SCIENCE NEWS

Science Service, Washington, D. C.

THE MADISON MEETING OF THE NATIONAL ACADEMY OF SCIENCES

Special telegrams sent from Madison by Watson Davis, managing editor of Science Service

THE earth is being bombarded from all directions and at all times by rays more powerful, more penetrating and of shorter wave length than even the X-rays and gamma rays from radium, until now the most penetrating radiations known to science.

This amazing discovery of what might be called super X-rays was announced to the National Academy of Sciences meeting at the University of Wisconsin by Dr. Robert Andrews Millikan, director of the Norman Bridge Laboratory of Physics of the California Institute of Technology, Pasadena, California, and winner of the Nobel prize for physics on account of his pioneer work in measuring the electron.

From out of space, born evidently in the great cosmic reaches of the universe, these newly discovered rays come to earth with a penetration at least a hundred times greater than the most penetrating X-rays which can be produced in our hospitals. Whereas X-rays can not go through half an inch of metallic lead, it takes six feet of lead to completely absorb these cosmic rays which Dr. Millikan said are "harder and more penetrating than any which had before even been imagined."

Hearing Dr. Millikan was like being present when the Curies announced the discovery of radium, Roentgen reported the first generation of X-rays or Hertz sent the first wireless waves. For he has discovered a new realm of the spectrum. The idea of a series of ether vibrations ranging from low frequencies of alternating electric current, passing through radio waves, heat, visible light, ultra-violet light and finally reaching the short wave lengths of X-rays and gamma rays of radium is familiar to us. But far beyond these, approaching the abode of the infinitesimal, lies the region of the penetrating rays discovered by Dr. Millikan.

"Our experiments indicate that there is a region of frequencies as far above the X-ray frequencies as are these latter above the frequencies of light waves," said Dr. Millikan.

The wave length of the shortest of the "penetrating rays," as he calls them, is but one fiftieth of that of the hardest gamma rays from radium heretofore known and but one ten millionth that of ordinary light. And light has a wave length of about one fifty thousandths of an inch, which, so far as every-day measurements go, seems nearly the limit of minuteness.

Whence come these powerful rays?

Over five years of experiments, which took Dr. Millikan and his assistants to the top of Pike's Peak, caused them to probe the upper atmosphere with marvelous featherweight instruments lifted by small balloons, and carry on experiments sixty feet deep in a snow-fed lake under the brow of Mt. Whitney, proved conclusively that these penetrating rays do not originate on earth.

They are the result of transmutation of chemical elements taking place in the vast expanses of space. The gamma rays are produced only by nuclear transformations within the atoms of radium and thorium, in other words, when these elements disintegrate or are transmuted into other elements. Reasoning from such well-known facts, Dr. Millikan concluded that nuclear changes, that is, transmutations of elements, having an energy perhaps fifty times as great as the energy changes involved in known radioactivity on earth are taking place all through space. And the most probable sort of nuclear change is the capture of an electron by the positive nucleus of an atom. Thus the penetrating rays are signals of these cosmic transmutations sent to earth.

If the dream of the ages was accomplished here on earth and gold was made from mercury, the penetrating rays, Dr. Millikan has discovered, should be given off as a result of such a transmutation.

But to produce here on earth the penetrating rays, Dr. Millikan estimates that the immense energy of ten million volts or more would be necessary, and he holds out little hope of such an accomplishment. Consequently for the present at least the application of the penetrating rays to medicine and physics can not be anticipated.

Fortunately the amount of the penetrating rays reaching the earth is very small. Very delicate gold-leaf electroscopes were necessary in order to detect the rays in spite of their high penetration. The rareness of the rays is probably the salvation of life on earth, for if the quantity were large the effect might be like being treated with very heavy doses of X-rays.

Unlike light or any other radiation from outer space, the penetrating rays come to earth with equal intensity at all hours of day and night and with the same intensity in all directions. And when they strike the rocks on earth they stimulate softer rays whose discovery Dr. Millikan made as a by-product of the principal investigation.

The ultimate fate of the solar system of which the earth is a part is that it will become two stars, one of them the sun and the other a new star made up of all the planets with Jupiter as a gathering point.

This is the prediction of Professor W. D. MacMillan, of the University of Chicago, upon the basis of new mathematical studies.

Yet there is no need for immediate preparations for the judgment-day, for Professor MacMillan estimates that it will probably be some five hundred billion years before Jupiter becomes a star and swallows the earth in the process of doing so.

The reason for this end of the solar system and its conversion into a binary or twin star is that the planets are actually growing, extremely slowly of course. They

are sweeping up the cosmic dust or nebulosity throughout space somewhat as a snowball increases in size, and when the planets have gathered up enough matter they will be gobbled up by the largest of them due to the action of the laws of gravitation. The result is a star. A considerable percentage of the stars in the heavens are binary and Professor MacMillan considers it probable that many of them at one time were solar systems.

