Reg. 15th June. 1905

The winter lectures of the Adelaide University will be commenced this evening by Professor Bragg, who resumes last year's discussion of his important and interesting hobby—radium. It may be noticed with satisfaction that much really new matter will be placed before those who attend the projected courses during the coming months. Whether Professor Ennis can throw fresh light upon the great composers remains to be seen; the subject seems to demand chiefly a painstaking collation of authorities. Mr. Howchin, however, has made the subject of the geology of the Mount Lofty Range peculiarly his own, and has local and personal advantages in connection with its study. Professor Henderson has travelled to South Africa and back to obtain fresh matter relating to Sir George Grey's career, and much of what he has to say next month will have the charm of complete novelty concerning the great Pro-Consul. In a quite different branch of enquiry Professor Bragg has meanwhile been experimenting with radium, and the strange phenomena which have been under his investigation should excite curiosity even in the unscientific mind. To the skilled observer they are much more significant. Little is really known of radium at present. Its scarcity, the attempt to "corner" the supply by the chief country of production, its immense rise in market value—all these points can be appreciated by every one—but the man of science is more concerned in some unexplained property of the substance, some apparent defiance on its part of natural laws hitherto considered unchallengeable; while to a philosophic mind like that of Mr. Balfour the discovery has a revolutionary tendency towards an idealistic interpretation of Nature. There is all too little of original research in Australia, and in this connection this series of extension lectures should reflect special credit upon the Adelaide University. For the encouragement of such research endowments are almost imperative. In most other countries money is somewhere forthcoming for the support of any man of known ability who is willing, for a year or two, to devote himself entirely to the study even of an obscure order of shellfish. The wealthy men of Australia would do well to stimulate investigations that now have to be dropped because possessing no obvious market value. As it happens, in almost all laboratory research there are great possibilities of tangible wealth-bringing results. Some of the inventions most useful to mankind have sprung from disinterested work conducted in the true spirit of enquiry, without any definite expectation of a goal to be reached. To the mind duly constituted for the task any practical outcome is so much clear gain; the process of enquiry is an end in itself.

Reg. 16th June. 05.

EXTENSION LECTURES.

PROFESSOR BRAGG ON RADIUM.

This winter's extension lectures in connection with the Adelaide University were opened on Thursday night, when a large audience listened to Professor Bragg on the subject of "Radium." It was the first of three discourses that he will deliver.

Professor Bragg said that they all knew that radium was singular in the fact that it possessed tremendous powers of radiation. There were three kinds of radiation—alpha, beta, and gamma. The first of these was an atom, the second was an electron, and the third was a wave. All were interesting, but the alpha ray stood out above the others as the most powerful in its effects and perhaps the most remarkable in its properties. His lectures would be principally about the alpha ray and the results of investigations conducted in the University during the past year. The alpha ray was remarkable, first because it was actually an atom shot off from the parent atom of radium, and the result of its expulsion was that the radium atom turned into something else; secondly, it had enormous speed; and thirdly, it proceeded without deviation on its course from start to finish, never turning aside, but passing right through other atoms. It was now known that atoms consisted of numbers of electrons, every one of which contained a charge of negative electricity. There was in the atom a counterbalancing store of positive electricity, so that the atom as a whole was neutral, but of this positive very little was known. If an electron was torn away from the atom the result was that the electron became a free negative charge, and the remainder of the atom a free positive charge. When an alpha ray passed through atoms, say, of air, it broke up the atoms into positives and negatives, and these by means of an electric battery could be shepherded, the positives all going into an electrometer or electroscope, and the rest being allowed to run to earth. The result was that it was possible to examine the state of a gas through which the alpha ray had passed, and so to investigate the properties of the alpha ray. If it had not been for this electrical effect, the properties of the alpha particles must in all probability have remained undiscovered.

