SCIENCE NEWS

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THE MEASUREMENT OF THE SPECIFIC CHARGE OF AN ELECTRON

THE most highly developed parts of that highly developed field of the new physics, quantum mechanics, are not good enough to predict the results of clever experimenters. The Zeeman effect, which describes the behavior of an atom in a magnetic field, and the light given out by the hydrogen atom are the subjects under fire.

So complacent is the physicist about these matters that the discrepancies would not be believed were they not put forward by the highest authority in the field. Professor V. W. Houston, who has announced these results obtained at the California Institute of Technology with the collaboration of Professor Y. M. Hsieh, of Yenching University in China, and L. E. Kinsler, a graduate student, is known to have done the best experimental work in both these fields. He is at the same time one of the country's foremost theoretical physicists so that his interpretations must be considered as quite reliable.

Professor Houston had worked up a method based on the supposedly sound theory of the Zeeman effect for measuring the specific charge of an electron. His results were accepted and revised all previous work. Now with Mr. Kinsler he has found that in the simplest and apparently surest case, namely that of helium, the specific charge seems to come out wrong. Any physicist would have bet a hundred to one against this result.

In the other experiments with Professor Hsieh on the fine structure of the hydrogen spectrum the results are startlingly different from the predictions of the equation of Professor P. A. M. Dirac, the British physicist. This equation represents the pinnacle of achievement in theoretical physics and was the main contribution of Professor Dirac who recently was awarded the Nobel Prize. But Professors Houston and Hsieh show that even this equation is not good enough for exact work.

The difficulty with the theory seems to be that it treats the atom as if it were alone in space. Actually it is connected with its surroundings through electromagnetic fields. In other words it is part of the whole universe. How to take this interaction into account is likely to prove an extremely difficult problem.

ORIGIN OF THE POSITRON

THE idea that a bundle of radiation, such as a cosmic or gamma ray quantum, collides with an atomic kernel or nucleus, and gives birth to a positive electron or positron, receives support from calculations made by Drs. W. Heitler and F. Sauter, working at the University of Bristol and the Technische Hochscule at Berlin-Charlottenburg.

There has been considerable discussion as to just what happens when powerful radiation smashes into matter and particles fly out. Some physicists have interpreted these experiments as the conversion of energy into matter, while others suggest a blasting of the atom's center, releasing particles already there.

The widely acclaimed electron theory of Professor P. A. M. Dirac, the British physicist and Nobel laureate, and his formulation of the wave equation so as to explain experimental findings about the hydrogen atom, can be used to explain what happens if a fast electron, passing through matter, emits a quantum of radiation with energy comparable to its own, and the reverse happening, if a quantum of radiation colliding with an atomic nucleus gives birth to a positive electron.

The production of a pair of electrons by cosmic radiation in the presence of an atomic nucleus has been reported as the result of experiments at Cavendish Laboratory, Cambridge, England, by Professor P. M. S. Blackett and G. Occhialini, although Dr. Carl D. Anderson, of California Institute of Technology, Pasadena, California, discoverer of the positive electron takes the view that the electrons produced by cosmic rays smashing into matter are probably not created out of radiation, but are merely fragments of the atom's heart that has been disrupted.

Drs. Heitler and Sauter have calculated from the Dirac equation what is to be expected when radiation turns into electrons and the result agrees well with the experimental results. For the opposite process, similar calculations show that the theory seems to disagree with experiment. But the physicists explain that the Dirac wave equation may not apply to the very small radius of the electron and when the radiation has a wave-length that is smaller than this radius.

THE 200-INCH MIRROR OF THE MT. WILSON OBSERVATORY TELESCOPE

THE disc of the great 200-inch mirror of the new Mount Wilson Observatory telescope now being built will be made of a superior sort of pyrex glass and it will be poured at Corning, New York, in about a month.

Early plans called for a mirror of fused quartz, but now a superior pyrex glass, which has a small volume change with temperature, has been developed for the special purpose of the 200-inch mirror. When a few years hence the new giant telescope is placed in operation on a southern California mountain peak, it will be the world's largest, doubling in one gigantic step the diameter of the world's largest, the 100-inch on Mount Wilson, California.

At the Corning Glass Works, when the step takes place, the glass will be taken from the furnace at 1,500 degrees Centigrade, trucked to the mold and poured at about a thousand degrees. It will be allowed to cool to below 500 degrees and kept until the temperature is uniform throughout. For an ordinary disc 30 inches thick, 24 days would be enough to equalize temperature, but the thick mold which will hold the glass will require a longer time, probably over four months, before the cooling process can begin. This subsequent stage will take about the same length of time.

Dr. J. A. Anderson, of the Mount Wilson Observatory, discussed the annealing of glass before the Astronomy and Physics Club at Pasadena, California, and told how the problems involved were solved by American scien-

tists when our European sources of optical glass were shut off during the World War. The staff at the Geophysical Laboratory of the Carnegie Institution of Washington was especially effective. Their work has made the production of the enormous disc feasible.

