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THE AWARD OF THE NOBEL PRIZES IN PHYSICS

THREE European leaders in the new physics will receive the 1932 and 1933 Nobel prizes in physics. Professor W. Heisenberg, of Leipzig, was awarded the 1932 Nobel prize in physics for his development of quantum mechanics and its resultant discovery of the allotropic forms of hydrogen. The 1933 Nobel physics prize is divided between Professor E. Schrödinger, of Berlin, now working at Oxford, and Professor P. A. M. Dirac, of the University of Cambridge, England, for their new forms of atom theory. The 1933 Nobel prize in chemistry will not be awarded this year. The three relatively youthful European physicists who have been crowned with Nobel prizes in physics are the creators of physical theory that has had great influence upon philosophical ideas as well as science.

Professor Werner Heisenberg, awarded the 1932 Nobel physics prize, is now only thirty-two years old. Still younger is Professor P. A. M. Dirac, who is thirty-one years old, while Professor Erwin Schrödinger, formerly of Berlin and now of Cambridge, who shares the 1933 physics Nobel award with Professor Dirac, is the senior member of the group with an age of forty-six.

The three Nobel prize men, two Germans and an Englishman with a French name, all have picturesque personalities and their erudite adventures in physics, pursued in both European and American centers of research, have been accompanied by happy companionship among the trio and with other students of physics.

Professor Heisenberg is the son of a professor of Greek philology. He studied with Professor Arnold Sommerfeld and Professor Niels Bohr. By the time he was twenty-one he had an international reputation for his studies of atom structure and the Zeeman effect. His great achievement, the development of quantum mechanics, began in the fall of 1925. Then the young Heisenberg presented the scientific world with the first mathematical exposition of why the electrons revolving about atomic hearts stick to their orbits.

The famous Heisenberg principle of indeterminance or uncertainty was a further development of his theory. This proves that in the attempt to determine the velocity and the position of an electron science meets with a final boundary to human knowledge.

The citation of the Nobel award to Professor Heisenberg states that it is for his development of quantum mechanics "and its resultant discovery of allotropic forms of hydrogen." A colleague of Professor Heisenberg, then of the Kaiser Wilhelm Institute of Berlin, demonstrated experimentally the two molecular arrangements of varieties of ordinary light weight hydrogen (atomic weight 1) which are known as parahydrogen and orthohydrogen.

To a large extent the work on atom theory for which the 1933 physics Nobel prize is divided between Professors Schrödinger and Dirac is built upon the foundations of Heisenberg's work. The French physicist, de Broglie, who also received a Nobel prize, conceived the idea of the wave mechanics brand of physics which was carried on by Professor Schrödinger, who arrived at a shorter and simpler solution by a different route. Professor Dirac was doing his graduate work at Cambridge when Heisenberg's first paper was published in the autumn of 1925. Developing his own mathematics, using unconventional methods of getting clear of mathematical tangles, as exemplified by his invention of "q numbers," Professor Dirac produced a still more advanced system of quantum mechanics. Perhaps his most strikingly original and successful contribution is his relativistic theory of the electron. When just over thirty years of age, Professor Dirac was appointed to the Lucasian chair of mathematics at Cambridge.

Although until recently the Vienna-born Professon Schrödinger held the chair of theoretical physics at the University of Berlin, to which he was appointed in 1927, he now finds working at Oxford more congenial than the present atmosphere of Berlin. He made an enforced departure from Germany due to the present political régime, and last month he was elected to fellowship in Magdalen College, Oxford.

MATHEMATICAL EQUATIONS IN QUANTUM MECHANICS

SEEKING to link the extremely minute realms of the new quantum mechanics of physics with the wide-flung scope of the mechanics of relativity, Sir Arthur Eddington, the Cambridge astronomer, presented to the Royal Society of London new mathematical equations which may receive acceptance by the scientific world and thus extend man's understanding of the physical world about us.

To obtain tractable equations in linking microscopic quantum mechanics and microscopic relativity, Sir Arthur found it necessary to use something mathematically simpler than the kilogram as a comparison standard of mass. As an intermediary, therefore, he uses an ideal uniform distribution of matter which he described as a sort of ether.

The link between quantum mechanics and relativity is given by a quadratic equation that, translated into words that can be set in newspaper type, reads: Ten times the letter m squared minus 136 the letter m times the letter m subzero plus the letter m subzero squared equals zero. The letter m is the mass of the electric particle and the two roots of the equation give the masses of the fundamental units of matter, the proton and the electron, found to be in the ratio of 1847.6 to one. The letter m subzero is the mass of comparison of the ether and it is calculable from a formula in terms of the following four fundamental constants: Planck's constant, the velocity of light, the de Sitter radius of empty space time and

the number of particles in the universe. This number is equal to ten raised to the seventy-ninth power.

