SCIENCE NEWS

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SUPER-HEAVY ELEMENTS AND COSMIC RAYS

THE astounding picture of cosmic rays generating in the dense white dwarf stars of the universe by the splitting of super-heavyweight elements, nearly 10,000 times as massive as any known on earth, is suggested by Dr. Felix Cernuschi, Argentine exchange scholar at the Massachusetts Institute of Technology.

To generate cosmic ray particles of 1,000,000,000,000 electron-volts, like those which have been observed, requires elements having atomic number 10,000 and atomic weight 26,000. (The heaviest element found on the earth is uranium of atomic number 92 and atomic weight 238.)

In a report to *The Physical Review*, Dr. Cernuschi suggests that the kind of splitting recently found to occur in uranium under neutron bombardment—which makes a single uranium atom liberate about 200,000,000 electron-volts of energy—is possibly going on in his hypothetical super-heavy elements too.

His X elements, or whatever name they may be given, would break down into two fission elements having atomic number 5,000 each. And then these would each in turn go into an element of 2,500 atomic number and so on; all the while liberating tremendous quantities of atomic energy that would appear both as light and as invisible atomic particles (the cosmic rays).

The new Cernuschi hypothesis is not only intriguing because it is the first application of the new uranium splitting phenomenon to cosmic ray theory, but also because the suggestion of super-heavyweight elements would account for the known dense white dwarf stars. These stars, like the small dwarf companion of the bright star Sirius, are known to have a density 50,000 times as great as water. A cubic inch of the material from this star would weigh tons. It has previously been suggested that such stars were "collapsed" stars consisting only of neutron particles. Dr. Cernuschi's suggestion gives an alternative explanation which possesses the additional virtue of providing a reasonable explanation of the origin of cosmic rays.

Professor M. S. Vallarta, well known for his work in astrophysics and cosmic rays, was the faculty adviser of Dr. Cernuschi.

Drs. W. Baade and Fritz Zwicky, of the California Institute of Technology, have suggested that super-novae stars (having a brightness of more than 630,000,000 times that of our sun) were exploding stars and the place of origin of super-high energy particles like those found in cosmic rays. Dr. Cernuschi says he is unable to agree with parts of their reasoning as to this origin of cosmic rays and adds that no known atomic transmutations appear sufficient to account for the tremendous energies cosmic rays possess. Hence he calls on his new hypothesis of the fission of super-heavyweight elements.

THE NEW 60-INCH CYCLOTRON

THE world's most powerful beam of atomic "bullets" for bombarding atoms has been generated in the new 60-inch cyclotron of the University of California.

In its first official test the new instrument, whose magnets alone weigh 250 tons, generated deuterons of 16,000,000 electron-volts energy. When the nuclei of helium are used for the "bullets" it will be possible to produce a beam of alpha particles having an energy of 38,000,000 electron-volts.

In a report to *The Physical Review*, a research team of eight investigators, headed by Professor Ernest O. Lawrence, describes its success in the first test of the newest and most powerful atom-smasher in any physical laboratory. Nor is the present energy the limit, they say. "We . . . see no difficulties in the way of producing with the present equipment 25 million volt deuterons and 50 million volt alpha-particles, and moreover we are convinced that much higher energies could be obtained from a cyclotron of larger dimensions." Professor Lawrence has already suggested that a 1,000-ton cyclotron could be constructed to go to even larger energies. The present test substantiates in real performance his previous hopes.

So potent is the beam from the new cyclotron that its particles can be observed emerging in air from the target window for a distance of over a meter and a half, or about five feet.

CHEMICAL USED IN PHOTOSYNTHESIS

DISCOVERY of a chemical that allows the green plant to inhale waste carbon dioxide from air is announced by the Smithsonian Institution.

This hitherto unsuspected substance is a go-between for carbon dioxide and chlorophyll, the green coloring matter of plants. It seizes a molecule of carbon dioxide and delivers it to the chlorophyll. It is therefore one of the most important substances on earth, as without it sunshine energy could not be trapped in vegetation.

Dr. E. D. McAlister, biophysicist of the Smithsonian Institution, made the observation while making extremely delicate measurements of the amounts of carbon dioxide used by wheat seedlings. He found that plants continued to use carbon dioxide for a short interval after they had been plunged into darkness, which was contrary to conventional ideas about photosynthesis. He concluded that some intermediate chemical was playing an essential rôle.

The existence of the new chemical basic to life was thus demonstrated, but so fleeting is its existence that Dr. McAlister does not believe that it will ever be possible to isolate any of it.

Chlorophyll, by the process called photosyntheis, enables the plant to use sun energy to manufacture out of water from the soil and carbon dioxide from the air the various hydrocarbons, such as cellulose, starch, etc., used by men and animals for food and other purposes. Coal and oil contain the sunshine of past ages trapped in this way. Our breathing and the burning of fire use oxygen and pour out carbon dioxide into the air, while photosynthesis manufactures oxygen for the air. Thus the new chemical believed essential to photosynthesis is one of the important links in the energy cycle of life on earth.

