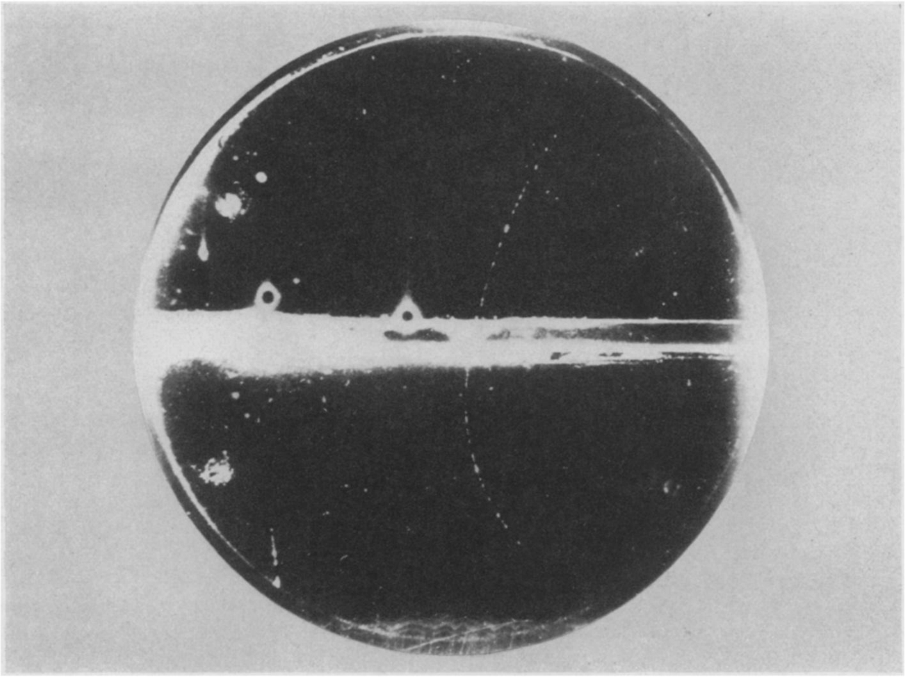

POSITRON

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 left a water droplet trail five centimeters long even after it plunged through six millimeters of lead. Carefully checking its curvature, inspecting the texture of the trail on the photograph, digging into the Dirac electron theory, Dr. Anderson concluded the positive electron had been caught. With due caution, he waited until two more similar photographs were obtained and then sent to *Science* the announcement of the discovery of the positive electron, a positively charged particle with a mass approximately equal to the ubiquitous negative electron.

He continued to make photographs, slowly accumulating in seven months fifteen photographs of positive electron tracks in a group of thirteen hundred photographs of cosmic ray tracks. Then in February, 1933, news came from Cambridge that in Cavendish Laboratory, the discovery of the positive electron was confirmed. Dr. P. M. S. Blackett and G. Occhialini had arranged their expansion chamber so that the passage of a cosmic ray through the chamber set up electrical impulses in two Geiger counters, one above and the other below the chamber. Only when both counters signaled at the same instant was a photographic plate exposed. The British experimenters found that some of their photographs showed "showers" or bursts of many tracks, all radiating from a single point. It was as though there had been an explosion. In the flying particles were positive electrons. There were ordinary common old-fashioned electrons as well. Dr. Anderson, too, found these showers. In many more cases than can be accounted for by chance, a negative and a positive electron were found to come from the same point. The significance of this may have important consequences. In giving birth to electron pairs, energy may be turning into matter. But that is another story.

Now that the existence of the positive electron was recognized as the result of work in two laboratories, it was time for it to be christened. Dr. Anderson named the child of the cosmic rays "positron." At the same time, for the sake of uniformity, he suggested that the name of the negative electron be changed to "negatron," but since the electron for forty-odd years has been called by its old name, it seems unlikely that scientists will take kindly to the new one. "Positron," since its coining, has been firmly written into the literature and promises to stick.

There was some objection to the disregard of mythology inherent in the word "positron." Prof. Herbert Dingle of Imperial College of Science and Technology in South Kensington, England, suggested the name "oreston" for the new positive particle. This is mythologically correct, for Orestes was the brother of Electra. Other English physicists had in the meantime contributed to the confusion, but not in a serious manner. The discovery of the positive particle came from the cosmic ray tracks that seemed to be bent in the wrong way. Sporting Englishmen immediately thought of cricket and the peculiar hops that the ball takes on bouncing in front of the wicket. These are called "googlies," so the new tracks and thus the particles in laboratory slang became "googlies" also.

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MEDICINE

Safer Morphine Invented at University of Virginia

MORPHINE more powerful and safer than the morphine that physicians now use to relieve suffering has been prepared and patented (U. S. Patent No. 2,058,521) by Dr. Lyndon F. Small of the University of Virginia.

The new kind of morphine—actually Dr. Small has patented three new morphine compounds — was discovered when Dr. Small was trying to develop a non-habit-forming substitute for morphine. The goal of non-habit-forming morphine is being sought in a fundamental scientific attack on narcotic drug addiction launched in 1929 by the National Research Council, the U. S. Public Health Service and the Treasury Department's Narcotic Bureau. The research on narcotic substitutes is being carried on at the Universities of Virginia and Michigan.

The new morphines which Dr. Small has just patented have not yet been tried on human patients. Tests on animals show that these new morphine substances are less poisonous than ordinary morphine; are more powerful so that smaller doses can be given; and act for a longer time, so that they need not be given as often as morphine in the relief of pain.

Because only animal tests have been made, no statement on the habit-forming possibilities of the new morphines can be made, Another morphine substitute, dihydrodesoxymorphine-D, which Dr. Small prepared two years ago, turned out to be more habit-forming than ordinary morphine, although preliminary tests encouraged the hope that it would be the long-sought non-habit-forming morphine substitute.

Clinical tests on human subjects of the new morphines will be made shortly.

The invention comprises three new ethers of morphine and dihydromorphine, in which the alcoholic hydroxyl group of the parent substances (morphine and dihydromorphine) has been etherified, viz:

1. Morphine alcoholic ethyl ether (heterocodethylin or heteroethylmorphine).
2. Dihydromorphine alcoholic ethyl ether (dihydroheterocodethylin, heteroethyldihydromorphine).
3. Dihydromorphine alcoholic methyl ether (dihydroheterocodeine).

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SEISMOLOGY

Kamtchatka Coast Shaken By Friday 13th Earthquake

KAMTCHATKA'S eastern coast was wrenched by a heavy earthquake on Friday, Nov. 13, at 11:31.5 p.m., local time (7:31.5 a.m., eastern standard time), according to calculations by seismologists of the U. S. Coast and Geodetic Survey, based on data collected telegraphically by Science Service. The epicenter was in approximately 57 degrees north latitude, 163 degrees east longitude.

Stations reporting were: Pennsylvania State College; Canisius College, Buffalo, N. Y.; Fordham University, New York City; University of Wisconsin, Madison, Wis.; University of California, Berkeley, Calif.; University of Michigan, Ann Arbor, Mich.; Franklin Institute, Philadelphia; Seismological Laboratory, Pasadena, Calif.; Dominion Observatory, Ottawa; Dominion Meteorological Observatory, Victoria, B. C.; Weston College, Weston, Mass.; the observatories of the U. S. Coast and Geodetic Survey at Tucson, Ariz., Ukiah, Calif., and Chicago, and St. Louis University.

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