SCIENCE NEWS

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SOME PAPERS READ AT THE PHILADELPHIA MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND ASSOCIATED SOCIETIES

Egg-shaped stars, which sometimes are more stretched out, at other times more nearly spherical, were described by Dr. Theodore E. Sterne, of the Harvard College Observatory, before a meeting of the American Astronomical Society. These are stars known as eclipsing binaries. Such a system consists of two separate bodies, revolving around each other in a sort of cosmic waltz. When one comes between us and the other partner, the total light reaching us is reduced. No telescope is powerful enough to show the two separately, but their presence can be deduced from the way the light varies, and from analysis of the light with the spectroscope. The tidal pull of each star on the other stretches it, so they are never exactly spherical, said Dr. Sterne. As they rotate, they present varying amounts of their surface to observers, depending on whether we see the egg on end or sideways. This causes additional variation of light, in addition to the eclipses.

A newly discovered force, 200 times as effective as gravity, was announced to members of the American Astronomical Society, meeting at the Franklin Institute. Dr. Lyman Spitzer, Jr., of Harvard College Observatory, told of this attraction, which acts on minute particles of dust between the stars. It is really a consequence of a well-known effect—the same pressure of light that makes a comet tail point away from the sun. Such radiation pressure pushes on the dust particles in space. When two different pieces are in line with the body from which light is coming, the first one absorbs light that would go to the other, and hence tends to approach the second. The force of this attraction is 200 times as great as their gravitational pull on each other. With only two particles, this force would not be appreciable, but there is a great deal of material between the stars, and the attraction has to be considered in studying the behavior and distribution of interstellar matter. Each particle, he said, has a negative electrical charge of about two volts potential. Since they are charged the same way, there is a repulsion between them and thus they will never come together. Their average speed is about two or three miles per hour.

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 Drs. 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 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 per cent. of hydrogen which they estimate in the sun, would also remove the discrepancy.

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 physicists 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 per cent. more energy, according to his calculations, than splitting into two parts, or 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 yields. Though the energy to activate the process is the same as for binary fission, Dr. Present believes that with low energy neutrons, it is less likely to occur than division into two parts. So far no experimental verification of the triple division has been found.

A new trap for cosmic rays, nearly two feet in diameter, was described by Dr. Thomas H. Johnson, assistant director of the Bartol Research Foundation of the Franklin Institute, and his associates, J. G. Barry and R. P. Shutt. This is a Wilson cloud chamber, which is a cylinder containing damp air in which the pressure is alternately raised and lowered. As the expansion takes place, a line of fog will form on the trail of atomic fragments left in the wake of a cosmic ray, or of certain of the rays of radium. The cosmic rays can not be aimed at such a chamber, usually only a few inches in diameter, and it is a matter of chance when one will strike. There-

fore, the larger the chamber, the more chance will there be of catching the rays.

Professor G. D. Birkhoff, of Harvard University, and Professor D. C. Lewis, of the University of New Hampshire, told of their newest studies on the "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 proved 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 Professor Birkhoff, and known as "chromatic polynomials." These techniques may be united to advantage. Thus, it may be that proof may be extended and perhaps even made general.

The movement of the core of the earth, which some believe to be fluid, resembles "the motion of a bowlful of jelly when you rock the bowl a little bit, but quite fast," according to David Rittenhouse Inglis, of the Johns Hopkins University. He studied the problem of whether this fluid core would be made by friction to rotate with the solid outer crust of the earth. It would, if the globe rotated about a fixed axis, he stated, but actually the axis shifts, during a period of about 26,000 years. If ordinary fluid friction alone is considered there would not be enough to pull the core around in all the earth's complicated motion. However, the core is so big that there is a considerable amount of turbulence, which increases the friction, making it nearly enough. The axis of rotation of the core is expected to lag behind the axis of rotation of the solid exterior by an angle of about one degree.

By measuring the amount of radium in mud from the bottom of the ocean, it is possible to determine how long ago that mud was deposited, according to Dr. William D. Urry, of the Geophysical Laboratory of the Carnegie Institution of Washington. Formerly samples of the mud were merely scooped up in buckets, but in recent years a method devised by Dr. Charles S. Piggot, Dr. Urry's colleague, has given specimens down to a depth of a number of feet below the bottom. This device consists of a long tube, which is shot into the mud. The radium is nearly all in the top layer of the muds and clays. This is explained because the uranium, the "grandfather element" which disintegrates into ionium and then into radium, remains dissolved. The radium formed drains down to the bottom. Then it disintegrates, half the atoms committing suicide in 1700 years, half of what remains in another 1700 years, etc., until after many thousands of years, practically all the radium is gone. Thus, by measuring the amount of radium, it is possible to tell when that particular part was deposited. In really deep parts of the ocean, even ten feet of the bottom may take as long as a million years to build up. This is only a small part of the recent life of our planet but an interesting part, because in it the earth has seen the ocean rise and fall, great changes of climate, ice fields stretching down into New Jersey and receding back into Canada, and, even now, perhaps only temporarily, retracted to the polar regions. All these and many other changes have left their very definite marks in the character of the bottom of the ocean.

