SCIENCE NEWS

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THE ENERGY OF GAMMA RAYS

MAN-CREATED gamma radiation, of the kind so widely used in the treatment of cancer, and excelling the best efforts of nature over six times, is being studied at California Institute of Technology. Four investigators, headed by Professor C. C. Lauritsen, of the Kellogg Radiation Laboratory, report in *The Physical Review* that they have unmistakable evidence of laboratory-produced gamma rays having energies of 16,000,000 electron volts. The highest energy found in natural gamma rays—given off by radioactive substances such as radium—is only 2,600,000 electron volts; an energy "record" held by the radioactive element known as thorium C″ (thorium C double prime).

Professor Lauritsen's 16,000,000 electron volt gamma rays were obtained in experiments performed in collaboration with Dr. H. R. Crane, Dr. L. A. Delsasso and W. A. Fowler. The light metal element lithium was bombarded with protons, the positively-charged nuclei of hydrogen atoms, to yield the piercing rays.

The proton atomic "bullets" were driven down a special vacuum tube in the research by electric voltages which ranged from 400,000 to a million volts. On striking the lithium target, the proton is believed to combine momentarily with lithium atoms. The lithium atoms are thought to be the isotopic form of mass seven. When a proton joins them, it adds its mass of one so that the total mass is eight.

The 16,000,000 electron volt gamma rays which emanate from the union are best explained by assuming that the lithium and proton of total mass eight break up into two helium particles, each of mass four. Such helium nuclei are known as alpha particles and, along with gamma rays and electrons, are given off when radium disintegrates. To balance the energy equation, it is necessary to postulate that 17,000,000 electron volt gamma rays come out when the two alpha particles are created. The presence of 16,000,000 electron volt rays was detected quite definitely by a study of the atomic "débris" knocked out. Tracks of the flying electrons from the impacted atoms of the lithium target were observed in a Wilson cloud chamber in the investigation of the high energy gamma radiation.

"FORBIDDEN LIGHT"

"FORBIDDEN LIGHT," which in reality never reaches the earth, has been indirectly analyzed by the spectroscope to give man increased knowledge of his remotest neighbors of the universe, the far distant nebulae. Dr. I. S. Bowen, of the California Institute of Technology, announced this achievement in spectroscopy at the Massachusetts Institute of Technology conference at Cambridge.

Applying a recently developed astronomical theory, he has investigated the light which does reach the earth and has worked back to an analysis of the "forbidden" wavelengths of light. This light, with its plentiful energy, is situated in the extreme ultra-violet of the spectrum and it is believed to cause the light that reaches the earth. Theoretically the forbidden light, present in the powerful energy of the extremely hot stars, excites the tiny atoms of helium and hydrogen in the star. As these shaken-up atoms return to normal, they emit the light that reaches the earth. This phenomenon is known as "the fluorescence of hydrogen and helium in the stars."

For some time astronomers have been seeking to learn more about these astronomical islands whose distance in space is measured in terms of millions of light years with the penetrating eye of the spectroscope to aid them. It has been possible to analyze some of the light coming from these nebulae and much has been learned concerning their composition, probable origin and condition.

The fact that all the light leaving the nebulae does not reach the earth, some of it being filtered out by the layer of ozone circling our globe, has been a great obstacle to more complete knowledge. Attempts to produce this light artificially in the laboratory have also failed, and the light has been termed "forbidden" since science has never been able to analyze it.

RAYS OF SUNSHINE THAT DO NOT REACH EARTH

THE first comprehensive studies of just what part of the sunshine has beneficial effects on man and animals were reported to the third International Conference on Spectroscopy held at Massachusetts Institute of Technology.

Dr. John M. W. Bunker and Dr. Robert S. Harris, both of the Massachusetts Institute of Technology, gave white rats specific doses of rickets and then exposed them to definite wave-lengths of light to determine just what rays would hasten the bone calcification, the failure of which causes rickets. It was found that the wave-lengths between 2537 Ångstrom units and 3025 were the sources of beneficial vitamin D.

An unusual aspect of the find was that nearly all of the valuable therapeutic light is artificial in that it never appears in sunshine, for these rays are stopped by the earth's atmosphere. Dr. Bunker explained this paradox by saying: "It happens that animals of strictly nocturnal habits subject to rickets can be cured of this disease by light, and especially by light of wave-lengths which in nature never reach the earth."

The very fact, it was suggested, that the rats respond to light which is filtered out by the layer of ozone surrounding the earth now, may mean that at some previous time the sun emitted shorter, much more penetrating rays which ploughed through this ozone layer. This suggestion that the sunlight which our prehistoric ancestors enjoyed in the prehistoric days may have been different from that observed to-day is, of course, purely hypothetical, but is a feasible explanation.

