University should have been so successful, and that it should have added so materially to the knowledge of experts on the subject.

Ad. 10th June '05

## WONDERFUL RADIUM.

### THE LATEST EXPERIMENTS.

### A CHAT WITH MR. KLEEMAN.

The recent researches by Professor Bragg and Mr. R. D. Kleeman, of the Adelaide University staff, into the properties of radium, have aroused the keenest interest of the scientific world, and the experiments now being continued by those gentlemen are producing results of great value to physical knowledge. On Friday Mr. Kleeman was asked by an Advertiser representative if he had any fresh information on the subject, to supplement that contained in The Advertiser of that day. The instructor of the physics class at the University said that the experiments were being continued, and he was kind enough to give a progress report.

"Professor Bragg had an idea," said Mr. Kleeman, "that an atom consisted of electrons not near one another, which could pass through any other atom without suffering a deflection as a whole."

Will you kindly explain what an electron is?

"An electron is about the thousandth part of a hydrogen atom, and has a negative charge of electricity. An atom is supposed to consist of a crowd of electrons, and different atoms only differ from one another in the number and arrangement of the electrons. These electrons, experiments have proved, are not close together, but are separated so as to resemble a shower of meteors. In the space between them we suppose there is a positive charge of electricity equal to the sum of the negatives of the electrons. Before proceeding further I may explain the changes of radium. Rays shoot off in alpha particles (which consist of a crowd of electrons) at a velocity of 8,000 miles per second. These are a small part only of the radium atom, and there is left behind what is known as an emanation, which behaves like a gas of heavy molecular weight. That emanation shoots off in alpha particles again, and a still further remainder is left, which breaks again, and is known as emanation X, or the first change. What is left after this undergoes a change without shooting off rays, and when that has taken place another alpha particle is shot off, besides electrons and rays known as gamma rays. Following this are two more changes, which take place so slowly, however, that they are of no importance here.

"Since an alpha particle consists of a number of electrons, when it passes through the air (and consequently through the air molecules) they are not deflected as a whole, but tear one or more of the electrons of the air molecules out, which, of course, leaves those air molecules positively charged. Therefore the torn-out electrons are attached to the remaining part of the molecule as attracted to a negatively charged body.

"This furnished our means of investigating these phenomena," continued Mr. Kleeman, "and we, that is, Professor Bragg and I, have found that the alpha particle is not deflected in its path, and that it comprises four streams which differ from one another in initial velocity, and also that it spends its energy in ionisation (that is to say, tearing out electrons in the air). These four streams, in our experiments, went four different distances in the air, and then stopped dead, their energy being expended. The alpha particle sent off by the radium goes about three centimetres in the air before it stops. The alpha particle shot off from the emanation goes about 3.5 centimetres; that by emanation X (or the first change) 4.5 centimetres, and the third change 7 centimetres.

"In the course of our experiments we shot the alpha particles through thin sheets of different metals, amongst which were gold, silver, copper, and platinum films, and we found that a thin film of any of the metals tried would diminish the distance that these streams were shot into the air by the same amount, but would not deflect the alpha particles from their straight line course. The density of the metal, multiplied by its thickness, and divided by the product (consisting of the diminished length of a stream), and multiplied again by the density of the air, gave us the stopping power of the metal as compared with air. And it was found that this was not proportionate to the density of the substance, but proportionate to the square root of the atomic weight. And in the case of gases, we found that the stopping power was proportionate to the sum of the square roots of the atoms composing the molecule of the gas."

Would you mind, Mr. Kleeman, explaining this in less technical language?

"Certainly. I will put it into popular language. The physical interpretation which can be placed on this is that an atom consists of circular discs, and electrons on the circumference of the discs are only capable of being knocked out by the alpha particle. For the circumference is proportional to the square root of the area of disc—that is, proportional to the mass of the atom, and when we have a molecule consisting of several atoms electrons can only be knocked off the circumference of each constituent atom. I should like to add," continued Mr. Kleeman, "that we have found that all along the path of the alpha particle we have electrons knocked out of the air molecules, and the latter are left with a positive charge. These are gathered up in our laboratory by means of an instrument known as an ionisation chamber, consisting of a plate, kept positively charged, and parallel to a gauge, some distance away, negatively charged. This chamber gathers together the debris between the gauge and plate, and by having the arrangements at various distances from the radium we set the debris in the path of the alpha particles."

In conclusion, Mr. Kleeman spoke confidently of the success of the experiments now in progress.

### BELGIAN SCIENCE CONGRESS.

Melbourne, June 9.

The Prime Minister, in replying to an invitation from the Belgian Government, has stated that the Commonwealth Government do not see their way to be represented at the International Congress on radiology and ionisation, to be held at Liege in September next.

Reg. 15th June 05.

### UNIVERSITY EXTENSION AND ORIGINAL RESEARCH.

The system of University extension lectures is now well founded, generally accepted, and sure of continuance. It was primarily intended—as its name seems to show—to carry some of the benefits of a university into localities where no such seat of learning existed, to bring a breath of the spirit of Oxford, Cambridge, or London to people who would otherwise know nothing of it. In Adelaide it serves a useful purpose in enabling those who know little of a particular subject to form some acquaintance with it through masters with a minimum of exertion; whether they are experts or not in other branches of learning counts little. The learned and the unlearned meet here for the moment on a common footing. It is not pretended that any real depth of knowledge can be attained by listening to a series of popular addresses, however excellent they may serve to convey broad conclusions. But many may be led on from such a beginning to a thorough study of the subject; and, in any case, whatever knowledge may be acquired is so much clear gain. Much harm has been done by that mischievous maxim, "A little learning is a dangerous thing." It is dangerous only to those who use it amiss, who presume on its possession. A man who set himself up as an authority on a subject because he had heard it lectured upon would be foolish. So would he be who swung himself over a precipice by his watchchain. But that is not to say that he should go without any information on the particular subject—or without a watchchain. Both possessions may be ornamental and even useful when properly applied.