No place in the world, not even the bottom of the ocean, is safe from the prying eye of the candid camera and its accompanying flash bulb. A new kind of deep-sea photography, of use in fisheries management, was described before a meeting of the Limnological Society of America by Professor George L. Clarke, of Harvard University and the Woods Hole Oceanographic Institute. Professor Clarke told of the biological application of apparatus invented by Dr. W. Maurice Ewing, of Lehigh University, for purpose of geographical research. Dr. Ewing's deep-sea flash-bulb camera can be lowered to a position near the bottom, where it gets a snapshot of an area about $2\frac{1}{2}$ by $3\frac{1}{2}$ feet in size. It has worked successfully in waters from about 125 feet to more than half a mile deep. Photographs taken in the waters of Georges Bank, the fishing ground northeast of New England, show a dense bottom population of animals. There are crabs, a sea-snail, starfish, sea-urchins, sand-dollars, deep-sea scallops and other shellfish, tube-building worms, and sponges. In two of the photographs the sand-dollars are so numerous that they are actually piled on top of each other. Singularly enough, however, no sign of plant life could be found on any of the photographs.

Dr. C. Hawley Cartwright, now of the Corning Glass Works; John Daniel, of the U. S. Bureau of Public Health, and Alex Petrauskas, have measured the transmission of infrared 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 infrared rays are the same as heat rays. It was 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.

A change in only eight or nine molecules of the visual purple, in the retina of the human eye is sufficient to produce the sensation of sight, according to Professor Selig Hecht of Columbia University. Associated with Professor Hecht in his experiments were Simon Shlaer, also of Columbia, and Dr. Maurice H. Pirenne of the Belgian-American Educational Foundation. In the research, an observer would stay in a dark room for half an hour, until his eyes had become dark-adapted and reached a maximum of sensitivity to light. Then a flash of light, exactly a hundredth of a second in duration and of carefully measured radiant-energy content, was shot at his eyes. The amount of light actually reaching the retina, when the minimum sight-causing illumination was reached,

was calculated at eight or nine quanta, each quantum being able to cause the necessary chemical change in one molecule of visual purple in the retina. Professor Hecht pointed out that "judging by the structure of the retina, the structure of light, and the chemistry of visual purple, it is hard to conceive of a biological system which could be more sensitive than this. Certainly there are no physical systems which even approach it."

Better use of the sulfa drugs in treating pneumonia and human ailments may come from laboratory studies was reported to us by Dr. George W. Raiziss, of the Graduate School of Medicine of the University of Pennsylvania, and Dr. M. Severac and J. C. Moetsch, of the Dermatological Research Laboratories of the Abbott Laboratories. Sulfapyridine is a better weapon against the pneumonia germ than sulfathiazole, although the latter is less toxic. Sulfathiazole, on the other hand, gives better results in treating infection with the staphylococcus aureus, the germ commonly thought of as the cause of boils and which also causes a serious form of blood poisoning. The effect of the two sulfa drugs in Type II and Type III pneumonia infections in mice was almost equal in the first 48 hours. After 28 days, however, 28 per cent. of the mice infected with Type II pneumonia and treated with sulfapyridine survived, compared to only 3 per cent. survival of mice treated with sulfathiazole. Of the mice infected with Type III pneumonia germs, 12 per cent. survived following sulfapyridine treatment, but only 3 per cent. survived with sulfathiazole treatment.

Dr. Harvey C. Rentschler, director of research for the Westinghouse Lamp Laboratories, reported that germs inherit strong or weak constitutions from their ancestors, and the strength of a germ varies according to the stage of its life cycle. During a germ's weakest moment it is eight to ten times less strong than during its most healthy period of life. This variation is considerably greater than was suspected and must be seriously considered in making tests of the efficiency of germ-killing agents. Studies of the germ-killing action of ultraviolet rays led to Dr. Rentschler's discoveries about the strength and weakness of bacteria and also shed new light on how radiation affects bacteria. Contrary to the generally accepted "single photon hit" theory, according to which bacteria are either killed or escape unscathed when subjected to lethal radiation, Dr. Rentschler found that bacteria may be injured, if not killed outright, by sublethal doses.

Dr. True W. Robinson, of the University of Illinois, reported that one of the substances that promotes growth of roots in plants was found to be effective in checking growth of one type of cancer in mice. He soaked pieces of mouse sarcoma tissue in a solution of indole-3 acetic acid, and then transplanted them into the bodies of mice. In eighteen experiments, only one piece "took," while in parallel control experiments with similar tissue not given the preliminary soaking, all 18 sarcomas grew. In other experiments, Dr. Robinson tried the effects of injecting the indole-3 acetic acid into the mice themselves, both before and after they had received implants of sarcoma tissue. These experiments also indicated that the acid has an inhibitory effect on the growth of the sarcoma.

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