THE QUANTUM THEORY

FOLLOWING Professor Albert Einstein's criticism of the quantum theory on the grounds that it does not give

a complete description of physical reality, Professor Niels Bohr, of the Institute of Theoretical Physics at Copenhagen, makes reply. He is one of the leading exponents of the quantum theory, for certain developments of which he was largely responsible. The theory was initiated by Professor Max Planck; others associated with it are those of De Broglie, Dirac, Eddington, Heisenberg, Jeans and Schroedinger.

Professor Bohr's initial rejoinder is in the form of a letter to the editor of *Nature*. He is shortly to publish a longer communication in *The Physical Review*, where the paper by Professor Einstein, Dr. Boris Podolsky and Dr. N. Rosen was published. His criticism of the deductions of Einstein and his co-authors is based on disagreement with their criterion, or standard of test, of physical reality. He does not think that their definition of this reality can be approximately applied to problems of quantum mechanics.

Professor Bohr writes: "Since, as the authors show, it is always possible in quantum theory, just as in classical theory, to predict the value of any variable involved in the description of a mechanical system from measurements performed on other systems, which have only temporarily been in interaction with the system under investigation; and since in contrast to classical mechanics it is never possible in quantum mechanics to assign definite values to both of two conjugate variables, the authors conclude from their criterion that quantum mechanical description of physical reality is incomplete. I should like to point out, however, that the named criterion contains an essential ambiguity when it is applied to problems of quantum mechanics."

THE "ELECTRIC EYE" AND THE RECORDING OF EARTHQUAKES

A NEW way of making earthquakes write reports of their occurrence in distant parts of the world has been devised by Halley Wolfe, of the California Institute of Technology. It combines the advantages of two former systems, and avoids disadvantages that handicap both of them.

Present types of earthquake records are made in two ways. In one, an instrument with a heavy pendulum holds a delicate pen-point against a sheet of moving smoked paper, and makes wiggly lines when an earthquake occurs. The advantages of this method are its low cost and its constant visibility; its disadvantage lies in the lower sensitivity caused by the heavy weight.

In the other method, a small mirror, mounted on a much lighter, more delicately balanced weight, causes a beam of light to dance back and forth on a sheet of photographic paper when the quake comes. This method has the disadvantages of requiring the use of expensive photographic paper. Furthermore, the only way in which the observer can tell whether a quake has occurred is to remove and develop the recording sheet.

In Mr. Wolfe's new device, the mirror-directed beam of light is used, but the photographic paper is omitted. Instead, the beam plays on a photoelectric cell—the "electric eye" of physicists—which sets up a fluctuating current as the beam flickers across it. This electric current, suitably amplified through a vacuum tube hook-up, drives a specially constructed pen which records the waves on a moving sheet of plain white paper.

Mr. Wolfe's apparatus, set up at the seismological laboratory of the Carnegie Institution at Pasadena, has been in successful operation for over a year. Records made by it in ink on paper correspond in exact detail with records of the same earthquakes made by the direct photographic method.

BEETLES ON THE NEW JERSEY COAST

STORMS probably were responsible for the deluge of Japanese beetles recently cast up by the sea along the New Jersey coast making beaches of summer resorts unfit for bathing or lounging in the sand. Apparently drowned by immersion in the Atlantic, beetles by the thousands came to life and transformed sunny expanses of sand into stretches teeming with squirming insect life, to the disgust of vacationists.

The so-called "heavy flight" season for these insect pests is at its peak at present, and New Jersey, where they first appeared in America, has greater numbers of them than any other state. Although they seldom fly more than 200 to 300 yards, a heavy wind blowing offshore could easily have blown tens of thousands into the Atlantic to be cast up again by the waves. Their extreme hardiness would keep great numbers alive even after considerable time in the water.

Soil about the roots of a shipment of Japanese iris to New Jersey concealed grubs of the Japanese beetle and was accidentally responsible for their introduction into the United States, where entomologists discovered them in 1916. Since then they have spread with great rapidity and have established themselves as the undisputed princes of plant destroyers.

Peach, apple, pear and shade trees are some choice feeding grounds preferred by these insects, although they will devour with relish dozens of vegetables and other varieties of trees. The smooth green fairways of golf courses are much in demand as good locations for the hatching of grubs.

Entomologists have found these beetles to be wily as well as hardy, and consequently extremely hard to poison with ordinary "bug dopes."

Every conceivable way to rid America of Japanese beetles has been tried. Trees have been sprayed with extracts of plants known to be repellent to the insect. Parasitic wasps and flies have been introduced from China, Japan and India. At one time breeding of a species of bantam rooster known to feed upon them was considered. Elaborate traps using the scent of geranium as a bait have been developed. All these succeeded in checking the spread of the pests somewhat, but not in destroying them.

THE SOVIET STRATOSPHERE FLIGHT

RIPPED balloon fabric ended the recent (June 26) Soviet stratosphere flight just as it caused the failure of the Army Air Corps-National Geographic Society balloon *Explorer II* before it left the ground. Whereas no lives were seriously endangered by the latest American adven-

ture, the Russian flight in the *U. S. S. R.* balloon ended without major tragedy only because two of the three men who made the ascent jumped in parachutes and lightened the load at the crucial instant.