NEW FILM FROM CLAY

THE United States may soon be able to replace most of its imports of valuable sheet mica with an American-made substitute, it appears from chemical discoveries reported to the colloid symposium at the Stanford University meeting of the American Chemical Society.

The new mica substitute is Alsifilm, made from bentonite clays. Its development has been under way for some time and was first reported last year. The new advances and improvements were described in a paper presented by Professor E. A. Hauser, of the Massachusetts Institute of Technology, and Miss D. S. le Beau, of the Dewey and Almy Company, Cambridge, Mass.

The new film can be made thin and almost transparent (looking like celluloid or Cellophane) and has superior electrical insulation properties. It is composed of inorganic materials that make it fireproof. Mica sheet is at present on the War Department's list of strategic materials of which the United States lacks adequate sources.

The bentonite clays are remarkable materials most commonly known for their ability when wet to swell to many times their dry size. One common use of bentonite is for sealing leaks in earth dams or in ditches. Wet bentonite closes the cracks. As it dries it shrinks, a little water penetrates, then it becomes wet and swells up again. This process is repeated indefinitely.

In the form of thin films bentonite is compressed strongly into a permanently stable material which is virtually impervious to water and does not swell as does bentonite normally.

As a substitute for sheet mica the new film may be expected to replace, to some degree, existing imports of this strategic material. In 1938 sheet mica imports amounted to 4,646 tons of unsplit mica and 1,115 tons of split mica. The value of imports of sheet mica in 1938 was $664,419.

VACCINE AGAINST HORSE PLAGUE

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TRAGEDIES such as the death from horse "sleeping sickness" of Dr. Charles E. Salsbery, of Kansas City, Mo., veterinary biologist who acquired the illness in the course of his scientific work, will probably be prevented in future.

A vaccine against the disease will be the means of preventing these tragedies. Such a vaccine already has been used successfully in protecting horses and a modified vaccine has been developed for human use. From 50 to 100 men and women who handle the dangerous virus in disease-fighting laboratories have already been vaccinated, according to information received by the U. S. Public Health Service.

The Federal Health Service, when asked, has advised firms manufacturing the horse-protective vaccine that they would be justified in using the horse vaccine to protect their employees so long as nothing better was available. Within the last month (June 9) the development of a vaccine suitable for human use was reported by Dr. Ralph W. G. Wyckoff, of the Lederle Laboratories at Pearl River, N. Y.

Dr. Salsbery was the fourth to be stricken with the disease in the course of the work. One other of the four, a girl laboratory technician, also died of it, the U. S. Public Health Service has learned. The name of the girl martyr and the laboratory where she was employed is withheld as being "confidential information."

Scientists and laymen alike were shocked at the announcement last fall of the first proved human cases of this horse ailment, which has the technical name of equine encephalomyelitis. There are two different viruses, one the Eastern and one the Western type. The Eastern type is more fatal among horses and according to present knowledge is apparently more fatal among humans also.

Thirty-eight human cases of the horse plague were reported in Massachusetts last year, of which 20 were fatal. There were six cases with one death reported from Minnesota and one fatal case in a child reported from California.

How the disease spreads is still a mystery. According to one theory, the virus is spread by mosquitoes or other insects, and some investigators believe that birds, rather than horses, constitute a reservoir of the disease. None of these theories has been proved as yet.—JANE STAFFORD.

THE TEMPERATURE DURING JULY AND AUGUST

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JULY and August are going to be warmer than average, if this summer's weather follows the pattern determined by many years of observation, according to Charles D. Reed, senior meteorologist of the U. S. Weather Bureau. Mr. Reed bases his long-range forecast on the high-temperature record established for May and June.

May was an especially warm month over the country's great crop areas generally, with a "plus departure" of about six degrees for the month in Iowa. June has shown about two degrees in excess of normal. Statistical studies have shown that when May and June temperatures together are that much above normal they are practically invariably followed by a hot summer. Mr. Reed's figures and forecasts are based primarily on Iowa conditions, and apply with decreasing pertinence over widening zones away from that midland center.

Based on the general temperature forecast is a second forecast by Mr. Reed, that not more than five per cent. of Iowa's great corn crop will be caught by frost next fall. Over a fifteen-year period, the average amount of frosted corn comes to 15 per cent. of the total crop, so that the expected 95 per cent. of frost-free corn for this year will represent a considerable gain.

The most uncertain quantity involved in this crop forecast is the question whether the excess temperatures to come during the next two months will be high enough to harm the corn. A let-up in the rains is normally to be expected after the end of June, but shortage of moisture alone is less damaging to corn than too high temperatures even when there is a moderate amount of moisture remaining in the soil.

Fears aroused by a dry May that the summer of 1939 would be another disastrous drought season have been well dissipated by a June that brought abundant rainfall. By contrast with its arid predecessor, June has seemed an excessively wet month, but official figures show only a slight to moderate excess in precipitation for the month. However, soil moisture is mostly in normal condition, so

that crops are in relatively good situation for the long pull through the hot-weather weeks ahead.—FRANK THONE.

