SCIENCE NEWS

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DISTANT GALAXIES

EXPLORING outwards in the time and space of the universe, Dr. Harlow Shapley, director of the Harvard Observatory, in the closing address of the Inter-American Astrophysical Conference in Mexico City, declared that by studying hundreds of thousands of great systems of stars, each comparable to our own Milky Way, it should be possible to work out whence our own system of stars came and where it is going.

Already Dr. Shapley has directed a census of these galaxies out to a distance of 100,000 light years (600,000,000,000,000,000 miles). More than 400,000 new systems have been discovered. About a thousand million million stars are involved in this gigantic study of the whole sky, now two thirds complete.

The new Schmidt-type telescope, dedicated at Tonanzintla last week, the largest of its kind reaching southern regions of the sky, is specially well suited to the study of these faint external galaxies. Three quarters of these great aggregations of stars have spiral arms which hitherto have been thought of as streams of stars thrown off from the central portion of the galaxy. Dr. Shapley told the conference that these arms actually appear to be condensations within the systems rather than ejections from the center masses.

Measuring photographic plates with electrical measuring instruments more sensitive than the human eye, the Harvard measurements reported by Dr. Shapley show that only a fifth of the light of a spiral galaxy is in its arms and most of it is in the little-noticed background of the galaxy.

Recent Harvard studies show that our own galaxy, the nearest stars of which we see in the night sky, is larger than supposed. Variable stars, used by astronomers as yardsticks, have been found as distant as 30,000 light years on the other side of the center of the galaxy.

Evidence that the Small and Large Magellanic Clouds may be physically connected was presented by Dr. Shapley. An extension or wing of the Small Magellanic Cloud was discovered and has been shown to be attached to it. This wing extends outward to the Large Cloud.

Out of such studies, Dr. Shapley predicted, will come more information on deeper problems, such as the age of the universe, and whether it is finite in size and material, or limitless in one or both of these quantities.

OTHER PAPERS READ BEFORE THE INTER-AMERICAN ASTROPHYSICAL CONFERENCE

FROM Einstein's special relativity theory, Dr. George D. Birkhoff, of Harvard, has derived the famous values for the change in the planet Mercury's perihelion and the curvature of light passing by the sun. These predictions were first made by Einstein on the basis of his general relativity, which followed his special relativity theory by some years. Their experimental confirmation enthroned relativity as a dominant law of the universe. Dr. Birkhoff announced his success to the conference. He urged consideration of Einstein's special and general theories of relativity in relation to quantum mechanics. He also recalled that in 1926 he had demonstrated that Schroedinger's quantum mechanics could be derived from general relativity, which was another bringing together of fundamental conceptions in theoretical physics.

A very short life for the universe so far—a mere two or three billion years—was suggested by new theories of evolution of the stars presented by Professor H. N. Russell, of Princeton, a leading authority on the life and death of stars. This is only about the age of the oldest rocks on the earth and it may mean that the earth is as old as the rest of the universe. Professor Russell's new theory takes into account the recent ideas that the stars are kept shining by means of the energy they obtain from transmutations of the atoms that compose them. The older ideas of thirty years ago, proposed by Professor Russell at that time, pictured the stars as undergoing a regular evolution, one sort turning into another. He now concludes that, puzzling as it may be, the white dwarf stars have not arrived at their present state through an evolutionary process but were "born" that way. The supergiants, blazing at a great rate, consume so much energy that they could not have kept up that pace during the new short lifetime of the universe. It is, therefore, suggested that these stars had an existence during which they did not shine, but were actually 170 degrees below zero Centigrade on their surfaces.

Everything on earth, even the meteoritic importations from outer space, are the same age, about two to two and a half billion years, according to Dr. Robley D. Evans, of the Massachusetts Institute of Technology. This suggests that the "pebbles from heaven" as well as the earthly elements themselves were formed at the same time. Dr. Evans used a new method of determining age. He estimated ages from the relative activities of long-lived radioactive isotopes or varieties of some elements. In terrestrial samples the radioactive isotopes of uranium, potassium, carbon, oxygen and others always occur in the same proportions, suggesting that they were all formed at the same time. Measurements of meteorites show the same relative abundance of the isotopes. This checks well with earlier age determinations upon iron meteorites and earthly rocks by measuring the amounts of helium produced as by-products of radioactive disintegration.

HIGH PRESSURES

How boiling hot ice and other weird things occur at extremely high pressures was told at the Iowa State College at Ames by Dr. P. W. Bridgman, Hollis professor of mathematics and natural philosophy at Harvard University. He spoke at Iowa State College under the auspices of the Sigma Xi, national fraternity for the promotion of scientific research, and will give the Sigma Xi

lecture at a number of other colleges and universities during the next few weeks.

