SCIENCE NEWS

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THE ENERGY OF POSITRONS

THE manufacture of matter out of energy, theoretically possible according to Einstein's theory of relativity, is demonstrated by experiments in which positrons, the new building blocks of matter, are produced.

To the Royal Society, Drs. J. Chadwick, P. M. S. Blackett and G. Occhialini, of Cavendish Laboratory, Cambridge, recently reported that their observations of the energy of positrons produced in gamma ray bombardment confirm the idea that the interaction of a gamma ray with an atom always produces an electron simultaneously with a positron and that both of these particles have the same mass.

While the artificial radioactivity discovered by the Joliots in Paris a few weeks ago may show that the positrons ejected from disintegrating atomic hearts are contained in these atoms themselves, the experiments at Cambridge by three bombardment methods seem to confirm the hypothesis that the twin electrons are created from radiant energy in the field of influence of the atom outside its nucleus.

If atomic nuclei permanently contain positrons, according to Dr. Blackett, the positrons must be "inoculated" in some manner against annihilation. Perhaps this is accomplished by a closer union with some other particle. Normally the positron, almost immediately that it is created, combines with an electron to form radiation.

Dr. G. Temple, professor of mathematics at the University of London, presented the first quantum theory of the neutron, which was developed by squaring the Dirac equation, which was so useful in predicting the positron before it was discovered. He followed the method of Sir Arthur Eddington, although there is an admitted theoretical drawback, since the Dirac analysis was directed to a linear equation. But Professor Temple added no arbitrary constants.

One set of solutions of the new equation yielded results referring to the ordinary hydrogen atom and another set referred to the neutron. The equation gave the effective radius and binding energy of the neutron which agrees well with the estimates made by Dr. Chadwick.

The quantum theory at present fails to explain why all hydrogen atoms do not collapse into neutrons. This is partially explained by Professor Temple's wave equations which indicate that hydrogen is in such a state as to permit no transitions.

THE SPEED OF LIGHTNING

How fast does a thunderbolt travel? This question has been answered by Dr. B. F. J. Shonland, of the Cape Town University, and H. Collens, of the Victoria Falls and Transvaal Power Company.

Using a camera provided with two lenses revolving in a circle at opposite ends of a diameter, an arrangement described by C. V. Boys in 1926, the two experimenters photographed a number of lightning strokes between earth and cloud. A moving lens tilts the image of a lightning flash on the plate much as a focal plane shutter causes a swiftly moving automobile to seem to lean forward. The other lens, moving in the opposite direction, tilts the image the other way, so that the real angle of tilt is found as half the angle between the two images. Knowing the speed of the lenses, which made 1,500 revolutions per minute, the experimenters could find not only the duration of the discharge, but which way it was going and how fast. They could determine also how long the luminosity persisted after the discharge had ceased, and other details.

Almost always, they found, the main flash was preceded by a faint "leader" as they call it. This traveled downward from the negatively charged cloud to the positively charged earth. As soon as it struck the earth, the main flash started upward from the same spot, and followed exactly the same path that the leader had taken, to the cloud.

The leaders were invariably thin, of uniform width, and unbranched. Their speeds ranged from 810 to 19,900 miles per second. They averaged 5,150 miles. The length of the strokes observed varied from 1.6 to 4.7 miles. The longest time occupied by a leader stroke was 1,670 micro-(millionths) seconds for a 4.7-mile stroke. The quickest flash took 69 micro-seconds to travel 3.5 miles.

The lengths of the strokes were measured along the crinkly paths registered on the plates. These did not show of course the motion toward or away from the camera, and the experimenters estimated that the real lengths of the strokes in space, and consequently the real velocities, were about 30 per cent. higher than those measured.

The leader appeared to be composed of an elongated dart. From the width of the track on the plate, the investigators were able to determine the duration of the luminosity at any point, and assuming that this was the time required for the dart to pass the point, they were able to measure the lengths of the darts. These varied from 80 to 370 feet, the average being 180 feet.

In conformity with the theory proposed by Dr. N. Ernest Dorsey in 1926, the authors believe that the leader consists of an "electron avalanch," which goes ahead and ionizes the air, thus preparing a conducting path for the main discharge that follows.

The main discharge is entirely different in character. It is thicker and brighter, and the thickness diminishes upward. It is more like a soaring flame than a moving dart. Also it travels faster. The speeds ranged from 14,900 to 68,400 miles per second, the average being 28,500 or about 15 per cent. of the speed of light.

Often the main upward discharges were branched—but they branched downwards. After each branch the main stem thinned but did not pause in its upward motion. The branch occurs at or after the moment the head of the discharge passes the point. The branches did not always occur in regular sequence, a lower branch sometimes sprouting out after an upper branch had developed.