Looking so far into the future and into the past has greatly changed astronomers' ideas of the lifetime of a solar system. Whereas they used to think a solar system had a life expectancy of a mere hundred million years, Professor MacMillan now estimates it at a million billion years, called for convenience an eon. Once an eon, on the average, a star will make a close approach to the sun, an event which would be explosively disastrous to our part of the universe whether it happened while the earth still existed or when the earth had long since disappeared in the clutches of Jupiter.

Dr. R. A. Millikan's startling announcement of the discovery of ultra X-rays of great penetration and cosmic origin continued to be the chief topic of conversation among the leading scientists.

It was realized that these extraordinary rays detected by Dr. Millikan are evidences of the actual construction of matter throughout all space. He suggests that they may be evidence for the condensation into matter out somewhere in space of the light and heat continually being radiated into space by the sun and stars. Our own sun dissipates into space each second some ten million tons of mass in the form of light.

It is a hopeful conception that in some other part of the universe this fundamental stuff and that emitted by all the other stars is being synthesized into matter from which other worlds can be made. How much more cheerful this is than the disintegration that accompanies radioactivity.

The Millikan rays also probably affect vitally radio communication for near the top of the atmosphere where they first impinge on the earth they help to create the ionized conducting Kennelley-Heviside layer of the atmosphere along which radio signals slide. In fact, the Millikan rays and the forces behind them may easily be one of the few universal fundamental laws or facts and may be in the same class with gravitation.

Such constructive evolution as revealed by Dr. Millikan's discovery and hypothesis is not confined to the physical side of the universe alone. Dr. J. C. Merriam, president of the Carnegie Institution of Washington, after a study of the past of the earth and man declared to the academy that "the future is not one of melancholy decline."

His investigations led him to believe that the Neanderthal men of Europe, considered by some to be abortive offshoots from the main stem of man's evolution, are actually man's ancestors. Viewing the long road that man has trod to his present estate, Dr. Merriam predicted that the human race would some day reach a level at least twice that now attained.

Such gigantic conceptions of the universe and the future are the product of the cerebral cortex, a relatively recent invention in the history of life. Professor C. Judson Herrick, of the University of Chicago, told the academy that it is the special business of the cortex portion of the brain to fit previous experiences into the present situation so that we can react to our past as well as our present.

River water that sterilizes itself against typhoid and other similar diseases, corn and wheat that have been bred to resist disease and a drug that restores to sanity sufferers from paresis were among the new achievements of science.

Contaminated river water would seem to be the last place to expect to find an antidote to such dangerous water-borne germs as those of typhoid, dysentery, paratyphoid and other such ills, but from below the sewage outlet of any large city there can be obtained a mysterious substance that not only purifies the flowing stream but can be used to treat sufferers of the diseases.

Dr. Martin Arrowsmith, of Sinclair Lewis's novel, might have been appearing before the National Academy when this report was made. In reality it was Dr. Philip B. Hadley, of the University of Michigan, who told of the most recent work on that intriguing substance, bacteriophage, eater of germs, which d'Herelle, the French-Canadian bacteriologist, discovered some half dozen years ago.

From the sewage-filled water of the Huron River, Dr. Hadley has obtained this lytic principle, as he called the bacteriophage, and with it he has been able to kill deadly germs in test tube and in the human body. In time of epidemic the evidence seems to show that this substance can be used as a prophylactic. In fact the advice to the public in such times of danger may be to drink river water carefully strained to remove bacteria and retain the defensive lytic principle. Boiling water as recommended now may become obsolete.

It was with the bacteriophage that Arrowsmith of the novel combatted plague. To-day in Europe and in South America the bacteriophages active against typhoid and dysentery are being used in the treatment and prevention of these diseases. America has been slow to make use of this puzzling antagonist of bacteria in its fight against disease and Dr. Hadley urged more hospitals to experiment with it.

A controversy has arisen as to whether the bacteriophage is a living substance or just a chemical effect. It seems to grow and reproduce itself like a germ, but the most powerful microscopes have failed to reveal it and in other respects it does not seem to be a living organism.

To those who suffer from paresis, a form of insanity due to syphilis of long standing, there is hope in the report made by Professor A. S. Loevenhart, of the University of Wisconsin, that tryparsamide can restore to right mind a third to half of these who have reached the stage of insanity. This arsenical drug was first made by workers at the Rockefeller Institute for Medical Research, and it has previously proved effective in the treatment of the sleeping sickness, that plagues Africa.

Potential millions of dollars have been saved the farmers of the country by researches conducted at the Uni-

versity of Wisconsin under the direction of Professor L. R. Jones. Dr. J. G. Dickson of his staff told the National Academy that a new breed of corn resistant to seedling blight is to be released to the farmers this fall and that wheat similarly immune is being developed, while Dr. G. W. Keitt announced that apple scab is about to be conquered.