Dr. Bridgman also described the steps by which pressures in his laboratory have been successively raised from a previous high of 3,000 atmospheres or 45,000 pounds per square inch, the maximum employed in artillery, to the present record of 400,000 atmospheres. This is 6,000,000 pounds per square inch, the pressure that would be found under a tower of bricks nearly 1,500 miles high, or at a point in the interior of the earth over 1,000 miles below the surface.

Even at this extreme pressure, graphite refused to change to diamond, and Dr. Bridgman believes that this feat, which nature herself accomplishes so sparingly, can not be done at ordinary temperatures, no matter how high the pressure.

More than boiling hot ice was produced at a much lower pressure. At 40,000 atmospheres, ice was produced at a temperature of approximately 375 degrees Fahrenheit. This is 163 degrees above the usual boiling point of water, nearly as far above it as the boiling point is above the freezing point.

Hot ice is indeed not ordinary ice, but it differs from the latter practically only in that its volume is less; it sinks in water, and its melting point is raised with increasing pressure, contrary to the behavior of ordinary ice. This explains why it does not melt at high temperatures if the pressure is sufficiently raised. Six of these other kinds of ice emerge at different pressures. Nearly all substances behave in the same way. Eleven kinds of solid camphor, six kinds of bismuth, appear as these substances are compressed.

Physical properties change remarkably. Poor conductors of electricity become fair conductors, and good conductors become sometimes better, sometimes worse.

OLD COTTON FIELDS AND FISH PONDS

BIG crops of fish can be raised on old cotton fields in the South—fields too worked-out to produce paying land crops any longer. The system has been developed by Dr. H. S. Swingle and Dr. E. V. Smith, of the Alabama Agricultural Experiment Station at Auburn. All that is necessary is a field and a creek, so situated that a low earth dam will turn the field into a shallow pond. The water, instead of the soil, then receives a fertilizer application and is stocked with fish. Bass, catfish and bream are regarded as most promising.

High food yields at low costs have been obtained in the experiments. As much as 600 pounds of fish per acre, at production costs between three and six cents a pound, have been taken out of the ponded fields. Comparable fields used as pastures yielded only 149 pounds of beef per acre, at much higher per-pound cost.

The fertilizers used are the regular commercial kinds, applied at a rate of 100 pounds to an acre. Results were improved by adding ten pounds of nitrate to the regular fertilizer mixture. Too much fertilizer resulted in the growth and decay of such an excess of aquatic plant and animal life that the water was robbed of its oxygen and the fish smothered. Moderate fertilizer applications, therefore, are emphasized as essential to the success of the method.

Fish are not directly nourished by the fertilizer. First result is the encouragement of a good growth of microscopic water plants. These become the food of microscopic animals, and these in turn are eaten by others. The fish are next to the last and largest link in the biological chain of eat-and-be-eaten. The last and largest link of course is the field owner and his family, who get sport, increase and new variety in daily menu, and cash from the sale of surplus fish.

BACTERIOSTATIC ACTION OF SULFANILAMIDE

NEW research confirming earlier evidence that sulfanilamide attacks bacteria by literally starving the germs may provide a hopeful method of "making drugs to order" for specified germs. Until recently, pharmacologists have worked mainly on a hit-or-miss basis. Ehrlich, for example, tried 606 times before he hit on salvarsan, the specific drug for the organism of syphilis.

The new research is reported in the *Lancet* for January 10. It is described in a report by Dr. Sydney D. Rubbo and Dr. J. M. Gillespie, of the University of Melbourne, Australia. They found that a chemical called p-aminobenzoic acid is needed by a certain type of bacteria for growth. This acid is similar in its chemical structure to sulfanilamide. When the sulfanilamide is present, the bacteria are tricked into using it instead of the necessary acid. Since sulfanilamide does not promote growth, despite the similarity in chemical structure to the acid, the bacteria can not develop.

However, only one part by weight of the acid will offset the growth inhibitory qualities of 26,000 parts of the sulfanilamide. This is a possible explanation of why such large amounts of the drug are needed in treatment of bacterial infections.

Dr. D. D. Woods and Dr. P. Fildes, of England, had earlier discovered evidence that the acid was necessary for bacterial growth, and that sulfanilamide inhibited growth by interfering with the bacterial use of the acid. The present research confirms their evidence, while an editorial in the same issue of the *Lancet* comments that "one new and more rational method has been added to those already available in (drug) research."

THE LIVING CELL

A LONG-SOUGHT clue to a more complete understanding of the living cell, the basic unit of all life, has been found in experiments with the atom-smashing cyclotron at the University of California.

Dr. Alfred Marshak, research fellow in the Radiation Laboratory, has shown that in the first stage of development of the cell, which is called the resting phase, and during which time the cell is supposed to remain inactive, this tiny unit of life is constantly changing. One function of the cell is to reproduce, and it does this by progressing through a number of fairly definite stages until it finally splits into two cells. It is the simplest biological unit, consisting of a nucleus with chromosomes,

rod-like structures considered to be the carriers of genes, chemical entities which determine heredity.