The time required for the discharge to reach the cloud varied from 44 to 65 micro-seconds. To reach the end of the last branch took from 40 to 145 micro-seconds. The bright luminosity at the base lasted from 12 to 164 micro-seconds. Usually it was out before the discharge reached the cloud, occasionally not. A faint luminosity, however, lasted much longer, sometimes as much as 1/50th of a second, as though the path had been heated and continued to glow.

THE TREATMENT OF BENZENE POISONING

THE many cases of sudden death due to benzene poisoning that occur each year in various industries where benzene is commonly used as a solvent may be prevented by an injection of the drug, acetyl-choline. This announcement was made before the New Haven Medical Society by Dr. Louis H. Nahum, of the Yale Medical School, who told of his work in this field with Dr. H. E. Hoff, also of the Yale medical faculty.

Benzol vapor, Dr. Nahum explained, produces an abnormal sensitivity of the heart to adrenalin, a common constituent of the blood, bringing about an irregularity in the heart-beat which causes death. Adrenalin, incidentally, is sometimes injected into a heart that has stopped beating in an effort to restore life. Excitement and physical activity predispose to the occurrence of sudden death by benzol vapor. Excitement, moreover, is a condition in which the adrenalin glands pour into the blood large amounts of adrenalin. Animals deprived of adrenalin did not die of ventricular-fibrillation, the fatal irregularity of heart action which appears to be the cause of death in benzene poisoning. It was found, further, that an injection of acetyl-choline counteracted the action of the adrenalin and protected the animals against this fatal irregularity.

This finding, while important in itself, opens up a new field of investigation of the causes for death by heart failure. Adrenalin under abnormal conditions, one of them being exposure to benzol vapors, produces ventricular-fibrillation. Whether other conditions, heretofore overlooked by physicians, predisposes the heart to the lethal action of the adrenalin, remains to be investigated.

A DEVICE FOR THE STUDY OF EARTHQUAKE EFFECTS

EARTHQUAKES will have less terror for cities in active seismic regions, as the result of engineering data obtainable with a new device demonstrated at the Massachusetts Institute of Technology. It is known as a stress recorder, and is the invention of A. C. Ruge, research associte in seismology in the department of civil engineering.

The stress recorder consists basically in a train of lenses and reflecting prisms, which pick up a slender beam of light and pass it on to a sheet of photographic paper mounted on a slowly rotating drum. So long as the system is at rest the pencil of light writes a straight line on the paper. But when a stress bends or displaces the support of one of the reflectors, the beam of light is correspondingly displaced, so that the line traced on the photographic paper becomes a curve, accurately recording the degree of bending and hence the force exerted at that point. A timing device, which splits time up into thousandths of a second, makes its record on the same sheet of paper.

The optical parts of the stress recorder total less than an ounce in weight, and models of the essential structural units of a steel building can be kept down to a few feet in height and a weight of a hundred pounds, so that the entire arrangement can easily be mounted on a "shaking table" which will simulate under laboratory conditions any type of earthquake whose effects on structure it is desired to study.

The stress recorder constitutes a simple mechanical short-cut to results previously obtainable only by the most tedious and long-drawn-out kind of labor with slide-rule and calculating machine; and some of the results obtainable with it represent the integration of forces so complex that their mathematical calculation by ordinary means is not possible at all.

THE DANGER OF CARBON MONOXIDE IN AUTOMOBILES

INSIDIOUS carbon monoxide gas seeping from engine into automobiles may be the cause of many unexplained accidents. In 1933, there were 58,900 unexplained automobile accidents in which cars driven off the roadway for no apparent reason killed 3,260 persons and injured 53,240.

During tests here conducted in cooperation with the Connecticut Motor Vehicle Department and Department of Health, air within typical "run of the road" automobiles, such as police cars, private passenger cars, busses and trucks, was examined for its carbon monoxide content.

The conclusion was that fully seven per cent. of motor vehicles when in operation contain enough carbon monoxide to cause the collapse of occupants. There was probability of serious accidents if drivers were exposed to these dangerous atmospheres four or more hours. At least sixty per cent. of automobiles tested contained measurable quantities of the gas when in operation.

The first symptoms of carbon monoxide poisoning include headache, dizziness, smarting eyes, drowsiness and nausea, which result in slowing down of mental processes. The report of the test thus holds that the gas which comes largely from poor combustion and escapes through leaking exhaust pipes may also be partly responsible for some of each year's several thousand accidents attributed to poor driving judgment.

The research, conducted by the Travelers' Insurance Company and the Cities Service Oil Company, found that it is possible for a dangerous concentration of carbon monoxide to accumulate within a car which is following another at the usual trailing distance. The gas may enter the trailing car whether its windows are open or shut.

SANDSTONE MARKINGS MADE BY SNAILS

SNAILS of the east coast of Africa have helped Professor Othenio Abel, of the University of Vienna, to solve the riddle of certain markings in fine-grained sandstones found near Vienna, that have stumped scientists for many years.