The oven for the large reflector has already been used to make the 120-inch test plane required for the large concave mirror. Dr. F. Pease, who watched the pouring, said the result was most successful. Preliminary tests for strain showed it to be superior to the excellent 60-inch mirror now used on Mount Wilson. It was perfectly clear and almost free of bubbles.

The test plane will have the same type of construction as the big mirror. A hexagonal system of ribs will give rigidity without bulk. Nineteen points of support will be provided in these ribs. The supporting levers will be attached in ball bearings so that frictional and elastic distortions will be minimized. The holders will work in any position so that the mirrors can hang upside down if necessary.

THE TREATMENT OF DISEASE BY SHORT RADIO WAVES

A NEW device for treating disease by very short radio waves is being shown at the Physical Society's exhibition in London. Lung abscesses, empyema, carbuncles and infectious arthritis are among the diseases that have yielded to attack by this weapon of modern physics. The device was developed in Germany.

The wave-lengths used vary from four to fifteen meters. They are the type now being investigated by Marconi, and used experimentally by amateurs. The new device, an ultra short wave oscillator, is used to treat various diseases by changing the wave-length. A given wave-length seems to affect living matter, like bacteria or "germs," to a varying extent depending on the composition of the living matter. For example, Dr. Erwin Schliephake, of Giessen. Germany, found that with the new apparatus he could kill one common type of micro-organism, the staphylococci, in the body, but the rate of speed at which the organisms were killed depended on the length of radio wave used.

Cases of actinomycosis, or lumpy jaw, could be cured by waves four meters long, Dr. Liebesny found, but were unaffected by waves fifteen meters long. Nasal empyema was healed by treatment with waves of four to six meters.

The new device is not diathermic, since plates of glass insulate it from the body. It is possible to raise the temperature of the whole body more than seven degrees Fahrenheit in from forty to ninety minutes by means of the oscillator, but local heating depends on the degree of ionization of the cells.

The effect of the short waves seems to be to weaken the invading bacteria, to cause a migration of the white blood cells to the site of invasion, and to increase the destruction of the micro-organisms by the scavenger cells of the body.

AMOEBIC DISEASE IN A GROUP OF COLLEGE STUDENTS

MINUTE animal parasites, some of them the kind of amoeba that caused the dysentery which was reported as epidemic and took death toll in Chicago this summer, are more wide-spread in the general population than has been suspected, Drs. D. H. Wenrich, R. M. Stabler and J. H. Arnett, of the University of Pennsylvania, conclude as the result of a survey of 700 freshmen entering college in 1931 and 1932.

A single examination made for each person showed that about one in twenty harbors the parasite, *Endamoeba histolytica,* which causes the amoebic disease and belongs to the group of microscopic animals known as the protozoa. But five or six examinations may be required to determine the actual percentage, so that probably about ten per cent. of those examined harbor these parasites. Most of those with the parasites are not ill, but are carriers who, through carelessness, may infect others in their community. This is especially true if they are food-handlers.

Surveys made recently in Tennessee show that in the rural populations of that state probably one in five persons harbor the disease-producing amoeba. Closer to the tropics the incidence of the parasite tends to be larger.

One third of the college freshmen tested once by Drs. Wenrich, Stabler and Arnett were found to harbor one or more of seven kinds of protozoan parasites, including the dysentery-producing amoeba. Four other kinds of amoeba are likely to be confused with the disease-producer and expert knowledge is needed to make the diagnoses. Two other parasites belonging to the flagellate protozoa were found and these are thought by some to produce a mild illness in susceptible persons.

MEASURING THE INSIDE OF THE SKULL

THE first instrument enabling science to measure accurately the interior of the human skull has been invented, scientists hope.

In a demonstration before the Royal Anthropological Institute, London, the inventor of the instrument, Dr. K. Wagner, assistant professor of anatomy at the University of Oslo, showed that previous scientific views about the asymmetry of the human skull may be revised.

The difference in size and shape of the two hemispheres of the brain is an important feature of anatomy which has never been completely explained. The interior of the skull cap, which fits neatly over the brain, shows these irregularities.

Dr. Wagner's instrument consists of a metal bar, from the end of which slightly flexible arms project. When inserted within a skull, the adjustable arms give the measurement, which is read directly from a scale on a bar. A small mirror on the instrument enables accurate placing of the arm ends against the bone.

Dr. Wagner told of examining 369 skulls of Norwegians, Lapps, Eskimos, Maoris and Australians. His tentative report is that the typical human skull is asymmetrical by having the left hemisphere longer and the right hemisphere broader. This finding differs from previous scientific reports on Egyption skulls, which were made with calipers and were admittedly unsatisfactory. British investigators, expressing interest in the new device, urged renewed efforts to solve the mysteries of asymmetry.

