

SCIENCE NEWS

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MEETING OF PHYSICISTS AT CHICAGO

BY WATSON DAVIS

WHY cosmic rays bombard the earth less energetically near the equator, as Dr. Arthur H. Compton's world-wide survey discovered, was given theoretical explanation by the Abbé Georges Lemaitre, University of Louvain priest-cosmologist, in a paper before the American Physical Society meeting at the University of Chicago. Using the idea that cosmic rays are affected by the magnetism of the earth just as electrons from the sun cause the aurora in polar regions where magnetism is strong, Professor Lemaitre has evolved a mathematical theory that shows that electrons of ten thousand million volts can not reach the earth's surface at the equator. The great earth-magnet pulls the electrified particles into streams over the two ends of the earth. Professor M. S. Vallarta, of Massachusetts Institute of Technology, collaborated in this theory with Professor Lemaitre. After coming to America for the eclipse, Professor Lemaitre has worked in Cambridge, Massachusetts. He is now going to visit the Mount Wilson Observatory and the California Institute of Technology. There he will probably see Einstein, who arrives about New Year's Day. The idea of the expanding universe originated with Professor Lemaitre and last year he suggested the following theory: Ten thousand billion years ago, more or less, the universe was a gigantic atom weighing as much as all the matter in the universe. That primordial atom exploded, shooting out powerful rays, as uranium and radium disintegrate to-day. These rays have traveled through space ever since and now rain on the earth as cosmic rays. He considers that this theory is upheld by the Compton experiments and his newer theory. Instead of being mere electrons or even heavier helium particles, Professor Lemaitre further suggested that the cosmic rays may be the hearts of weightier atoms, such as oxygen and iron, let loose in the original atomic and universal super-radioactivity.

STREAMS of electrons, the ultimate particles of electricity, when shot through crystals promise to reveal some of the secrets of the heart of matter, the atomic nucleus, according to a report made by Drs. K. Lark-Horovitz and H. J. Yearian, of Purdue University, to the American Physical Society. They have found unmistakable evidence of the rôle that the nucleus of the atom plays in the diffraction of electrons by crystals. Whereas the x-ray method of crystal pattern study shows only the behavior of the electron cloud around and outside the heart of the atom, the electron waves are strongly influenced by the charge of the nucleus of the atom itself. This effect showed in the Purdue experiments as a difference in the intensity distribution of the scattered electron waves as compared with the x-ray pattern. The German physicist, Dr. M. von Laue, first discovered that x-rays could reveal atomic structure. He was given the Nobel prize for this research. The x-rays are so much

shorter in wave-length than visible light that they are scattered by the atoms that make up matter. Photographs of x-rays passed through crystals allowed physicists to work out the way atoms arrange themselves in matter and in part how they put themselves together. The discovery that electrons themselves have some of the properties of light and x-rays and can be diffracted was made by two American physicists, Dr. C. J. Davisson and Dr. L. H. Germer.

A NEW instrument for measuring gravity so sensitive that it detects the attraction of the moon was explained to members of the society by its inventor, Dr. Kenneth Hartley, of Houston, Texas. Measurement of gravity to within two or three parts in a million, which corresponds to two or three feet of difference in elevation, is of value in prospecting for oil and valuable minerals. Dr. Hartley made his gravity balance with that end in view, but it has proved to be so sensitive that it has an accuracy ten times that of the pendulum apparatus of the Coast and Geodetic Survey with which official gravity values are determined. The attraction of the moon registered on the Hartley balance agreed with the vertical part of the moon's pull upon the instrument as computed theoretically. Making readings each hour during a complete cycle of the moon's journey around the earth, which takes a little less than a month, Dr. Hartley found that the moon's attraction has a period of 24.8 hours and that the 12.4 hours' period found in the tides is not present. Another puzzling discovery was a small lag in time of the recorded values as compared with those mathematically expected. This has not been explained. The Hartley gravity instrument uses the elasticity of a spring in measuring gravity. The only previous successful methods have used some form of pendulum for determining the acceleration produced by gravity. With the type of pendulum apparatus used by the government engineers, gravity can be accurately determined in only three or four places in a month, while Dr. Hartley claims that he can ascertain gravity at three places within an hour if the weather is reasonably good.

VAMPIRE BATS AND PANAMA HORSE DISEASE

MURRINA, or trypanosomiasis, a fatal disease of horses in Panama and northern South America, is transmitted from infected cattle to healthy horses by the vampire bat.

This is the second known instance of a disease being carried by a mammal. Discovery of the bat's rôle in the spread of the disease was made at the Panama laboratories of the Gorgas Memorial Institute and reported by the director, Dr. H. C. Clark, at the meeting of the board of directors in Washington.

The only other mammalian vector of disease so far known is the dog, which transmits rabies. Certain other mammals, such as rats, play an important part in the

spread of diseases, but the actual transmission of the germs is by insects.

