

SCIENCE NEWS

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LITHIUM FLUORIDE CRYSTALS

A SCIENTIFIC discovery that holds promise of contributing to important research into the atomic structure of matter became known when Professor Donald C. Stockbarger, of the Massachusetts Institute of Technology, announced that he has successfully grown in his laboratory large and optically perfect lithium fluoride crystals.

Lenses made from such crystals, because they transmit light over a wider range of wave-lengths than any known optical material, are expected to be a powerful new tool for science. Natural crystals of this kind are usually too small for satisfactory use in lenses, and previous attempts to grow large ones artificially have been unsuccessful.

Formal announcement of the artificial synthesis was made by Professor Stockbarger at the recent meeting of the American Physical Society in Baltimore. Several of the new crystals, including one three inches in diameter, were exhibited.

Lithium fluoride transmits light waves from the infra-red region through the visible part of the spectrum but farther into the ultra-violet bands than other substances. Prime use of lithium fluoride crystals, in fact, should be in studies of the ultra-violet region of the spectrum.

In addition to its use in the ultra-violet, lithium fluoride should aid in research in the visible range, for its bends the various colors of the spectrum far more equally than other materials. Thus, images made by lenses of this substance are less subject to color fuzziness around the edges, which necessitates the use of compound lenses to offset this effect when glass or quartz lenses are used.

Crystals of lithium fluoride are also expected to aid science greatly in spectroscopic investigations, particularly in atomic research on liquids and some gases which must be confined in a container which permits the transmission of light over the widest possible range of wave-lengths. Use of microscopes in various phases of research may also be widely extended by using lenses made from these crystals.

The success of this method of growing the crystals lies in the synthesis of lithium fluoride salt in the purest form and the growth of the crystals in a specially designed electric furnace capable of precise temperature control. In this way he expects he will be able to grow crystals even larger than three inches in the future.

The substance is first produced in the form of a powder and then melted in specially shaped platinum crucibles with conical bottoms. After melting, a slow process of cooling is started and a tiny seed crystal forms in the point of the crucible, growing until the entire substance is crystallized. The finished product can easily be cut to the desired size and shape and polished.

IS THE UNIVERSE EXPANDING?

THAT the earth is near the center of an exploding or expanding universe may be just a false concept built up in the mind of man, suggests Professor Fritz Zwicky, of the California Institute of Technology.

When scientists interpret the much-observed red shift of the light from distant nebulae as proof that the separate parts of the universe are rushing away from one another with velocities as high as 15,000 miles a second, they are making only one of several possible interpretations. Dr. Zwicky, reporting in *The Physical Review*, points out that while the theory of relativity partially explains the red shift in terms of an expanding universe, the relativity predictions are not in accordance with observation in several important respects.

The red shift of light from distant nebulae is analogous to the lowering of the pitch of a sound like that from the whistle of a locomotive speeding from the observer at the crossing. In both cases the shift is one toward lower frequencies: for the whistle it is sound frequencies; for the expanding universe concept light frequencies are concerned. Lower light frequencies make the observed rays from the distant nebulae more reddened than they really are. The colors are not necessarily red in the observed spectral lines, but merely shifted in the red direction—hence the so-called red shift.

In his complex mathematical scientific paper Professor Zwicky sets up all the requirements which any explanation of the observed red shift must satisfy in order to be acceptable. For one thing, the shift ought to come out to be the property of any point in space instead of just that particular corner of the universe around the earth. "We do not want to assume that our earth is just the center of things. The relativity explanation of the red shift satisfies this requirement but so do other theories."

In other requirements the relativity explanation does not meet observed conditions, but Professor Zwicky, in his report, shows how to examine broadly all possible theories and has found, surprisingly, that some theories meet all demands and may be as good as, or better, than, the relativity explanation of the red shift.

The selection among the possible alternative theories must be left to checking by observations. Some of these require new developments in astronomical technique such as the installation of the new 200-inch telescope at Mount Palomar for the California Institute of Technology.

ANALYSIS OF SOUNDS BY THE CAMERA

DEVELOPMENT of a "sound camera," which, within a few seconds, automatically makes a picture of the quality of tones and noises within most of the range of human hearing, is announced by Dr. Harry H. Hall, of the Cruft Laboratory of Electric Communication Engineering at Harvard University.

With older methods these scientifically important tone pictures could be made only in several days, but Dr. Hall's new apparatus can make them in less than four seconds. With them the sounds of musical instruments can be studied and minute differences in tone between very fine and just ordinary instruments can be detected and analyzed. Accurate and detailed records of speech sounds can also be obtained with the new camera.

