PHYSICS-CHEMISTRY

Debye, Hess and Anderson Win Nobel Prize Laureates

Cosmic Radiation Research, Discovery of Positron, Findings on Electric Behavior of Liquids Honored

JOINT award of the 1936 Nobel physics prize just made to Dr. Carl D. Anderson of California Institute of Technology and to Prof. V. F. Hess of the University of Innsbruck, Austria, resulted from research on the penetrating cosmic radiation that still holds many mysteries.

Dr. Hess receives the prize for his discovery of cosmic radiation in 1912. Dr. Anderson, then only 27 years old, discovered the positron or positive electron in 1932, and thus wrote his name into the history of science as the first to recognize one of the fundamental particles out of which the universe is built. This discovery of the positron came while cosmic rays were being investigated.

Balloon ascensions made by Dr. Hess in 1911 showed that the mysterious and penetrating radiations that other scientists attributed to radioactive substances in rocks must originate outside the planet earth. Dr. Hess, who is still active in physics research, was thus a pioneer balloonist in quest of cosmic ray data. At first Dr. Hess suspected that the radiation originated in the sun, but that was later disproved.

Study of the powerful radiations was undertaken by many scientists in subsequent years. Among the leaders was Dr. Robert A. Millikan, whose researches brought them into prominence. Dr. Anderson collaborated with Dr. Millikan upon his researches and while watching tracks of radiation made in water vapor subjected to intense magnetic fields found the positron or positive electron which previous theory postulated must exist.

Chemistry Prize

The Nobel Prize in Chemistry for 1936 has been awarded to Prof. Peter Debye, director of the Kaiser Wilhelm Institute of Physics in Berlin and professor of physics at the University of Leipzig. Prof. Debye, who recently was in this country as a guest speaker at the Harvard Tercentenary celebration, is a co-founder of the famous Debye-Huckle theory in physical chemistry, which made it possible to calculate exactly the electrical conductivity of a strong electrolytic solution.

One of the most interesting applications of this theory to everyday things is the concept that the invisible inner structure of water resembles that of a solid like a diamond much more closely than it does a vapor like steam, in which molecules are all tumbled about without any right-side-up or upside-down.

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PHYSICAL CHEMISTRY

Prize Theory Concerns Electricity in Solutions

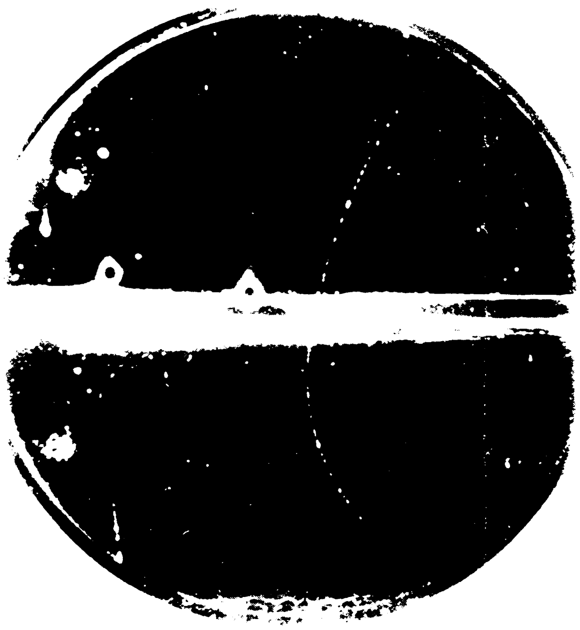
THE FIELD of molecular physics, of equal interest to chemists and physicists, has benefited from Professor Peter Debye's work. He is responsible for developments of extreme importance in the study of solutions, the electrical properties of insulators, the heat capacity of solids, and the structure of individual molecules. His work has provided the foundation for the methods which today are used to obtain as near as possible a "photograph" of an individual molecule. Of course, the "photograph" is not directly a picture of the inconceivably small molecule but rather a pattern from which a picture can be deduced by mathematical methods. Similarly, his mathematical deductions have led to a much clearer insight into the processes by which salt solutions conduct electricity—important to chemistry.

Electrical engineering as well as pure science has been benefited by his theories of electrical insulators, which are based on the idea that most molecules, although they contain equal quantities of positive and negative electricity, are electrically unbalanced inasmuch as one end of the molecule is positively charged while the other end is negatively charged. When a liquid containing such molecules is subjected to an electrical field, the molecules have a tendency to turn into line with the direction of the electric force. This very markedly affects the electrical properties of the liquid. Engineers are interested in these electrical properties while pure scientists are greatly interested in the information regarding molecular structure which Debye's theory yields.