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The lecturer showed models of the electrical instruments used for the purposes referred to, some of them working models, and illustrated his statements by actual experiments. Then he went on to explain what was the result on the radium atom of its expulsion of the alpha particle. By means of models he explained how the radium atom, after the expulsion of the alpha particle, turned into an atom of a substance called radium emanation. This rose as a gas and floated away in the air unless the radium was very highly heated, which process imparted to the radium the power of subsequently retaining its emanation. The radium atom therefore once it was exploded in this way was no longer radium, and consequently any store of radium must in time be exhausted. Of any number of particles of radium half would have disappeared in this way in about 1,000 years. The emanation atom in its turn expelled an alpha particle, and turned into a substance known as radium A. The life of the emanation atom was on the average about four days. The new substance, radium A, was very short lived, the average being about three minutes. It exploded in its turn, shot out another alpha particle, and turned into a substance known as radium B, which lived on the average about half an hour, and turned into another substance called radium C. Radium B was very remarkable in that its change was not accompanied by the expulsion of an alpha particle of sufficient violence to be observed. Scientists knew of its existence only by the fact that, if they took some radium B, radium C was not formed immediately, but appeared in a little while. Radium C in the same manner expelled an alpha particle and turned into radium D. Radium C was especially remarkable in that it expelled a beta particle (an electron) and a gamma ray (a wave) as well. It was the first of the rays that did this. Moreover, its alpha particle was exceptionally violent. The life of radium C was about half an hour. Radium D was remarkable for the fact that it lived about 40 years on the average, and expelled only a beta particle. The last substance about which anything was known was radium E, which had a life of about a year and expelled an alpha particle. This long series of radio-active changes had been worked out by Professor Rutherford (a New Zealander) and Mr. Soddy.

Professor Bragg added that having explained the methods of research and something of the consequences of radio-activity on the original radium atom, in the next lecture he would try to explain what had been discovered with respect to the alpha particle itself, and in particular would describe more of his own researches.

Ad. 16th June. 1905.

PROFESSOR BRAGG ON RADIUM.

Professor Bragg continued his lectures on "Radium" at the University on Thursday evening before a large audience. The professor said the three radiations of radium differed very much in their properties. Alpha was an atom; Beta an electron; Gamma a wave, or pulse running through the ether. The expulsion of an Alpha particle from the radium atom meant the birth of two new atoms after the death of the old one. The Alpha particle could pass through other atoms without any deviation from its course, and it passed through any molecules it might encounter. The breaking up of the radium atom into two was as wonderful as anything the alchemist ever dreamed of. If they could imagine all the lead in the world shooting out something which turned into gold, they would have an instance of what happened in the case of radium, only the process was so minute that it had not attracted commercial attention. The electron which was detached from an atom was the same whatever the atom that was taken. There was strong reason for supposing that the electron was the all-important constituent of the atom; that it was the bricks with which the atom was built. The atom was like the solar system in miniature, and the electron corresponded, so to speak, with the world and the planets. An atom was neither positive nor negative, electrically speaking; it was neutral. Taking an electron from an atom meant the production of two charges, a negative and a positive, and it was on account of this property that they were able to work with radium. There was a good deal of mystery as to where the positive electricity was in the atom. All they knew was that the positive was there, and that it was balanced by the negative. The Gamma rays were the weakest of the three, but the most penetrating. Every time radium was washed, three-quarters of its strength was taken away, but if it were left alone for three weeks it would recover its original strength. This strange fact was due to the removal from the radium of a substance which was itself radio-active. In 1,000 years a number of radium particles would be half gone, and the new thing proceeding from them, which was known as radium emanation, was a gas. The professor showed by experiments how long the generic products of radium lasted. The original Alpha particle lived only three minutes, whilst a subsequent product, known as radium D, lived 40 years.

Ad. 21st June. 1905

RADIUM.

ANOTHER LECTURE BY PROFESSOR BRAGG.

