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THE INTERIOR OF ELECTRONS AND PROTONS

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PROFESSOR ALBERT EINSTEIN has extended his unification of the laws of gravitation and electricity to the interior of the electrons and protons, a realm for which he has been unable heretofore to find a law.

A promising addition to his previous unified field theories of 1929 and 1931 is made in this latest formulation of physical theory by the great German physicist. The details of the new theory are contained in a communication by Professor Einstein and his associate, Dr. W. Mayer, to the Prussian Academy of Science and published in its proceedings under the title: "A Unified Field Theory of Gravitation and Electricity."

There is hope that the permanently accepted consequences of the quantum mechanics will be found in this latest of Einstein's unified field theories. Quantum mechanics deals with the laws of the electrical particles and has been fruitful in the understanding of the realm of the minutely small.

Without a law for the behavior of the electromagnetic field in the interior of the electrons and protons, Professor Einstein had previously found it necessary, as Maxwell had before him, to treat the electrons and protons as foreign bodies embedded in the electromagnetic field, influencing it but not of it. He now assumes a somewhat more general structure of his four-dimensional space-time continuum as expressed in the axiom governing the five component vectors in terms of which he describes this structure. By this means he is now able to set up a series of equations capable of treating the electrons and protons as integral parts of the electromagnetic-gravitational field.

The detailed application of these equations to special problems has not yet been carried out. The complexity of this new unified field theory may be seen from the fact that Professor Einstein requires for its description twenty different functions of the coordinates which in a four-dimensional space requires sixteen independent differential equations for their full description. Actually in the form in which the equations are now written twenty-five differential equations appear. Professor Einstein is, however, able to prove that nine of these can be deduced from the other sixteen, so that the resulting equations are not inconsistent, but, as the mathematicians say, compatible with each other.

In the ordinary electromagnetic equations of Maxwell, there is a system of twelve field equations plus special assumptions governing the behavior of electrons and protons. The ordinary Newtonian equations of gravitation consist of three field equations plus the special assumption that action and reaction are equal. It is not surprising, therefore, that in a unified theory which covers both these systems of equations in their most general form, sixteen equations should be required.

In modern theory of physics, the electron and the proton have been much in the position of the *deus ex machina* of the old Greek dramas, introduced in the language of the mathematicians as a "singularity" in the field. The nature of the singularity and the laws of the disturbance that it causes in the field is independent of the laws of the field itself, and they are added as a special assumption. It is too early to state whether this new synthesis will banish the *deus ex machina* from physical theories as thoroughly as it has been banished from the modern stage.

The new theory may give a new approach to the understanding of the interior of the electrical corpuscles, the protons and the electrons. As yet it has nothing to do with atomic structure as an atom is a conglomeration of electrons and protons.

In modern conceptions of physics the space between the protons and the electrons in the atomic nucleus is subject to the same laws as the space outside the nucleus. All these laws, both inside and outside the nucleus, are now formulated in terms of quantum mechanics. Professor Einstein has expressed the expectation that all the assured results of the quantum theory would be found in his unified field theory.

PHOTOGRAPHING LIQUID HELIUM

THE first photograph of liquid helium to be taken was shown to members of the Royal Society of Canada, meeting at Ottawa on May 26, by coworkers of Professor J. C. McLennan, of the University of Toronto, who secured it during experiments at temperatures near the absolute zero.

The pictures were taken at just two degrees Centigrade above absolute zero and showed that the surface of this extremely cold liquid helium has a peculiar nature. Professor McLennan and his associates, H. D. Smith and J. O. Wilhelm, discovered hitherto unnoticed changes in the appearance of the liquid helium as it passed from one modification to another at its triple point, the temperature at which solid, liquid and gas can exist side by side.

The depths of the temperature scale, corresponding to below minus 450 degrees on the familiar Fahrenheit scale, were explored in these experiments at the University of Toronto in order to test the Raman effect on liquid helium. This is the discovery for which the Hindu investigator, Professor C. V. Raman, received the 1930 Nobel prize. He found that intense light of a single color is partly changed to other colors when it passes through various transparent substances.

Professor McLennan found that the Raman effect for liquid helium corresponded to the theoretical value. The experiments were performed in the same laboratory in which helium, the noninflammable elemental gas, was first liquefied in America.

THE MYTHICAL PLANET VULCAN

A NEW nail has been driven into the coffin of the mythical planet Vulcan by Dr. H. von Klüber, of the

Astrophysical Observatory at Potsdam. Vulcan was once supposed to revolve around the sun in an orbit within that of Mercury. Such a body would never be seen in the night sky, but would be visible either when it passes in front of the sun, or during a total eclipse, when the bright solar disc is temporarily hidden by the moon, and faint objects in the same part of the sky are made visible. For many years observations to detect it were made at eclipses, without success. It had been quite definitely decided that no such planet exists.