Some time ago, Professor Abel had opportunity to watch the behavior of the strand animals on the wet beaches of the east coast of Africa. A certain species of snail attracted his special attention. This snail, scientifically known as Bullia, is a veritable galloper among snails; it can travel over the wet sand at the rate of nearly a yard a minute. It feeds mostly on stranded jelly-fish; hundreds of the snails can be seen hastening to the feast wherever one of these luckless creatures has been washed ashore.

If the sand becomes too dry, or if something frightens the snail, it behaves in a most peculiar manner. It wraps its wide "foot" around its shell, turns a somersault, and disappears into the sand. There, having found a level at which the moisture is more to its liking, and concealment from any threatening foe as well, it goes on its subterranean way, mole-fashion. Naturally, this subterranean path leaves a burrow quite different from Bullia's surface tracks; and a comparison of the modern snail-burrows in the African beach sand and the puzzling markings in the ancient Austrian sandstone shows a most convincing similarity.

Clinching the argument even more closely was Professor Abel's observation that an abruptly ended surface track on a slab of the sandstone could be traced as a burrow-marking on the under-side of the same slab. The ancient Bullia had evidently seen something it did not like, dived, and "continued the march" underground, leaving its footprint in the gradually hardening sands of time.

ITEMS

DEFORMED pods, which add further to the destructive effects of the mosaic disease of peas, have become of considerable concern to the California grower of summer and fall peas, according to Dr. William C. Snyder, of the University of California. When the pea plant becomes infected with the virus prior to the completion of pod development, the pods become markedly distorted, the walls assume a rough, ridged, wrinkled condition and, as a result of the corrugations, is badly deformed and somewas dwarfed. Pods resulting from blossoms borne on a badly diseased vine may become so badly twisted or curled as to be hardly recognizable as pods. Such pods remain severely stunted and may produce no seed.

FRAGMENTS of clay that once went into the building of a New Stone Age hut, accidentally baked into a brick-like consistency by a chance fire, have preserved for thousands of years evidence that the neolithic farmers grew a species of wheat similar to that cultivated in the earliest fields of Egypt and Mesopotamia. Professor Fritz Netolitzky, of Rumania, identified the plant remains after soaking the clay fragments in water and patiently picking them to pieces. Professor Netolitzky tells of his discovery in a report to the *Forschungen und Fortschritte*. The investigation was carried on at the Wallraf-Richartz Museum, Cologne.

EASY living is hard on the parts of the pancreas that produce insulin; abstemiousness tends to repair the damage. This has been shown in the case of fish by Dr. Walter N. Hess, of Hamilton College, who used rainbow trout as his subjects. Some of them he overfed, others he put on a diet too high in fat-forming foods, and still others he fed normally but kept under-exercised. In all cases, the islets of Langerhans in the pancreas, which are the insulin-producing areas, diminished in number and degenerated in condition. However, when Dr. Hess put similarly pampered trout on a diet low in fat-producing materials and kept them thus in training for a time, the damaged vital portions of the pancreas showed a high degree of regeneration.

STONY meteorites which came from outer space and were catapulted to earth as the result of the great meteoric display of March 24 last year and a less spectacular meteor of August 8 last year have been recovered by H. H. Nininger, Secretary of the Society for Research on Meteorites. Following the March 24 meteoric display which was witnessed from seven states of the Southwest, Mr. Nininger mapped the visible course of the meteor through the atmosphere and then stimulated searches for fragments that may have fallen to earth. Two of the fragments found had dropped to earth 35 miles before the end of the meteor's visible course, and another fragment was found 12 miles farther along the path. Ranchmen of the region are now searching for more fragments of the visitor from space. The August 8 meteor flashed over northwestern Nebraska where its meteoric fragment was found. Meteorites of both falls are almost identical in structure and composition. They seem to contain no metallic iron and are an uncommon variety of aerolite.

DINOSAURS may have evolved some of their most bizarre species as the result of a peculiar glandular disease, known as acromegaly. Acromegalic human beings become "horse-faced" giants, with huge hands and feet. The disease is caused by the over-activity of the pituitary, a small ductless gland within the skull. Acromegaly has been invoked by Dr. Richard S. Lull, paleontologist of Yale University, to account for the terrific skull sizes and the outrageous development of horns by certain species of ceratopsians, or horned dinosaurs, whose remains have been found in the Belly River Valley, in western Canada. What may have turned a disease into a driving force in evolution is uncertain: Dr. Lull conjectures some abnormality in the food available to the animals.

FORCIBLE demonstration of the gigantic scale on which the seas were run in remote times is given by a fifteen-foot fossilized herring which has just been placed on display in the Peabody Museum of Yale University. It was found near Russell Springs, Kansas, in a rock deposit that was soft sea-bottom mud when this great fish laid him down to die nearly a million centuries ago. Professor Malcolm Thorpe, of the department of geology, says that this is the most complete and probably the finest extant skeleton of an ancient fish. It has 87 articulated backbone segments, and the head retains an impression of the actual skin. It bears the scientific name *Portheus molossus*.