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THE ORIGIN OF THE COSMIC-RAY

PROFESSOR ARTHUR H. COMPTON, professor of physics at the University of Chicago, and Dr. P. Y. Chou, of the National Tsing Hua University, Peiping, China, discuss in the current issue of *The Physical Review*, a new hypothesis on the origin of the cosmic ray. It is pointed out that in the present stage of cosmic ray knowledge there is no known act of nature—even the annihilation of the atomic nucleus—which can provide sufficient energy to fit the observed energies of some of the cosmic rays. The only possibility is the primeval explosion that sent worlds and galaxies literally rocking and reeling into space.

Every kind of particle and the packets of energy known as photons would be the débris of such a staggering catastrophe. To account for the known preponderance of electrically charged particles, it suggested that the non-charged photons and neutrons have been lost in space because they could penetrate the magnetic field of stars and galaxies. But these same magnetic fields might trap the charged particles and so produce the observed particle component of the cosmic rays.

The authors acknowledge the expanding universe theory of Abbé LeMaître as the inspiration for the new hypotheses of the origin of cosmic rays. This is the first report on the subject to appear for some time. For some years investigators have been content to study and obtain more and more experimental data, leaving the fitting together of the pieces to a later time.

Discussing the high energy of cosmic rays and their apparent origin somewhere out in space, the authors write: "If the cosmic rays come from beyond the Milky Way, at a really typical place in intergalactic space the density of cosmic-ray energy would be of the order of 100 times as great as that of starlight. It is thus apparent that either the source of the rays must be a radiator which is very powerful compared with stars as a source of light, or the cosmic rays once emitted must be retained by the metagalactic system instead of being lost as is starlight. Although nuclear processes occurring in interstellar space might result in an adequate total energy, it appears that such processes are inadequate to account for the great energies of the individual cosmic-ray particles."

Concerning the trapping of the electrical particles they ask, "Is it possible that electrically-charged rays emitted by the initial explosion may be deflected by stellar or galactic magnetic fields just as a cosmic-ray electron is deflected by the earth's magnetic field? If so, those particles which would be most probably retained by the metagalactic system would be those with the highest ratio of charge to mass in order, electrons, protons, etc., whereas all neutral rays might be forever lost."

Because, on the hypothesis, the cosmic rays would spend much of their lifetime in intergalactic space they should suffer the "red shift" decay of energy in the same way that light does. If this is true the energies of the cosmic rays now striking the earth must be much less than those of the rays in the early history of the earth.

A NEW METAGALACTIC CLOUD

WHAT is probably the most extensive "metagalactic cloud" ever discovered, so tremendous that it may easily encompass 50,000 galaxies comparable with our own Milky Way, has been located and photographically studied by astronomers of Harvard University.

Shaped roughly like a narrow stream, it is estimated to be about 50,000,000 light years in length and 20,000,000 light years across. It is more than 100,000,000 light years distant from the earth, however, and despite its great size, its members are visible only through the most powerful telescopes. It is situated near the south pole of the heavens. According to Dr. Harlow Shapley, director of the Harvard Observatory, who announced the discovery, the cloud is of particular interest to astronomers not only because of its tremendous size, but because it is expected to be of much importance in studying the complex space-time-matter relationships in our "immediate" neighborhood, astronomically speaking—that is, out to about 100,000,000 light years. It emphasizes the lack of uniformity in the space distribution of galaxies. Astronomers have for some years been aware of the existence of so-called super-galaxies—clusters big enough to contain several hundred Milky Way systems. Until this most recent find, however, there has been no evidence of galaxies much larger than these—certainly not for any as large as the one just found. The new cloud was discovered on photographic plates taken at the southern station of the observatory during a more or less routine survey of all galaxies brighter than the 18th magnitude. At first it was classified as merely a "major irregularity" in the distribution of faint galaxies in the southern skies. The photographic plates actually show only about 15,000 galaxies, all of them between the magnitude of 16.5 and 18.5, but judging from other super-galaxies it is assumed that many members are too faint to show on the plates and have placed the probable complete census at more that 50,000 galaxies. Astronomically speaking the cloud extends over a region about 40 degrees in length and 15 degrees in width, from near the sky's south pole toward the south galactic pole in Sculptor.

RADIOACTIVE ELEMENTS

IN a report to the American Physical Society Professor T. R. Wilkins and Dr. W. M. Rayton, of the University of Rochester, present new evidence which helps make clearer the origins of the missing long-lived parents of the actinium series of radio-elements.

Scientific happenings which make it possible to throw light on the problem are that sometimes the change from one element to another is accompanied by a loss of weight and sometimes merely by a loss of electrical charge without the weight loss. The loss of weight occurs when the nucleus of a helium atom, known as an alpha particle, is

liberated in the radioactive disintegration. Then, the parent atom drops down two whole numbers in the numerical scale which rates chemical element from hydrogen, at one, to uranium at 92.