Dr. Clark and associates had been investigating flies, fleas and many other insects in their more than 20-year search for the vector or carrier of this disease. Having ruled out insects, they sought for the only blood-feeder left that commonly attacked horses, mules and cattle, the vampire bat, although it seemed like medical heresy to suspect this mammal.

Yet they have now established the fact that these animals can acquire the disease by feeding on a horse, mule or laboratory animal infected with the disease and that they live about one month after acquiring it. During this time their appetite is unaffected, so that there is ample time for them to pass the disease on to uninfected animals on whom they may feed. The germ of the disease incubates for about ten days in the body of the vampire bat. It then gets into the saliva and so is readily transferred to the next animal the bat feeds on. This is particularly favored by the bat's feeding habits.

This bat does not actually suck blood but licks it up with its tongue, Dr. Clark pointed out. When the bat feeds from below the wound or on a wound from which the blood is flowing freely, it does not lick, since it gets enough blood without. In such cases, the bat does not infect the animal on which it feeds. Ordinarily, however, the vampire bat makes a stab-like incision with its sharp upper tooth, much as a surgeon would with a blood-letting instrument. Then the bat will lick the wound for an hour or two until it is satiated.

Cattle in Panama are the chief reservoir of the disease. They may be infected with the germs of trypanosomiasis without becoming ill. Horses and mules commonly graze with cattle in Panama. These may be protected from the disease if they are stabled in barns, instead of being allowed to range with cattle at night, and if the barns are screened or well lighted by electric bulbs or clean lanterns. These measures will prevent bat attacks.

Unlike trypanosomiasis in Africa, which is fatal sleeping sickness, the disease in Panama and Central America does not attack people, but is limited to animals. Both he and his laboratory assistant were accidentally infected when a syringe containing the causative organisms broke in their hands, yet neither of them acquired the disease.

True vampire bats are very difficult to obtain for study. Prior to January, 1932, only ten, both living and dead, had ever been obtained. During the present year thirty-two of them have been caught unharmed. They roost in caves, and are quite small, about the size of mice. They will apparently feed on anything that has blood, and have even been known to feed on the web between the toes of a pelican, when they can catch the bird asleep. When they bite people it is only on the fingers and toes.

Horses afflicted with the disease can now be treated by injecting certain chemicals into the jugular vein. This modern method of treatment has been fairly successful. Dr. Clark expects to report further on the results of the method at a later date.

SEX CONTROL

PROSPECTIVE parents will some day be able to settle in advance whether the baby they are inviting into the world is to be a boy or a girl. This prophecy was made by Dr. Richard Goldschmidt, director of the Kaiser-Wilhelm Institute for Biology in Berlin, who is at present at the California Institute of Technology. Professor Thomas Hunt Morgan, president of the institute, introduced Dr. Goldschmidt as a leading authority on the subject of sex control.

Dr. Goldschmidt stated that he believes a technique will eventually be discovered to control the sex of children. He also believes this will not alter the present sociological situation, which is based on the approximate numerical equality of the sexes.

The problem is simple in principle, Dr. Goldschmidt said. It depends on the fact that the male sex cells in man are of two kinds. One half of all the male sex cells carry the so-called sex chromosome, the other half are without it. If the female sex cell, or ovum, is fertilized by a male sex cell carrying the sex chromosome, the child which develops from this union will be a girl. If the fertilizing male cell does not carry the sex chromosome, the child will be a boy. The problem of controlling the sex of future children therefore becomes a problem of encouraging one kind of male sex cell and of discouraging the other kind.

Since male sex cells are produced in batches of hundreds of thousands, with both kinds mixed together, the problem will be no easy one to solve. No method now exists to determine in advance the sex of human children, and none is in immediate prospect; nevertheless Dr. Goldschmidt is hopeful that eventually a method will be found.

The presence or absence of a sex chromosome in the male sex cell determines the sex of the resultant individual if developmental conditions are normal and are not interfered with. But the determination is not an absolutely rigid matter. Chemical upsets in the environment of the developing embryo during its earlier stages can cause the production of "intersexed" individuals, or even reverse sex altogether, making females of what would normally have become males and *vice versa*. This chemical reversal of sex in already-started individuals has been accomplished many times with lower organisms. Conceivably it might some day be worked on human beings as well.

THE IMPORTANCE OF VOLCANOLOGY

A RECENT address by Dr. E. G. Zies, of the geophysical laboratory of the Carnegie Institution of Washington, on volcanology, ranged through various practical fields to such problems in "pure" science as the study of the orientation of the magnetic field of lava flow. There is some evidence, Dr. Zies said, quoting his associate, J. A. Fleming, that the local magnetic field of a lava flow is determined in its polarity or direction by the condition of the earth's general magnetization at the time the lava was erupted. If this preliminary evidence is substan-

tiated by later work, it may some day be possible to date lava flows from the known state of the earth's magnetic field in the past.

