PHYSICS

Possibility of More Energy From Uranium-235 Is Seen

Fission of Nucleus Three Ways Instead of Two With 10% More Energy Called Theoretically Possible

POSSIBILITY that the energy yield from U-235, form of uranium that may some day be useful as a source of atomic power, may be greater than hitherto supposed, was suggested by Dr. R. D. Present, of Purdue University.

Speaking before the American Physical Society, which was meeting in affiliation with the physics section of the American Association for the Advancement of Science in Philadelphia, he stated that it is theoretically possible for the nucleus of the uranium atom to divide into three parts as well as two. Such a reaction would yield about 10% more energy, according to his calculations, than binary fission.

It is the binary fission that has held the spotlight in most of the recent discussions of atomic power. It was forecast in 1939, and verified experimentally early in 1940 when minute samples of U-235 were isolated. Such fission, it has been found, can be instigated either by bombardment with slow neutrons (which are atomic fragments without electrical charge) or by gamma rays.

When fission occurs, energy is released, and more neutrons are emitted. Thus, it is believed, a chain reaction could be started, since these neutrons would cause fission of additional atom nuclei. The energy given off might be utilized as a source of power, so that U-235 would be millions of times more effective than coal. So far as known, however, no one has yet isolated a large enough piece of U-235 to test this thoroughly.

Ternary fission, or division into three parts, can also occur, with still larger energy fields, finds Dr. Present. Though the energy to activate the process is the same as for binary fission, he believes that with low energy neutrons, it is less likely to occur.

So far no experimental verification of the triple division has been found.

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Temperature Inside Sun

THE temperature in the heart of the sun is 25,700,000 degrees Centigrade (slightly less than 50,000,000 degrees in the Fahrenheit scale) according to new calculations presented to the meeting by a four-man research team. It comprises Dr. H. A. Bethe, of Cornell University; G. Blanch and A. N. Lowan of New York City; and R. E. Marshak, of the University of Rochester.

The density in the solar core is calculated to be about four pounds to the cubic inch, which is ten times the value for lead. Both the density and the temperature value, they pointed out, are considerably higher than those usually taken for the sun.

Dr. Bethe is known as one of the originators of the theory that the sun, and other similar stars, keep going by the energy given off in a process of transmutation of hydrogen to helium with the aid of carbon.

On the basis of their present assumptions, it is estimated that this process would yield about a hundred times too much energy. However, they call attention to the fact that they have not taken into consideration the variation of the molecular weight which is caused by the progressive ionization, or breaking up of the atoms. This correction, it was said, may cause a lowering of the internal temperature. The presence of more helium, in addition to the 35% of hydrogen which they estimate in the sun, would also remove the discrepancy, they stated.

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110,000 Times Per Second

THE PROPELLER of a pursuit airplane, spinning at 2,500 revolutions per minute, is practically standing still compared with a tiny steel ball used in experiments described (*Turn to Page* 11)

ENTOMOLOGY

Fly Reverses Role; Catches Spider in Web

A BLOODTHIRSTY fly, that lives like a spider, catching prey in a web that it spins, is the extraordinary insect described before the meeting of the American Association for the Advancement of Science in Philadelphia by Dr. B. B. Fulton, research entomologist of North Carolina State College. It is even able to snare and devour small spiders, as Dr. Fulton demonstrated by experiment; whether or not it regularly reverses the traditional spider-and-fly role in this way he was not prepared to say. And it does all this while it is still only an infant, a larva, looking very much like a small worm.

And just to make the strange insect more nearly incredible, it is luminous

"WON'T YOU WALK INTO MY PARLOR?"

This curious-looking web wasn't spun by a spider, but by a fly! The fly does this while it is still a baby—a larva. The spindle-shaped branches are sticky, and they catch prey for the larva, head-end of which can be seen at top-center.

As to cancer, early diagnosis and prompt treatment by surgery and radiation are increasing the number of cured patients. Diabetics, thanks to insulin, are living longer than ever before. Most of them are leading fairly normal lives and are able to work as well as other individuals of the same age.

The record for accidents is somewhat unfavorable this year. The increase in industrial accidents is probably a reflection of the speeding up of industry for national defense. In the last World War such an increase occurred. The entrance of large numbers of inexperienced workers into new occupations inevitably introduces its own particular danger. The urgent need of preparing for the safety of the nation may result in some sacrifice of safety for the individual. It is to be hoped, however, that industry will guard against any such tendency at this time, for it not only results in needless waste of human life, but also impedes the carrying out of the vital program of national defense.