Wilfred Le Gros Clark, professor of anatomy at St.

Thomas' Hospital, reported researches on asymmetry begun in Borneo fourteen years ago. His studies stress three factors as linked with brain and skull shape. These are right-handedness, distribution of the veins and a characteristic skew which is found in the Chinese brain. Dr. Clark mentioned observing forehead veins in men who had been playing tennis, and finding that in 14 out of 19 men, the last forehead vein on the right was more prominent.

THE UTILIZATION OF AGRICULTURAL BY-PRODUCTS

NEW impetus has been given the nation-wide search for economic means of utilizing agricultural by-products through the allotment of $70,000 from Public Works Administration funds for the erection of a building to house the Agricultural By-Products Laboratory of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, at Iowa State College. Construction of the laboratory will begin at once.

Upon receipt of the appropriation, P. Burke Jacobs, chief of the laboratory, announced the intended amplification of the research work now under way, and the probable addition of several new projects. The present destructive distillation equipment will be enlarged to allow the complete recovery, under factory conditions, of acetic acid, carbon and other by-products from farm wastes. "Activated" carbon, tar oils for uses such as anti-knock motor fuels and insecticides, and methanol for anti-freeze liquids will be produced on a scale sufficient to allow large-scale tests of their possible application.

Fermentation studies involving the production of utilizable pulp or of alpha cellulose, fuel gases, or organic acids will be expanded. This entails the consideration of the whole question of costs of purified cellulose as extracted from farm wastes. A situation may eventually be reached where increasing costs of wood will allow economic utilization of the vast amount of cellulose now produced and wasted annually as farm wastes, for the manufacture of paper, press board, rayon and other valuable uses.

New projects contemplated include the production of fuel briquettes from farm wastes, utilization of feathers from the packing house industry, utilization of glucose and gluten wastes from the refining of corn products, investigation into the improvement of processes for manufacturing paper from straw, improved fermentation processes for the production of fibers from flax and possibly the utilization of creamery wastes.

ITEMS

WHEN the metal lithium is bombarded with ions of the heavy, mass two isotope of hydrogen, deuterium, alpha particles are ejected with a speed considerably greater than swiftest alpha particles from radioactive substances, experiments at Cavendish Laboratory, Cambridge, under the direction of Lord Rutherford have shown. The research shows that a deuterium particle occasionally enters the kernel or nucleus of a lithium atom of mass six and that the nucleus that is formed then breaks up into two alpha particles, which are kernels of helium atoms. These two alpha particles escape in nearly opposite directions. The capture of a particle by a lithium nucleus of mass seven causes a breakup of the system into two alpha particles and a neutron whose maximum energy is equivalent to fifteen million volts.

SIX hundred galactic nebulae, great masses of stars similar to our own Milky Way, have been found by Harvard Observatory in a region where only sixteen were known hitherto. Dr. Harlow Shapley, director of the Harvard Observatory, described this latest accomplishment made with the aid of one of the observatory's new telescopes and explained that the nebulae images were found and counted upon a photographic plate as one of the last Harvard Observatory discoveries of 1933. He was able to report this accomplishment at the time that he was awarded the Rumford medal by the American Academy of Arts and Sciences. The bit of the heavens thus given nearly a forty-fold increase in its known population of galaxies is an area about equal in size to the bowl of the Great Dipper and lying between that constellation and the star group known as the Lynx.

A SUBSTANCE identical with a female sex hormone, theelin, has been obtained from palm nuts by Professor A. Butenandt and Professor H. Jakoby, of the University of Göttingen. Sex hormones, like theelin, are spread throughout the whole animal kingdom from the highest down to the lowest single-celled organisms. Similarly acting substances are also found in plants. It has been known for some time that the plant hormones could stimulate sexual activity in animals and that the animal hormones affected the plant's development, stimulating ripening and blossoming. The reason for this, it appears from the work of Professors Butenandt and Jakoby, is that the sex-stimulating hormone in both plants and animals is the same substance. While the investigation was restricted to palm nuts, it is probable that the sex hormones of all plants is the same.

MITOGENETIC rays, those mysterious and potent rays said to emanate from roots of growing plants and yeast cultures, may exist, but physical proof of their existence is lacking, it appears from the annual report of activities of the U. S. Public Health Service to Congress, made public recently. At the office of field investigations of cancer, in charge of Dr. J. W. Schereschewsky, at Boston, studies designed to demonstrate by physical means the presence or absence of these rays were carried out. In these studies an apparatus for detecting and measuring extremely small quantities of radiation, the so-called "Geiger radiation counter," was used. The sensitivity of this apparatus was determined in absolute units and was found to be at least six times as great as necessary to respond to radiation of the intensity assigned to mitogenetic radiation. Even with this very sensitive detector no rays could be detected from any of the various substances said to be active radiators of mitogenetic rays, the government scientists reported.