The chief practical point in the study of volcanology, however, is the hope it gives of eventually working out a method for the prediction of eruptions. We are still far from this, Dr. Zies stated, but enough has been done to justify a hope that it can yet be accomplished. When predictions are undertaken, they must be reliable, for the unnecessary terror caused by the prediction of an eruption that fails to come off would be second in evil only to failure to predict one that does happen.

The working out of a practical prediction method will depend entirely on amassing continuous and connected data over a long period of years, Dr. Zies pointed out. This will have to be done, not by short-lived expeditions to the neighborhood of some spectacularly active volcano, but by settling down in the neighborhood of an active volcanic field with a staff of competent scientists and carrying on the work as a regular laboratory project.

According to Dr. Zies, Central America offers at our own back door the best imaginable field for such an intensive study of volcanoes in all phases of their activity. It contains the greatest concentration of volcanoes, both active and long-extinct, in all the world. Among the active craters is the famous Izalco, the most active volcano known; it erupts every half hour, and about every two years sends forth a lava flow. Contrasted with this are volcanoes so long extinct that all traces of their craters are eroded away and deep gorges have been carved in their slopes.

His suggestion is that some agency, either an already existing scientific foundation or a cooperative group of volcanologists with a central administrative organization, go into the field with a definite program of work in view, to cover a long stretch of years. Under a scheme like this he feels that an encouraging beginning can be made toward a fuller understanding of volcanoes and the eventual ameliorating of their terrors through a foreknowledge of what they are likely to do next, and when they will probably do it.

ITEMS

PHOTOGRAPHIC records of the spectrum of a meteor, believed to be the first ever obtained, were made during the recent Leonid shower by Dr. P. H. Millman, of the Harvard College Observatory. Dr. Millman carried on his observations at the Oak Ridge station of the Harvard Observatory, and on the morning of November 16 succeeded in photographing the spectra of persistent trains of two unusually bright meteors. Examination of the bright bands in these "rainbow photographs" will tell scientists what elements were burned during their swift and brilliant flight of annihilation through the earth's upper atmosphere. In spite of the disappointingly low number of meteors, Dr. Millman and his cooperators succeeded also in obtaining direct photographs of the brighter of the two meteors, as well as simultaneous observations of both from two or more well separated stations. These will enable the astronomers to make good determinations of their heights.

A NEW atom-smashing machine, operating at a power of 4,800,000-volt electrons, has been completed at the University of California, and is ready for use in exploring hitherto unattainable corners in the field of physical research. It exceeds by 1,200,000 the previous high attainment of 3,600,000-volt electrons, announced a few weeks ago. The tests were made by Professor E. O. Lawrence, head of the university's radiation laboratory, and his associates Dr. M. Stanley Livingston and Milton G. White. The new apparatus will be used in work along the same lines that resulted in the smashing of the lithium atom by physicists at the University of Cambridge last spring. In disrupting the lithium atom, the lightest of all metallic atoms, 800,000-volt electrons were used. With the far more powerful apparatus now available, it is believed that any atom in the whole table of elements can be blasted apart.

MEASURING the intensity of radium applied externally for treating cancer in the head or neck is a problem that one British hospital has attempted to solve by the use of wax models. A life-size human head has been built up in a series of sections about one third of an inch thick. Each is cast in wax of very nearly the same density as the soft tissues, and superimposed on the top and bottom surface of each section is a photograph of the anatomical structures occurring there. If the actual radium applicator used on the patient is applied to the model it will affect a photographic film inserted at any particular level where the dosage is in question so that after development its relative intensity can be measured.

ARIZONA Indians ate turkey nearly a thousand years ago. They also ate hawks, owls, coots and robins as well as the more appetizing quail, if bones found in two Arizona ruins dating between 1000 and 1100 A.D. are any criteria. The bones were found by Lyndon L. Hargrave, of the Museum of Northern Arizona, and identified by Dr. Alden H. Miller, of the Museum of Vertebrate Zoology of the University of California. The turkeys, Dr. Alden says, could have been obtained by the Indians in the neighborhood of the San Francisco Peaks, a prominent mountain range in Arizona.

A NEW German scientific device makes possible the "micro-melting-points" of crystals. The exact determination of the melting points of various materials is of great importance not only for chemists and physicists, but for the metal trades, chemical industries and other practical applications of science. It is not always possible to determine melting points of large quantities of material, and sometimes only tiny samples can be had in any case. The new apparatus gets around these difficulties by providing a glass-covered, electrically-heated metal plate on which the sample can be placed while it is observed or photographed through a microscope, to detect the first signs of melting, in the breakdown of sharp crystal outlines and the formation of liquid droplets. The micro-melting-point apparatus is described by Professor Ludwig Kofler, of the University of Innsbruck, in *Forschungen und Fortschritte*.