Fatalities from motor vehicle accidents will this year exceed those reported in either 1938 or 1939, and may run as high as 34,500 for the country as a whole. The campaign for prevention of automobile accidents, which seemed to function so efficiently in 1938 and 1939, has not been so successful in the past year.

Considering the trend of mortality in recent years, it seems well assured that the public health will continue to improve along many lines during 1941. Whether the excellent record of the last few years can be repeated or even excelled will depend largely on two or three factors. In the first place, much will depend upon the extent of the spread of influenza now in evidence on the Pacific Coast and other isolated points and upon the continuance of it in a mild form. A widespread epidemic of a more virulent type of influenza would not only increase deaths from that cause, but would also increase mortality of the older people suffering from chronic conditions.

A second factor which must be considered in a forecast of the mortality of 1941 is the effect of the draft on public health. The bringing together of many individuals who have not established immunity against the more common communicable diseases will undoubtedly increase the incidence of such diseases. We must be prepared for a possible recrudescence of epidemic cerebrospinal meningitis such as we had in the draft of 1917 and 1918. Fortunately the introduction of chemotherapy has put us in a better position to handle this disease than formerly. Likewise the recently developed vaccines for influenza and the type-specific antiserums and chemotherapy for pneumonia should result in better control of the respiratory conditions.

A third factor which may affect unfavorably the 1941 mortality is the accident situation. As was noted before, the hazards resulting from the speeding up of industry for national defense must be guarded against to prevent an increase in such deaths.

However, in spite of these difficulties, which are very real, and which will require the best efforts of all those interested in maintaining the public health at a high level, I believe we can look forward to 1941 with confidence. We can continue to make progress in the saving of human life provided we take seriously our personal obligations to keep fit, and our community obligation to support our official and voluntary health agencies with sufficient resources to carry on their work effectively.

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SEISMOLOGY

New England Earthquake Centered Near North Conway

Damage Was Slight at Point of Origin, But Waves Traveled Great Distances and Were Detected

NORTH CONWAY, New Hampshire, was close to the center of the earthquake which shook New England early in the morning of Friday, Dec. 20. This location was determined by experts of the U. S. Coast and Geodetic Survey on the basis of reports from seismograph stations gathered by Science Service.

The quake occurred at 2 hours 27 minutes 23 seconds a.m., Eastern Standard time. A preliminary determination of the epicenter placed it at 44.1 degrees north latitude and 71.1 degrees west longitude. This is about 20 miles north of Lake Ossipee, in a region where mild earthquakes have been felt before. On Oct. 9, 1925, a quake felt over a 15,000-square-mile area was centered in the same region.

The first reports of the quake were obtained by long-distance telephone and telegraph from the seismograph stations at Harvard Observatory, Harvard, Mass.; Weston College, Weston, Mass.; Williams College, Williamstown, Mass.; Georgetown University, Washington, D. C.; the Dominion Observatory, Ottawa, Ontario, Pennsylvania State College and St. Louis University.

Though the damage was slight at the point of origin, waves of the tremor traveled great distances, and were detected by other means. M. W. Lewis, of Hyattsville, Md., reported that a dime balanced on edge on his mantelpiece since June 24 fell over. Presumably this was an effect of the earthquake. A galvanometer in the test laboratory of the Coast and Geodetic Survey recorded the vibrations, as did an instrument for measuring the earth's magnetism at their Cheltenham, Md., observatory.

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SEISMOLOGY

New England Quakes Forecast New Year Week

A FIVE-TO-TWO chance that earthquake shocks will be felt in New England or the Southern Appalachians, or both, probably between January 3 and 7, is forecast by Dr. Helmut Landsberg, well-known geophysicist at Pennsylvania State College.

Explaining that he bases this probability on study of 50 years of Appalachian earthquake patterns, in which follow-up shocks occur after about 13 days or multiples of 13 days in the majority of quakes in the area, Dr. Landsberg added that such recurring shocks in this case would probably be no more severe than those experienced during December. The recent tremors, he said, have been following the typical Appalachian pattern, in which shocks in one region are followed by reaction shocks in another.

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by E. L. MacHattie, of the University of Virginia.

He told the meeting that by magnetically suspending a steel ball 3/32 inch in diameter in a vacuum, so that friction was nearly eliminated, he was able to spin it 110,000 times per second,

about 2600 times as rapidly as the propeller.

In some researches, a rapidly rotating mirror is needed. To test the feasibility of such a use of the device, two flat faces were ground on the ball. Then it was spun to more than 100,000 revolutions per second without bursting. In another test a drill rod 3/16 inch diameter and 7/8 inch long, was spun at 36,000 revolutions per second, before it was bent double.