Working in greenhouses in which all sorts of weather and conditions can be produced at will, Dr. Dickson found that the fungus causing seedling rot was thwarted in its attacks upon the tender plant when the plant builds up a woody armor. This happens in the case of corn when the soil is warm, whereas in cold weather only mucilage-like substances are grown which provide a luxurious and destructive living for the fungus. The new corn has been bred so that it will grow as resistant to the fungus in cold weather as in warm.

THE GERM OF SLEEPING SICKNESS

THE organism that causes sleeping sickness, or *encephalitis lethargica,* which has mystified scientists since the first appearance of the disease in Vienna during the world war, has at last been identified by Miss Alice C. Evans, of the U. S. Hygienic Laboratory. The organism belongs to the streptococcus group of bacteria. It varies so greatly in size that it can pass through the finest filter devised by science, and yet it grows so large at other times that it can easily be seen with the ordinary microscope.

The disease is not the same as the African "sleeping sickness" that is caused by an organism carried by the tsetse fly. *Encephalitis lethargica* has been thought by some scientists to be due to the same organism that causes influenza, because it has followed influenza epidemics.

Miss Evans obtained the sample streptococci, with which she experimented, from the brain of a patient who had died of sleeping sickness at St. Elizabeth's Hospital for the Insane at Washington. The organisms were cultivated in test tubes and used to inoculate rabbits. The animals contracted the same disease, and after death the identical organisms were found in great quantities in the rabbits' brains. The disease was given to other rabbits by means of germs recovered from the brains of the ones that had died; this was continued until a succession of seventeen rabbits had been killed by the descendants of the original streptococci taken from the brain of the human case.

The organisms are not very hardy, and when kept for a long time under artificial conditions they lose virulence. Miss Evans also noted that when very small doses of strong streptococci were injected into rabbits they did not contract the disease immediately, and when they did so, it took a long time for them to die. In other words, small doses gave them a partial immunity.

Sleeping sickness has been more prevalent in the United States than is commonly believed. Altogether, since the appearance of the first case in 1918, not far from a thousand cases have been registered in cities with a total population of about 22,500,000. The disease causes irreparable injury to the brain, and patients who recover are generally mentally abnormal. The three cases that occurred in St. Elizabeth's Hospital for the Insane were of persons who had had an acute attack of the disease from four to six years before.

ELEMENT 75

(By Cable to Science Service)

ACCORDING to a cablegram to *Science Service* from London the missing chemical element number 75 has been discovered by Dr. J. Heyrovsky, professor of physical chemistry at Charles University, Prague, and Dr. Doleysek, of the Prague Academy of Sciences. The element has been named bohemium, in honor of Bohemia, and was discovered as an impurity in magnesium through the use of the mercury drop electroscope. Professor Heyrovsky was a pupil of Ramsay who discovered several elements, including argon. The discovery of element 75 is also claimed by Professor Walter Naddack, of the University of Berlin, working with Otto Berg and Ida Tacke. On June 17 a *Science Service* dispatch from Berlin told how they had identified both numbers 43 and 75, known to be closely related, through the use of X-ray analysis and spectra. They selected the names, rhenium and masurium, as the elements 75 and 43, respectively, in honor of regions lost to Germany as a result of the war.

From the arrangement of the chemical elements based on laws developed by Moseley, the English physicist killed at Gallipoli, the properties of missing elements can be predicted. From such theoretical evidence it is known that elements 43 and 75 should be closely related and that they should also have physical and chemical properties allied to manganese. If one or the other of the two claimants for the honor of occupying niche 75 is successful, and if element 43 has been discovered as claimed, only three missing chemical elements will remain to be discovered. These are numbers 61, 85 and 87.

ITEMS

ONE thousand volunteers, who can be called upon to give their blood in transfusion cases, are being enrolled by the London Blood Transfusion Service, a little known branch of Red Cross work. This service to London hospitals was organized five years ago because doctors found it so difficult to obtain blood of the right type when a transfusion was necessary to save a patient's life. The blood of each human being belongs to one of four chemical types, and an individual who is willing to transfer some of his blood can be used only if he has blood like that of the patient. The classification is based on the presence or absence of two substances which are found to be hereditary. One type of individual has blood containing substance A; a second type has substance B; a third has neither A nor B; and a fourth, which is comparatively rare, has both A and B.

To date the London transfusion corps has served 247 cases, but calls from hospitals have become so numerous that a few hundred volunteer reserves are no longer enough. The organization states that calls come in at all hours of the day and night. It has its members classified according to blood type, and within an hour of the request the service has a volunteer of the proper type at the hospital.