When electricity is given off by the emission of an electron the atomic number of the element jumps back up the scale by one unit. Thus Uranium I (92) gives off an alpha particle and becomes Uranium X_1 (90). But Uranium X_1 gives off an electron and becomes Uranium X_2 with atomic number 91. Thus in stepwise fashion, but sometimes up and sometimes down the scale of atomic numbers, go the disintegrations of the heavy radioactive elements, of which the best known is, perhaps, radium with atomic number 88. Common, grey and soft lead is the final offspring of all these spontaneous changes and there are four different kinds of lead; radium lead, thorium lead, actinium lead and just lead. The radium, thorium and actinium here mean that it is lead which had each of these specific origins. Plain lead merely means that its origin can not be specifically fixed.

The ability of the radioactive atoms to lose or take on weight at various stages means that there will frequently be two or more varieties all having the same chemical properties but slightly different masses even though they may have the same atomic number rating. Thus Uranium X_1 and its three isotopes all have atomic weight of 234. One has an atomic number of 90, another is number 92 and two are number 91.

While chemical methods are not sufficiently exact to permit distinguishing between all these varieties, other methods, and in particular, the range with which alpha particles are emitted, serve as experimental checks.

Drs. Wilkins and Rayton have studied the alpha particle ranges as their method is seeking actinium's "lost parent." The investigation also throws much needed light on the way alpha particles are emitted from the nucleus of atoms; a problem which has bearing on the much-studied and important field of the constitution of the inner cores of atoms.

A previously-unfounded isotope of uranium has been indicated, at least tentatively, which might well serve as the parent for the now-orphaned series of actinium radio-elements.

A SCIENCE OF HUMAN BIOLOGY

A SCIENCE of human biology, broad enough in its scope to synthesize knowledge of man's mental and spiritual sides as well as of his physical nature, ought to be evolved within the next century if civilization is to survive—perhaps even if the human race itself is to escape extinction. This was the concluding note of an address by Professor Raymond Pearl, of the Johns Hopkins University, at the celebration on June 17 of the hundredth anniversary of the founding of the University of Michigan.

The necessity for such a science of social synthesis has been thrust upon us, Professor Pearl said, by the long strides science has taken in putting more wealth and power into the hands of men, while other aspects of our evolution have remained stagnant. We have advanced enormously in power, and little or not at all in wisdom and goodness. So the very advances we boast of in material things make our development so lopsided that it threatens to crash and end, as many other lines of great but unbalanced evolutionary development have ended in the past.

Fumbling attempts at such unification of human knowledge and striving have been made hitherto by politicians and clergy—with results not particularly distinguished. They are not wholly to blame for lack of success, either; the prerequisites of real knowledge of the whole nature of man has simply not been met—the data do not yet exist. That is one of the chief challenges to the scientific man: both by natural aptitude and training he is best equipped to obtain such data; and he should therefore seek and find them.

Professor Pearl invited his hearers to look backward over the hundred years since the founding of the university: Pasteur, Lister, Huxley, most of the great leaders of the scientific revolution of the nineteenth century, were still children then. With a record of so great achievement in so short a time there is no reason for supposing that the world will not continue to go ahead. As a practical matter, he expressed the belief that the universities, rather than specially founded independent institutions, offer the best environments for scientific research. That research institutions unparented by universities have been called into existence at all he regards as a symptom of the departure of modern universities from their original tradition; but this, he thinks, is a passing phase, and the universities will soon come into their own again as homes of research.

THE PARTICIPATION OF ENGINEERS IN NATIONAL AFFAIRS

THE electrical engineering profession was urged to participate actively in national projects and events in which it has special knowledge at the recent meeting in Milwaukee of the American Institute of Electrical Engineers. Frank R. Innes, the western editor of *The Electrical World*, made the recommendation as he disclosed a recent poll of engineers to see if they wished their societies to enter actively into topics of national interest. That the engineers wished, by a great majority, to undertake this greater social responsibility was evidenced by the poll reported.

Mr. Innes charged that engineers have talked much in vague, nebulous terms that belie their scientific training, about social responsibility as it affects engineers. The time for action is at hand, he indicated, and suggested that the first topic of study by a committee of electrical engineering societies might well be the federal water power program. Specifically, electrical enginners should investigate criticisms of the program that are now current, namely:

(1) That the only markets available for government plants are those which would take away existing utilities, or that most government plants are so remote from large markets that it can be said that no markets exist for them.

(2) That the cheapest electricity to-day comes from fuel plants near existing markets; and that it costs less

to haul coal for fuel than it does to transmit the electric power from a distant source.