Professor Bragg delivered his second lecture on radium at the University on Tuesday evening. The hall was crowded, and many were unable to gain admission. The greatest interest was displayed in the lecture, and especially in the experiments with which it was illustrated. Professor Bragg explained that certain experiments of Madame Curie and Mons. Becquerel had suggested to him that the alpha particle moved in a straight line from the beginning to the end of its course. It was undeflected when it went through any other atom, just as one solar system might sweep through another without any deflection from its course. It was further suggested to him that if an electron of a flying alpha particle hit an electron of an atom, which it passed through, no doubt one or both electrons would be torn from their places. The result would be that from the neutral atom there would be formed two electrified nuclei, one positive and the other negative. He also reasoned that the accidental encounter in this way of an electron of one atom with an electron of another atom would not affect the motions of the atoms themselves. A regiment of soldiers in open order might run through a second regiment of soldiers in open order without any collision between individual soldiers. If a soldier of one regiment had a collision with a soldier of another regiment, the two soldiers might suffer, but the line of march of each regiment would be undeflected. Arguing in this way, he said an alpha particle ought to have a definite range depending on its initial velocity. He then proceeded to explain how he had put this theory to the test, and had discovered that there were alpha particles of four different ranges given off by radium and its products. He had succeeded in identifying the alpha particle of shortest range with that given off by the radium itself, and that of the longest range with the alpha particle given off by radium C. The intermediate products of radium, namely, the emanation and radium A, gave off alpha particles of intermediate range. The experiments had also shown that the alpha particles of all the products were exactly alike in all respects save that of speed, and that each product when it shot out its alpha particle did so at identically the same rate, thus giving a novel confirmation of the atomic theory of Dalton, namely, that it was remarkable that such heavy atoms as those of radium should be alike even to the extent that when they did break out they all shot out alpha particles of identically the same speed. He then proceeded to explain the experiments of Sir William Ramsay and Mr. Soddy, by which it was shown that the alpha particles were atoms of helium, and mentioned as likely to be of interest to the audience that the radium which he had been using, and which he showed at the end of the lecture, was actually part of that which had been used by Ramsay and Soddy in their experiments. He promised to give next time some account of the phenomena attending the passage of alpha particles through thin plates of metal, and also to give some idea of how the energy and velocity of the alpha particles were measured. As many people were unable to gain admission, Professor Bragg announced that he would repeat the lecture to-morrow evening.

Reg 21st June.

EXTENSION LECTURES.

MORE ABOUT RADIUM.

There was another good attendance at the Adelaide University on Tuesday evening, when Professor Bragg delivered the second of his course of lectures on radium. He explained that the course of the alpha particle through the air could be traced by the fragments of the atoms left in its path, which fragments were electrified and could be collected and measured. Madame Curie had shown that the influence of the alpha particle appeared to cease with some suddenness at a few inches away from its source, as if the motion of the particle had come to an end. This and other experiments had suggested to him the possibility that the alpha particle moved in a straight line from start to finish. On theoretical grounds this was not unlikely, for if an alpha particle was an atom—a miniature system of whirling electrons—then, if it in its motion came across another atom, say of oxygen or nitrogen, or any other substance whose composition was similar, the two systems would pass through one another just as one solar system might be conceived of as passing through another solar system. Such an event would not necessitate the turning aside of either solar system from the paths they had been pursuing before; but if a planet in one system happened to collide with a planet in another system, then the motion of those planets would be seriously interfered with. Just so in the motion of one atom through another—the accidental collision of an electron in one atom with an electron in another atom might have a serious effect on the motions of those electrons, but could have little effect on the motions of the atoms themselves. Arguing in this way, he had repeated Madame Curie's experiment in greater detail. He then found that there were issuing from the radium more than one stream of alpha particles, and he was able to distinguish one from the other, because, on the hypothesis mentioned above, the alpha particle ejected from radium or any other radio-active substance would run through a certain course before it came to rest. It would move in a perfectly straight line until it had spent its energy by breaking up atoms through which it passed. Thus alpha particles of different speeds would have different ranges. In experiments it appeared that there were four sets of alpha particles with