In the maze of connections between physical constants developed by Sir Arthur this number of particles in the universe is the one pure number which has as yet no theoretical explanation.

One result of the equation that can be tested by observational astronomy is that there is a limiting speed of recession of the nebulae or the so-called red shift or Doppler effect. This limit is computed by Sir Arthur as 780 kilometers per second per megaparsec. This is a sort of upper speed limit for the explosion or expansion of the universe.

Sir Arthur Eddington, widely known as the author of "The Nature of the Physical World" and other books as well as for his scientific work in astronomy and theoretical physics, has in the past few years been developing a theory of the electron that can be reconciled with the relativity theory of Einstein, which incidentally Sir Arthur by his 1919 eclipse expedition did much to bring to the attention of science.

ALUMINUM-COATED MIRRORS AND ULTRA-VIOLET LIGHT

STARS that are hotter and brighter than science ever conceived, which make our own sun-star look like a candle beside a powerful beacon, have been "captured" in the aluminum mirrors of the Boothroyd expedition, just returned to Cornell University from a mountain peak in Arizona. For the first time, the ultra-violet spectra of about 80 stars have been photographed, opening up an entire new field to astronomers in the study of stellar matter and stellar temperatures.

This feat was accomplished as the result of a new process developed by two young Cornell physicists, by which chromium and aluminum can be deposited on glass. The silver-coated mirrors hitherto used in reflecting telescopes have been able to capture the spectrum only as far as the yellow-green region, and were unable to catch the high wave-length of the violet emanations, which tell more than anything else about the temperature and condition of the stars.

Professor S. L. Boothroyd, head of the Cornell department of astronomy, who organized the expedition to Arizona to put the new invention to practical test, reported on his return that not only did their spectrograms confirm previous ideas on the hotness of certain stars, but indicated that some of the so-called "dim" stars are in reality brighter, photographically, than those hitherto considered the brightest.

These tremendously hot stellar bodies are called "blue stars," as contrasted with red and yellow stars. They are dim, if not wholly invisible, to the human eye, because their ultra-violet rays escape the eyesight. The aluminum-coated mirror, however, proved much more effective than the human eye.

The Cornell investigators were given cooperation by the Lowell Observatory at Flagstaff, Arizona, and made use of the observatory's mountain station, 11,500 feet above sea-level on Schultze Peak, some ten miles north of Flagstaff. This location was chosen because of the clearness of the atmosphere and the comparative absence of dust, which absorbs much of the ultra-violet spectrum at lower levels. The expedition worked for about six weeks, taking pictures which have now been brought back to Cornell for study. About a year will be required for the detailed measurements and interpretation of the 200 spectrograms which were taken.

Professor Boothroyd's companions on the expedition were Robley C. Williams and G. B. Sabine, who, at his suggestion, developed the aluminum mirror. Their first success was with chromium, but aluminum proved even a better reflector. The mirror which did most of the work at Flagstaff was 15 inches in diameter.

"We obtained spectrograms of a region about as far beyond the violet," Professor Boothroyd said, "as the violet is from the yellow-green." Among the stars to which particular attention was given and which are expected to reveal valuable secrets about stellar composition were iota Orionis, Betelgeuse, Procyon and Rigel.

The Arizona experiments proved that high humidity of the atmosphere does not affect the transmission of ultra-violet rays; in fact, it does not even scatter them, as was previously suspected. The only thing that interfered with the work was dust and smoke, which seemed to keep the rays from coming through to earth.

Professor Boothroyd said that transmission was perfect after a rainstorm, when the atmosphere held a large amount of water in gaseous state. But when a windstorm blew up, filling the air with dust from the surrounding desert, results were extremely poor.

Some of the work was done at the Lowell Observatory, whose altitude is 7,350 feet. The astronomer noted the fact that there was practically no difference in transmission of the violet rays at that altitude and at the mountain station, which is 4,150 feet higher.

A DELICATE TEST FOR LEAD

LEAD, a poison against which our food, drugs and cosmetics have to be guarded with ever-increasing vigilance, is now made to betray its presence by the red blush it causes in a greenish solution of one of the aniline dyes, diphenyl-thio-carbazone, called "dithizone" for convenience by the chemists. The new test, which has the double advantage of being both delicate and quick, was described before the meeting of the Association of Agricultural Chemists by H. J. Wichmann, of the Food and Drug Administration, U. S. Department of Agriculture.

Food and drug analysts often have to determine whether or not a shipment of fruit is carrying more than the tolerated minimum of lead-spray residue. They can not take more than a few hours for this. Yet hitherto the quickest accurate lead-determining technique demanded several days. To deliver themselves from this dilemma they made their search for a new and quicker method.