Details of the Soviet venture have just reached Science Service in mailed dispatches from Moscow. They offer a picture of what might well have happened to the *Explorer II* if its accident had occurred in the stratosphere instead of on the ground. Professor Alexander Verigo, chief physicist of the Department of Radioactivity and Cosmic Rays of the Geophysical Laboratory in Leningrad—who was scientific observer—and engineer Y. Prilutski, the co-pilot, were the two men who jumped. Chief pilot K. I. Zillie, was then able to bring the balloon to a safe landing without damaging its scientific apparatus and cosmic ray records.

At 45,000 feet altitude on the ascent the balloon passed through a layer of turbulent air which tossed the 24,000 cubic meter bag to and fro. It is believed that this stormy session caused the rips. The buoyant gas quickly leaked away and only the parachute jumps stayed the rapid descent to a degree that made a safe landing possible.

ITEMS

THE probability of war between Italy and Ethiopia has resulted in the newest link in the world-wide system of radiotelegraph communication to handle the expected increase in message traffic. Cable and Wireless, Ltd., of London, announces that London and Addis Ababa, Ethiopian capital, are now in direct communication by radio. The previous circuit included a relay station in Cairo, Egypt. Messages from the United States are transmitted from New York to London by RCA Communications and then to Ethiopia by its British associate, Wireless and Cable, Ltd.

THE recent moon eclipse improved radio receiving conditions according to the preliminary results of tests made by Dr. Harlan T. Stetson and T. S. McCaleb, of the Institute of Geographical Exploration of Harvard University. Tests for nights after the eclipse are expected to give support to Dr. Stetson's theory that the moonlight affects radio signal intensity. "It was a novel sensation to observe an astronomical event through clouds by radio methods," Dr. Stetson said. In spite of clouds that obscured the moon visually the observations of radio signals from Station WBBM Chicago were successful, showing improved conditions as the moon entered the earth's shadow.

THE spectroscope, instrument that analyzes the light of stars, chemicals and other industrially useful things, promises to tell why some skins sunburn with rashes and splotches and others just redden and tan. To the Massachusetts Institute of Technology conference on spectroscopy Dr. Harold F. Blum, of the University of California, explained the use of the spectroscope to study various kinds of sensitivity of human skin to light. Normal skin is sensitive only to that light which ordinarily produces sunburn and then tanning, he said, but some skins possess special pigments which respond to light with various rashes and splotching. By sorting sunlight with a spectroscope he was able to filter it and determine the exact wave-lengths which caused particular rashes. This may suggest possible cures although no progress in this direction has been made as yet.

MARKED progress toward the complete and positive identification of pepsin, the important digestive juice found in the stomach, which is expected to be of tremendous aid to medicine, was reported to the third International Conference on Spectroscopy, meeting at Massachusetts Institute of Technology, by Dr. George I. Lavin, of the Rockefeller Institute for Medical Research. Although science has for years realized the importance and the function of pepsin and has been fairly sure that it was composed of carbon, hydrogen, oxygen and other elements, just what amount of these substances constitute pepsin and how they are chemically arranged has remained a mystery. Only recently it was discovered that pepsin is a protein, but medicine has looked in vain for much-needed additional information. Dr. Lavin's research, conducted with the spectroscope suggests that pepsin may have some amino-acids in it. His method was to compare the spectra of pepsin with those of substances of which it might be composed.

EXCEPTIONAL progress toward a solution of the problem of the structure of hemoglobin was reported by Dr. David L. Drabkin, of the University of Pennsylvania, who spoke at the Conference on Spectroscopy. Hemoglobin is that complex constituent of the blood which acts as a conveyor of oxygen to the various parts of the body. Its importance, Dr. Drabkin said, is exceeded only by the difficulty of studying it. With the spectroscope, however, Dr. Drabkin has been able to conduct analyses far in advance of any carried on previously and although the problem is still unsolved, steps toward the ultimate solution have been made. Dr. Drabkin described the comparative ease with which spectroscopy had enabled investigators to study vitamin B1, the oldest known yet most elusive vitamin. The next step, he said, would be a method of studying the reflection spectra of tissues directly to replace the present method of studying biological substances in solution.

THE amount of lactic acid in the fluid in the spinal cord gives aid in diagnosing certain diseases of the brain and central nervous system, particularly meningitis, Dr. S. Bernard Wortis, of New York City, reported at the second International Neurological Congress meeting in London. The measure of this acid may also be used to tell the physician something of the progress of the disease and the patient's chances for recovery. Children may be protected against infantile paralysis by two small hypodermic injections of the killed virus of the disease obtained from the spinal cords of monkeys. The work leading to this method of protecting children against infantile paralysis was carried on by Dr. Wortis and Dr. Maurice Brodie, both of New York University.