In May, 1929, Professor Erwin Freundlich, director of the Einstein Tower at Potsdam, photographed the eclipse of the sun visible in Sumatra. Though made for other purposes, these plates showed such a profusion of star images that Dr. von Klüber decided to examine them carefully to make sure that Vulcan was not concealed there. For purposes of comparison photographs of the same part of the sky, but without the sun, were made six months later at Potsdam, with the same telescope. If a planet were present, it would betray itself by its motion between the time of the two exposures.

The search proves conclusively that there is no planet as bright as the ninth magnitude, considerably below naked-eye visibility, up to a distance of 40 minutes from the sun. This is approximately equal to one and a third solar diameters. Closer than this the bright solar corona, visible at eclipse time, might have made faint objects invisible, but even there, believes Dr. von Klüber, a planet as bright as the seventh magnitude, also too faint to be seen with the naked eye, would have been found. Thus, he has decided, if there is a planet closer to the sun than Mercury, it is extremely small.

THE VALUE OF WATER

JOBS created by a program of natural resource conservation would come most legitimately under the classification of "income-producing works." This thesis was upheld at the meeting of the American Forestry Association, recently, by its president, George D. Pratt.

"To my mind it qualifies under the operation of the Finance Corporation just as much as does protection of our banking institutions, for in the last analysis these institutions are dependent upon the natural wealth of the communities and states which they serve. I hold that it would be a wise policy for the states to borrow money of the Finance Corporation to protect their natural resources and that it would be a wise policy for the Federal Government to loan money through the Finance Corporation to the states for this purpose."

The speaker held that this project is supported by nine distinct points of advantage. These include: the creation of many jobs; preservation of basic capital; benefits to national credit; promotion of confidence; benefits to agriculture by checking of erosion; stabilization of land ownership; creation of needed recreational areas; furnishing a basis for sound bond issues; conservation of water resources.

Water, its value as a national resource and the means necessary for its conservation and control, made up the dominant note of the discussions at the meeting. The abuse of this and other natural resources supplied the text for a vigorous criticism of short-sighted industrialists by Samuel S. Wyer, of Columbus, Ohio, consulting engineer.

"America's greatest danger is not from radicals, reds, Socialists or Communists, but from selfish business men who have failed to see the social significance of the forces in our rapidly accelerating machine civilization," he said. "If capitalistic society is to endure, then human rights and the welfare of human beings must be regarded as superior to property rights, and we must recognize that social significance and service, and not mere money-making alone, must guide business practices."

He called for more intelligent appreciation of the flood problem and more concerted effort toward its solution, for cessation of unnecessary stream pollution, and for a lightening of the tax burden on reforested lands as among the steps needed to place water resource conservation on a social rather than a selfish basis.

MENTALLY DEFICIENT CHILDREN

DR. EDGAR A. DOLL, director of research of the Training School, at Vineland, N. J., reported to the meeting of the American Association for the Study of the Feebleminded that as many as four per cent. of primary school children are mentally deficient, and some careful surveys report as high as eight or even ten per cent. so subnormal as to require education outside the regular classrooms of the public schools.

Of these, fewer than ten per cent. are cared for in institutions—nine out of ten of the feebleminded children are at large in the community.

"We know to-day that a person must be something more than feebleminded to require institutional care," Dr. Doll said. "He must be feebleminded and helpless, or feebleminded and dependent, or feebleminded and anti-social, and so on."

Most feebleminded children live in their homes in the community and are probably going to public schools, and since very few children are cared for in special classes, about 80 per cent. of the feebleminded of school age are found in the regular classes. The real problem of education and training of the feebleminded is, therefore, a community and a public school problem.

A more careful diagnosis and classification of mentally handicapped children than can be made on the basis of intelligence level alone was urged by Dr. Doll as of the utmost importance for educational purposes. Of particular importance he considered a distinction between the high-grade feebleminded and intellectually retarded normal child. The feebleminded child is one who will never be able to take care of himself without some degree of supervision. The intellectually retarded or subnormal child may be intellectually no brighter than the feebleminded, but he possesses certain other qualities which will enable him at maturity to maintain himself. The feebleminded are usually handicapped physically and socially as well as mentally; the intellectually re-

tarded are handicapped chiefly in regard to their verbal intelligence.

The distinction is apparently not one of emotional stability alone, but is rather one of common sense and practical judgment in the affairs of every-day life.