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New Earthquake Wave

A NEW kind of vibration wave in the earth, which travels broadcast from the center of an earthquake, "may require drastic revision of interpretations of earth structure," Dr. L. Don Leet, director of the Harvard University Seismograph Station, declared.

Speaking before the American Physical Society meeting with the sections of physics and geology of the American Association for the Advancement of Science, he told of the latest studies on this new type of wave, the first to be discovered in nearly 40 years.

Dr. Leet revealed his discovery of this wave more than a year ago. He found it on seismograph records of the waves from artificial earthquakes, set up by explosions. Now, he announced, it has been found in records of natural tremors.

"It is not explained," he said, "by current forms of the classical theory of elasticity. The discoveries are so new that the trend of their true significance may not be known for some time."

The Leet wave is the fifth of the recognized wave-types. Fastest wave from a quake is one that goes through the earth's center, and is compressional, imparting a push-pull movement to the particles. Then comes another internal wave, the shear wave, which moves the particles from side to side. The new wave moves the earth particles in a diagonal motion, and is referred to as a "coupled wave." The last two types are still slower, and cause a more complicated movement.

Dr. Leet reported that studies at the Harvard Seismograph Station by one of his associates revealed that at certain distances it is the same as the old shear wave. "This led further," he declared, "to the discovery that the so-called shear wave is actually compressional in character over certain distance ranges, a coupled wave over others and shows the characteristics of a true shear wave over only a relatively narrow range."

Saying that "seismology has reached a critical stage where serious discrepancies between observations and current theories have been established," he suggested that studies by mathematical and experimental physicists might aid in solutions of importance in giving data on the crust and interior of the earth.

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Aviators Not Endangered

FEARS that radium-lighted numbers and hands on the dials of instruments on airplanes might be a danger to pilots exposed to their rays are unfounded, Robert B. Taft, of Charleston, S. C., told the physicists at another session.

It had been suggested, he said, that with so many instruments, the radiations might be enough to be harmful, so Mr. Taft conducted tests in a Douglas DC3 and a Lockheed Electra.

"While there was a surprisingly large amount of radiation," he stated, "the total dose was far under that generally accepted as perfectly safe for radium workers."

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Map Problem Studied

IN THESE days of changing maps it might seem that the cartographer's palette would run out of pigments when he comes to finding enough colors to mark all the various regions. Speaking before the Mathematical Section of the American Association for the Advancement of Science, Prof. G. D. Birkhoff, of Harvard University and Prof. D. C. Lewis, of the University of New Hampshire, told of their newest studies on mathematics' famous "map problem."

Surprisingly enough, experience indicates that with only four colors it is possible to make a map with any number of countries, no regions with a common boundary having the same color. However, it has not yet been proven mathematically that this is the case, though proof has been given where the number of regions is not greater than 35.

Two different techniques have been used for such proofs, one the method of "chains," the other that introduced by Prof. Birkhoff, and known as "chromatic polynomials." In their paper presented this morning, the two mathematicians showed that these techniques may be united to advantage. Thus, it may be that proof may be extended and perhaps even made general.

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Infra-Red Penetrates Flesh

THE human body is partially transparent to infra-red rays, vibrations like light, but too long to be visible, a research trio working at the Massachusetts Institute of Technology has found. Their work was described at the meeting.

The researchers, Dr. C. Hawley Cartwright, now of the Corning Glass Works, John Daniel of the U. S. Bureau of Public Health and Alex Petrauskas, measured the transmission of the rays through the cheek to the inside of the mouth. Visible light of shorter wave length, from the violet to the orange part of the spectrum, is stopped completely. The transmission begins with orange light and increases up to the longest visible red waves, where about 2 per cent is able to penetrate. These have a length of about 7,000 angstroms (about one thirty-five-thousandth of an inch). For waves still longer, between 10,000 and 13,500 angstroms, there is more transmission, with a maximum of 3 per cent at 11,000 (one twenty-four-thousandth of an inch).

These infra-red rays are the same as heat rays. They found that by applying them from a tungsten lamp with a water filter it was possible to raise the temperature inside the mouth 3 degrees Fahrenheit without discomfort.

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● RADIO

Charles F. Jackson, chief engineer of mining division, U. S. Bureau of Mines, will describe the Government's search for new supplies of strategic minerals that we normally import from abroad as guest scientist on "Adventures in Science" with Watson Davis, director of Science Service, over the coast to coast network of the Columbia Broadcasting System, Thursday, Jan. 9, 3:45 p.m. EST, 2:45 CST, 1:45 MST, 12:45 PST. Listen in on your local station. Listen in each Thursday.