THE PSYCHOLOGY OF CROWDING AND AIR TRANSPORT

THE bad psychological effects of overcrowding of passengers will place a limitation on the size of long-range transport airplanes, it was reported at the San Francisco meeting of the American Society of Mechanical Engineers. A. F. Bonnalie, assistant to the director of flight operations for United Air Lines Transport Corporation, said, "One thing that seems to have definite limits, at least for any long-range aircraft, is the rapidly increasing crowding effect with increased numbers of passengers. . . . The problem becomes most acute when any more than a relatively small number of passengers are involved for more than a relatively short space of time."

The most crowded condition is represented by a trip of six people in a small motor car. About 114 cubic feet of space is available, or about 19 cubic feet per person. This is tolerable only for a group of friends or relatives with common interests and then only because the scenery is changing very rapidly near-by the car. High overhead in an airplane the scenery frequently is monotonous except on those particular flights which may traverse a mountainous region. Over-ocean flying is notoriously monotonous after the first few hours.

It is probable, according to experts, that 19 cubic feet of space for each passenger is the lower limit at which passengers can be attracted to aerial transport. Mr. Bonnalie pointed out that "As the number of passengers increases the difficulty of providing for the human pay load increases faster than the numbers involved. Even the development of airplanes large enough to have habitable wings may not be more than a minor relief. It is also going to be necessary to take these factors into consideration in the construction of terminal facilities, waiting rooms, and so on."

ITEMS

THE flash flood at Morehead, Ky., which brought death and heavy property damage to that little mountain community was caused by heavy rains of more than 2.6 inches in 48 hours, according to the report of the flood division of the U. S. Weather Bureau. The only rainfall station near Morehead is at Pikesville, Ky., where 0.58 inch of rain fell for the 24 hours ending July 4 at 7 A.M. For the next 24 hours rainfall was 2.02 inches, an almost unprecedented amount for this region. Louisville, Ky., and Cincinnati, Ohio, reported no precipitation and there is no flood danger on the major rivers and tributaries.

A HUGE cluster of sun-spots, so large that more than a dozen earths could be dropped into them, now sweeping across the face of the sun, is disclosed on photographs taken at the U. S. Naval Observatory. The current spots comprise the largest group seen in recent months. Three of the spots, with smaller satellite spots near-by, are lined up in an east-west direction across the sun. Not far away is a fourth group consisting of three small spots arranged in the form of a triangle. All passed the sun's meridian line about July 8 and should disappear off the western edge of the sun about July 15. If they keep their shape they should reappear again on the sun's eastern side near the end of July. The period of rotation of the sun, which determines the speed with which sun-spots appear to move, is about four weeks as seen from the earth.

AMERICAN aviation hangs up another first with the establishment of the world's premier "windmill airplane" airline, which has started shuttling airmail between Camden airport, the Philadelphia flying field and the Philadelphia post office. Not only does Eastern Airlines' "land-on-a-dime" Kellett autogiro haul 400 pounds of mail in five minutes a distance a mail truck requires a half hour to negotiate, but it promises a solution to the big city airport problem as well. The autogiro can land on the post office building roof. With mail now successfully carried, passengers will be carried later just as quickly and easily.

RADIO observations as to how the ionized layers in the earth's upper atmosphere reflect transmissions give a good index to the activity of the sun, according to W. M. Goodall, engineer of the Bell Telephone Laboratories. Comparing critical radio frequencies of what scientists call the F2 region of the ionosphere with astronomical observations of the calcium flocculi on the middle part of the sun, he finds both give measures of the sun's activity.

SPECIAL paints that change color when they are heated to definite temperatures are being used successfully in German airplane engine research. While temperature-indicating paints or "thermocolors" have been used previously, engineers of the I. G. Farbenindustrie at Oppau have developed a series of new paints that are reliable thermometers up to 825 degrees Fahrenheit. The exact compositions are not disclosed, although it is known that they are mostly metallic salts. Earlier thermocolor paints were effective only up to 150 degrees F. and the color change was not permanent. They consisted usually of double iodides of mercury and copper, or mercury and silver.

A NEW x-ray procedure which promises to help in the fight on tuberculosis was described by Drs. Israel Steinberg, George P. Robb and Ursula J. Roche, of New York City. The new method may enable doctors to determine the effect of lung collapse therapy, one of the new methods of treating tuberculosis, on the physiology of blood circulation in the lungs, and even to evaluate effectiveness of this treatment. "It seems certain," the inventors of the method said, "that many problems in pulmonary disease which previously have been studied only in animals or in autopsy material may now be investigated during life." The new procedure consists of injecting a concentrated solution of diodrast rapidly into the veins. This substance makes the veins opaque so they can be seen in the x-ray picture. Within a matter of seconds, the heart and the veins and arteries of lungs and chest of a normal person can be seen by this procedure. Striking decreases in the number of veins carrying blood away from the involved areas of the lungs were found to be characteristic of pulmonary tuberculosis. Other changes in the arteries of the lung were observed.