LOCATION OF EMOTIONS IN THE BRAIN

NOT only consciousness but also feeling takes place at the base of the left half of the brain in right-handed persons, Dr. Leland B. Alford, of St. Louis, reported to the American Psychiatric Association meeting in Philadelphia on May 31.

Dr. Alford reached this conclusion tentatively after studying patients whose brains had been injured or who had suffered from brain tumors. When the right half of the brain was injured, even if the injury was extensive, the patient appeared conscious and aware of what was going on, and his emotions were normal. Even when the left side of the brain was injured, there was no apparent confusion in the patient's mind, no disturbance of emotions, unless the injury was at the base of the left half of the brain.

It is known that the left half of the brain governs the right side of the body, and the left side of the body is governed by the right half of the brain. In right-handed persons, the left half of the brain is dominant, but when the right half is dominant, the individual is apt to be left-handed.

Dr. Alford studied a series of right-handed patients who were completely paralyzed on one side or the other. It is generally thought that such permanent, complete paralysis of one side of the body results from injury to the base of the brain, rather than to any other part. Of 30 such patients whose paralysis was on the left side, due presumably to injury to the right side of the brain, not one showed confusion of consciousness. On the other hand, of 55 persons suffering from right-sided paralysis, indicating left brain injury, 27, or nearly half, were confused. Dr. Alford hopes to be able to prove his theory more conclusively by finding, in examination after death, actual destruction of or injury to the tissues at the base of the left side of the brain in such patients.

His findings about the emotions also indicated the base of the left brain as their center. He suggests that the behavior disturbances occurring in children who have suffered from encephalitis lethargica, the disease known familiarly as "sleepy sickness" because the patients change day into night and reverse their sleeping habits, are emotional in nature and may be due to a small injury to the brain tissue concerned with the emotions.

ITEMS

A SUN-SPOT so large that it would engulf the earth is now on the face of the sun. It is a single spot with a total diameter of 22,000 miles, of which 9,000 miles is the darker interior portion or umbra. Two earths of the size of ours, 8,000 miles across, could easily be placed within this disturbance in the atmosphere of the sun. Observations made at the U. S. Naval Observatory by C. B. Watts, astronomer in charge of solar studies, show that the spot is just beyond the center line of the sun and four degrees north of the solar equator. It is roughly circular and is the largest single spot to appear on the sun this year. Keen eyes viewing the sun through heavily smoked glass may be able to detect the spot. A sun-spot minimum is approaching and the sun has been relatively unspotted. Reports from Mount Wilson Observatory, California, showed that two groups of spots containing four spots were observed recently.

KOPFF'S comet, a periodic visitor to the earth's part of the solar system, has returned after a six-and-a-half-year absence. It was sighted before sunrise on Wednesday, May 25, by Dr. Bobone, of Cordoba Observatory, Argentina, as reported through the Harvard College Observatory. As seen by Dr. Bobone, it was of the twelfth magnitude, and lacked any tail. It is below the celestial equator, an imaginary line through the sky directly above the earth's equator, and lies a little to the south of the zodiacal constellation Libra, the Scales. Dr. Bobone is a well-known comet finder; it was only a few weeks ago—April 18—that he reported the rediscovery of Houghton's comet. Kopff's comet was discovered for the first time in 1906, by the German astronomer whose name it bears. The last time it visited the neighborhood of the earth, in 1926, it was first sighted by another German astronomer, Professor Max Wolf, at the Heidelberg Observatory.

THE crystal form of insulin, secretion of the islands of Langerhans in the pancreas, which regulates the body's use of sugar, has been studied by means of long-wave x-rays. Professor G. L. Clark, of the department of chemistry of the University of Illinois, has reported his findings on this subject to *The Physical Review*. X-ray photographs of crystals give a picture of the internal arrangement of the atoms in the crystal. Such studies have been made of other crystals. One of the first to be investigated this way was the familiar sodium chloride, our common table salt. With the x-ray investigation and microscopic data, Professor Clark found the crystal form of insulin to be monoclinic, with one angle between 88 and 90 degrees. The individual crystals frequently assume a pseudo hexagonal form. There were 26 molecules per unit cell.

GERMANY'S rescued swallows have come home. Last fall the birds were trapped by the too-sudden advent of winter, before they had made the crucial flight over the Alps into Italy. Bewildered, threatened with exhaustion and starvation, they lingered in southern Bavaria, unable to wing their way over the mountains because of the incessant storms that raged there. Fearing for a serious depletion of the species, bird lovers in Germany and Austria captured thousands of them as they huddled, wet and wretched, on their perches. They slipped identifying bands about their legs, and then shipped them in cages into Italy. Lately the first wave of northward-migrating swallows passed over Bavaria. Some of them were trapped, examined and released. They wore the identifying bands.