Another very important application of mathematics was his treatment of the heat capacity of solids. The heat capacity of a substance is the quantity of heat which must be transferred to the substance in order to raise its temperature one degree. At very low temperatures, hundreds of degrees colder than room temperature, the heat capacity of all solids gets very small. Einstein gave the first explanation of this, and thus

PRIZE WINNERS

Dr. Carl D. Anderson, California Institute of Technology (left), is one of the winners of the Nobel Prize in Physics. Prof. V. F. Hess, University of Innsbruck, Austria, was honored jointly with Dr. Anderson. Prof. Peter Debye, Kaiser Wilhelm Institute of Physics (right), received the Nobel Prize in Chemistry.



POSITRON

This historic photograph, taken on August 2, 1932, by Dr. Carl D. Anderson, at the California Institute of Technology, is famous because it constitutes the discovery of the positive electron or positron. A 63,000,000-volt positron is seen passing through a six-millimeter lead plate and emerging as a 23,000,000-volt positron. The track consists of tiny particles of water collected along the path of the positron as it plunges through the moisture-laden atmosphere of the cloud chamber. The track is curved because the chamber is placed in a strong magnetic field. This may become one of the most famous photographs in physics.

paved the way for the more refined theory which Debye developed later. Although it was probably not foreseen at the time, this discovery also has industrial value since it is one link in a chain of calculations which can be used to decide whether or not a given chemical reaction will occur.

In spite of his long list of contributions, Professor Debye is only 52 years old.

Science News Letter, November 21, 1936

PHYSICS

Discovery of Positron One Of Science's Great Events

By WATSON DAVIS, Director, Science Service, writing in "Advance of Science"

THE DISCOVERY of one of the building blocks of the universe, the positron, was one of science's great achievements.

While most things about us seem to be solid, they are in reality made up of widely separated atoms, very tiny particles that in themselves may be thought of as miniature solar systems, consisting largely of open space. Inside the atom are found electrons, protons and possibly other particles.

Electrons have been known and studied for some forty years, ever since Prof. J. J. Thomson (now Sir J. J. Thomson) showed that cathode rays consisted of negatively charged particles far smaller than atoms. Dr. R. A. Millikan measured the negative electric charge on these electrons.

Electrons have proved to be nearly omnipresent. They are the stuff of electrical current. Metals are believed to be full of them. They are thought to be responsible for emission, absorption, and scattering of light. No atom could be complete without them. The electron is still, despite our changing ideas about ultimate, a fundamental particle.

In all these years of acquaintance with the negative corpuscle or electron, scientists felt very, very sure that there was no positively charged particle smaller than the proton, which was nearly two thousand times heavier. The first suggestion of a positive electron came from Prof. P. A. M. Dirac in 1931, when he put forth his theory of the electron. This prediction of a positive electron made scientists alert to the possibility of finding it in nature. But they did not know where to start to look for it.

The discovery was made in the course of experiments with cosmic rays at the California Institute of Technology. Dr. Carl D. Anderson had set up a Wilson expansion or cloud chamber on its side in such a way that cosmic rays might plow through the greatest possible length. He was photographing the long tracks that the cosmic ray particles leave behind them. An intense magnetic field was used to curve the particles and the amount of curvature gave an indication of the speed and energy with which they were traveling. This investigation was a part of the extensive program of cosmic ray research that Dr. R. A. Millikan had organized. It was not a search for the positive electron.

There was one feature of this expansion chamber, besides the intense magnetic field, that was unusual. Dr. Anderson placed a thin lead plate in it so that the cosmic rays and any particles that might shoot through the chamber would have something to try their energies upon. The Russian, Skobeltzyn, and others had previously watched and photographed cosmic ray cloud tracks, and Drs. Millikan and Anderson had adapted the method because of their hope that it would give information about the nature of cosmic rays.

In 1931, Dr. Anderson found that cosmic rays disrupt atoms of the air and other matter when they plunge earthward. He made photographs that showed particles, writing their paths in water droplets, curving in opposite directions under the magnetic influence, showing that they were oppositely charged with electricity. One such curving track was made, in a pioneer photograph, by an electron of 140 million volts energy. Another was made by a positive particle, which at that time Dr. Anderson guessed was a proton of about 70 million volts energy.

Here were projectiles of much higher power than physicists were in the habit of using in their researches. Here were transmutations on a grand scale of energies. Little wonder that young Anderson gambled harder than ever, risking the exposure of foot after foot of movie film in the hope of catching the atom smashing at exactly the right instant. Only the happenings during a fiftieth of a second could be caught at each try. Since the disrupting of atoms by cosmic rays does not happen every instant, many of the films were blank.

Then came August 2, 1932, and the making of the portrait of one of the most famous particles in all history. It