(3) That water power electricity, from an efficiency standpoint, is almost a closed art, whereas electricity from fuel plants has the greatest chance for future economies.

(4) That building large power plants may aggravate employment problems, reducing labor costs in production and removing it almost entirely from the field of transportation.

(5) That financing periods of fifty years, needed for the giant government hydro-electric projects, appear to be indefensible in the present age of technological progress when to-day's best machines may be obsolete in the next few years.

INSULIN IN THE TREATMENT OF SCHIZOPHRENIA

DR. JOSEPH WORTIS and Karl M. Bowman, of Bellevue Hospital, New York, reported at the closing session of the American Medical Association, that more than one thousand mental cases have been restored to health and sanity by treatment with insulin.

The treatment consists, essentially, of giving the mental patient enough insulin to produce shock. This is a much larger dose than is given to control diabetes. The treatment was originated by a young Austrian physician, Dr. Manfred Sakel, in 1930. Since then, Dr. Wortis said, it has been used in fifty hospitals and universities throughout the world from Korea to Iceland and from Edinburgh to Galveston. The results are "substantially positive and confirmatory." Dr. Sakel claims that nearly three fourths of the patients who have been ill less than six months recover completely, while good results are obtained in slightly less than half of those who have been ill several years.

The particular disease for which insulin shock is used is called schizophrenia. No one knows what causes it, but insulin treatment may give the clue on further study. Results from this treatment already show that the cause is probably a defect in brain structure or chemistry, and not mental or psychological, as some psychiatrists have held.

The treatment of this disease by insulin shock, produces improvement that outruns anything produced by any other kind of treatment, in the opinion of Drs. Roy G. Hoskins and D. Ewen Cameron, of the Worcester, Mass., State Hospital. These two physicians were the first to take up the insulin shock treatment of schizophrenia in the United States. They and the Bellevue doctors both reported their results, pointed out various points in technique and explained that the treatment must only be given in a well-equipped hospital under the supervision of a trained psychiatrist ready to meet the dangerous emergencies that may arise. Chief of these is the possibility of the patient succumbing to the shock unless proper restorative measures are at once instituted.

Striking changes in the behavior of the patients, including a return to a quiet, orderly, normally active life, with ability to concentrate and loss of hallucinations, were reported by Drs. Hoskins and Cameron.—JANE STAFFORD.

ITEMS

SUGAR CANE leaves can form cane sugar when they are detached from the stalk and kept in the dark, supplied with the two simpler sugars, glucose and fructose, or with either one of them alone. Experiments developing these points, performed by Dr. Constance E. Hartt, research plant physiologist for the Hawaiian Sugar Planters' Association, give further support to the theory that conversion of simple into complex sugars can take place in leaves.

LIKE a wartime listening post is the instrument for detecting boring insects in timber devised by F. M. Colebrook, of the National Physical Laboratory at Teddington, England. It consists of a soundproof box in which the suspected sample is placed, a microphone and amplifying setup, and headset or loudspeaker. Mr. Colebrook describes the gnawing of deathwatch beetle larvae as "a kind of muffled and intermittent rattle."

NEW land is being added, slowly but surely, to the map of the United States. The mangrove bushes along the coast of Florida are doing it, according to Professor John H. Davis, of Southwestern University. Professor Davis has been making a special study of this subject, from personal observations, examination of old maps, and comparison of newest air-survey photographs. The red mangrove, which grows in salt water, has numerous roots which catch and hold silt and clay. As the deposit becomes higher, the red mangrove is supplanted by the white and black varieties which grow better on the higher soil. On decay, the mangrove remains form peat formations which air further in the land-building process. Experimental plantings of mangroves have been made along the Florida coast so that further study of their rôle in land-building may be investigated.

A NEW antitoxin which promises to be a specific cure for gonorrhea, was reported by Dr. T. Anwyl-Davies, of St. Thomas's Hospital, London, at the conference of State and Provincial Health Authorities of North America, meeting at the U. S. Public Health Service in Washington. The new antitoxin is still in the experimental stage, but the results already obtained seem to encouraging that it will be tried by the U. S. Public Health Service at its venereal disease clinic at the U. S. Marine Hospital, Stapleton, N. Y. Dr. Anwyl-Davies reported excellent results in about half the 157 cases treated and good results in another quarter of the cases. "Cures" were effected in 36 cases which have been observed for over three months. Two of these were cured in 16 days, while other cases took as long as 8 weeks. The antitoxin is equally effective in acute and chronic cases, with and without complications. It differs from other antitoxins previously tried in this disease in the way it is prepared. Instead of being made by injecting the gonococcus directly into horses, the toxin produced by the gonococcus is injected into horses and the serum of these animals used for the antitoxin.