The dye "dithizone" has been known for a long time; it was first described in Germany by the famous chemist Emil Fischer. Fischer even noted the red precipitate caused by the addition of lead. But so far as is now known, nobody had previously discovered the beautifully delicate gradations of color, from the solution's original

green through blue and purple to cherry red, that occur when a lead solution treated with ammoniated cyanide is added to a solution of the dye containing chloroform. By matching hues with other tubes containing a known amount of lead-dithizone, the chemist can now determine in a very short time exactly how much lead an "unknown" sample contains. The error involved in this operation has been determined as within four per cent.

The dithizone reaction is practically specific for lead. If the suspected sample contains tin or thallium, there may be some interference; but these elements can be eliminated in preliminary steps. A modification of the method, using formic acid instead of chloroform, gives promise of yielding equally accurate determinations for mercury, another poison frequently encountered in food and drug work.

Dithizone has hitherto been manufactured only in Germany, and is exceedingly expensive, the cost of the pure product delivered in this country being about $400 a pound. However, chemists at the University of Maryland have undertaken its manufacture, and have already succeeded in making enough of it for all official needs.

AMEBIC DYSENTERY IN CHICAGO

PHYSICIANS throughout the country are warned to be on the lookout for cases of amebic dysentery among their patients who visited Chicago this summer and fall. This warning was sent at the suggestion of Dr. R. R. Spencer, of the U. S. Public Health Service, who is assisting Chicago's health commissioner, Dr. Herman N. Bundesen, in an investigation of the dysentery outbreak in that city.

Some of the cases were not recognized as dysentery and the patients have been operated on for appendicitis and ulcerative colitis with unfortunate results. This is because the disease for the most part only occurs in tropical countries and is generally not thought of by physicians practising in the north.

The outbreak, which started early in July, has been traced to chronic cases and carriers of the disease among the food handlers in two Chicago hotels, according to the Federal Health Service. Reports of 113 cases have already been received. Of these, 79, including 7 deaths, occurred in Chicago, while 34, with 8 deaths, occurred outside Chicago, but have been traced to the Chicago hotels where the patients had been guests. Among the fatal cases were several members of the executive committee of the National Lumber Manufacturers' Association.

Health officials do not foresee any wide-spread outbreak of the disease throughout the country. But they are anxious to have all cases recognized as dysentery so as to avoid any further deaths due to mistaken diagnosis and wrong treatment, such as surgical operation.

Amebic dysentery is caused by a single-celled animal called ameba. It may be spread by contaminated water or foods that are eaten raw or by carriers who handle food, as in the Chicago outbreak. Cooking kills the ameba. The disease takes about three weeks to develop after the patient has been infected.

ITEMS

A NEW chemical preparation that can be used instead of thyroid extract for the treatment of one type of thyroid gland disorder will be announced by Dr. A. B. Anderson, of University College Hospital, Professor C. H. Harington, of London University, and Professor D. M. Lyon, of Edinburgh University, in the forthcoming issue of *The Lancet*. The new preparation has the scientific name 3-5-diiodothyronine. It has been used successfully in the treatment of myxedema, a condition due to underactivity of the thyroid gland characterized by dropsy-like swelling especially of the face and hands, dulling of mental activity, drying and wrinkling of the skin, falling hair and general sluggishness. Daily doses of the new medicine relieve the symptoms of this disease without producing any ill effects. It is given by mouth and produces results comparable to injections of thyroxine, the thyroid gland preparation generally used to treat this condition.

TINY colonies of leprosy bacilli, appearing under the microscope as groups of very small, red-stained rods and probably representing a further step towards the conquest of leprosy, were described by Drs. Earl B. McKinley and Elizabeth Verder, of the George Washington University School of Medicine at a meeting of the American Society of Tropical Medicine. These bacilli, generally considered to be the germs that cause leprosy, are so small that whole colonies of them can hardly be seen without the aid of a microscope. They are important because they have been grown outside the body of man or other animal. This means that scientists may at last be able to study them in laboratories like the germs of other diseases which have finally been conquered by such scientific investigations. These little bacilli, which were obtained from the bodies of lepers, are extremely difficult to locate, because even colonies of them are so fine and small they are easily missed by trained bacteriologists. The method which Dr. McKinley and Dr. Verder have developed for finding them, however, may help to locate the germs in the early stages of the disease and thus aid in its diagnosis.

EEL grass, a marine growth important as food for certain aquatic birds, is apparently disappearing from European waters as well as from the Atlantic seacoast of North America, as recently reported. A. D. Cotton, keeper of the herbarium and library of the Royal Botanic Gardens at Kew, reports in *Nature* that the plant is almost gone from many places in England where it was formerly abundant, and that in other places only a few scattered undersized specimens are to be seen. The disappearance of the eel grass can have serious consequences aside from the distress and starvation it causes among waterfowl, for the plant is in many places the means of holding mud and sand banks stationary, which now, without its anchoring action, can be washed out by waves and currents, causing serious trouble by being redeposited in navigation channels.