According to classical biological teachings the cell in the resting phase is inactive. In the second phase of development the number of chromosomes doubles, in the third the membrane around the cell nucleus disappears, and in the final stage the cell splits in two. The new cells enter immediately into the resting stage, and according to the theory remain dormant for a while before they start the cycle over again.

Dr. Marshak bombarded cancer and plant cells with both x-rays and the neutron rays produced by the cyclotron, and made a comparison of the damage to the chromosomes of the cells in the resting phase. He found that neutrons produced relatively more damage to chromosomes in the resting phase. At certain definite periods in this phase the relative efficiency of neutrons in producing this damage is much greater than at others.

Dr. Marshak said that this clearly indicates distinct physiological states, rather than one inactive phase. He said that he has no idea of the character of these states, but that the evidence does give science a new clue to the functioning of life's simplest unit.

SIGNS OF SPRING

SIGNS of spring are beginning to appear: earliest violets and buttercups in the South, pussy-willows and alder catkins and skunk cabbages in the still-chilly North. First robins are being reported every day. But we really went "over the hump" of winter weeks ago, when average temperatures stopped getting lower and started getting higher.

A map of averages compiled by the Weather Bureau shows that this earliest preview of spring enters the United States at its southwestern corner, where the turn toward warmer averages occurs early in January. Across the South, and over a wide stretch up the Pacific Coast and eastward into the Great Plains, the warming-up begins during the middle ten days in January. Latest to feel the first warm breath of spring is the northeastern section, with the middle and upper Great Lakes region, where the welcome days do not arrive until the beginning of February.

Of most practical importance, in this study, is the later period when the vanishing number of frosty nights permits the planting of early crops, with reasonable assurance that they will not be frozen off after they come up.

"It is essential," according to the Weather Bureau report, "that spring crops be planted late enough to be reasonably safe from an untimely freeze after the plants have emerged, but where the advantage of maturity for early markets is a consideration the chance of damage should be considered on the basis of an economically sound safety margin."

The map shows, for example, that if early truck crops susceptible to freezing weather are planted early enough to be above ground on February 1 along the central and west Gulf coast, the chance, in the long run, that they will be killed by a freeze is only one year in ten.

ITEMS

A GUIDE to Public Vital Statistics has been published by the Work Projects Administration for 21 states, and the remaining state guides are scheduled for completion by April 1. They show where the birth records are listed in each county, city or town of a particular state, and the fee charged for the service. Copies of the guides containing birth certificate information published by the WPA are being distributed to State Departments of Health, Vital Statistics Bureaus, the Bureau of Census and to the libraries of the War and Navy Departments. They can be had by industries, recruiting officers, Selective Service boards and other official agencies by writing the WPA administrator of a particular State, or to the Washington Headquarters of the Historical Records Survey of the WPA.

THE intensity of the primary cosmic rays, as they come in toward the earth, varies with the number of spots on the sun, was stated by Professor James W. Broxon, of the University of Colorado, at the meeting in Detroit of the American Physical Society. The peak of the spots, however, occurs three or four days before the peak of the cosmic rays. The effect is supposed to be due to the magnetic fields of the spots. These variations in cosmic ray intensity produce at the earth's surface magnetic disturbances of a particular character that can be calculated and distinguished from magnetic disturbances due to other causes. This was pointed out by Dr. Foster Evans, also of the University of Colorado. If the incoming cosmic radiation consists of charged particles predominantly of one sign, he said, there must be compensating currents of slow-moving electrons in the vicinity of the earth. The earth's magnetic field would cause these electrons to spiral about the earth, and they in turn would produce a magnetic field opposing that of the earth. If the intensity of the incoming cosmic rays were constant, this diminution in the force on the compass needle would not be noticed. But variations of this intensity manifest themselves as magnetic disturbances. The calculated effects agreed with those observed.

PUTTING calcium carbide on pineapple plants to force them into bloom is the device used by planters of tropical Australia. The secret of the technique is the fact that calcium carbide is the parent stuff of acetylene, which evolves as a gas when the carbide is moistened. Acetylene is one of the hydrocarbon gases that has been used to stimulate plant processes, including blossoming. The Queensland planters, however, have found it unnecessary to go to the somewhat expensive bother of gas-treating their pineapples. They merely drop bits of calcium carbide into the heart of the leaf cluster when the plant is in bud, and the first rain, or even heavy dew, causes the evolution of the acetylene. Care has to be exercised in the treatment, because too much carbide burns the plants, too little produces no results. But experience indicates the right amount, and brings about an increase in the pineapple crop.