Analysis of a sound by the instrument is made from

a picture of the relative loudness of all parts of the sound, including the fundamental pitch, the overtones and incidental sounds such as the scratching of a violin bow. These pictures are in the form of line graphs showing the loudness of each of the component parts of the sound under examination.

All sounds from about 50 to 10,000 cycles can be handled by the instrument, a very satisfactory range in comparison with that of the human ear, from about 20 to 20,000 cycles.

The chief value of the device lies in its amazing speed for a complete picture of a sound can be obtained in 3.78 seconds. This permits thorough and accurate analysis of tones which remain steady for only a short time, such as those of the human voice. Thus the scientist can easily and quickly obtain all the material he needs for a detailed study of sound quality and acoustics.

ANESTHETICS FOR THE TEETH

DR. L. L. HARTMAN, of Columbia University, has discovered a "desensitizer" that does away with the painful sensations during the necessary drilling before a cavity in a tooth can be filled.

The desensitizer which Dr. Hartman discovered after nearly twenty years of research is a colorless fluid. Unlike other anesthetics which must be injected into the nerves or pulp of the teeth, Dr. Hartman's fluid is applied to the dentin, the substance which forms the bulk of the hard part of the teeth. It takes a minute or a minute and a half to take effect and the pain-killing effect lasts from twenty minutes to an hour, giving plenty of time to prepare almost any cavity for filling. There are no unpleasant after-effects and the pulp of the tooth remains normal.

The chemical composition of the desensitizer has not been announced and the fluid is still nameless. Patent rights for it have been assigned by Dr. Hartman to Columbia University. It will be on the market soon, and the quality and price will be controlled by the university in order to make it available for general use and to prevent exploitation of the public.

Human patients had to serve as "guinea-pigs" in the experiments leading to perfection of the desensitizer, since there is no satisfactory way of testing a pain-killer on a laboratory animal.

Discovery of this new kind of anesthetic for use in dental work recalls the fact that dentistry gave anesthetics to the world. Ether anesthesia was first used in the extraction of a tooth before its famous trial for a surgical operation at the Massachusetts General Hospital, Boston, in 1846. William Thomas Green Morton, who gave ether its first public demonstration as a surgical anesthetic, had been a dentist before he studied medicine.

VITAMIN A IN THE RETINA

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FIRST definite evidence of a vitamin participating directly in a physiological process has been found by Dr. George Wald, of the Harvard University Biological Laboratories, who has conclusively proved that the fat-

soluble vitamin A found in milk and fish liver-oils is present in the retina of the eye and is active in vision.

In the course of this research Dr. Wald also discovered a heretofore unknown yellow pigment which he has named retinene. Like vitamin A, this substance is related to the carotenoids, the coloring matters of many plant and animal tissues. Retinene, he found, is liberated by the action of light on the eye.

For some time it has been known that insufficient vitamin A in the diet results in so-called "night blindness," a lowered ability to see in dim light. Since the retinal rods are used principally in dim vision, it has been believed that the vitamin must be associated in some way with these organs.

The discovery of free vitamin A in the retina tended to substantiate this theory. Dr. Wald has now found that the vitamin participates directly in the formation of visual purple, a pigment contained in the retinal rods. The bleaching of this pigment by light is the initial step in the visual process.

When the visual purple is thus bleached an orange material called visual yellow is formed. This process is accompanied by the liberation of a large amount of retinene, to which the color of visual yellow is due. Following bleaching, the orange color slowly fades, the retina finally becoming colorless. At this point it is found that the retinene has disappeared, having been transformed entirely into vitamin A.

In the living animal the vitamin is re-synthesized to visual purple, completing the cycle. This cycle is not a perfect one, however, since some vitamin A is apparently lost in the process. This appears to be one reason why it is necessary to provide the animal with a continuous supply of new vitamin.

In the original experiments with frogs, Dr. Wald reported observations made principally with a pocket spectroscope. Recently he has been able to obtain objective records of each detail of these results by the use of a recording spectrophotometer, designed by Professor Arthur C. Hardy, of the Massachusetts Institute of Technology.

EFFECTS OF DRUGS ON THE HEART

HEARTS from dead men, revived and brought to life, are giving new knowledge of how to use the drugs that aid heart afflictions. Experiments wherein fresh blood was pumped through dead human hearts until they started beating freely again have been reported by Dr. William B. Kountz, of the Washington University School of Medicine.

The drugs commonly used to treat heart disease may be helpful, or harmful, depending on the state of the heart. In the type of heart disease Dr. Kountz investigated and reported to the Southern Medical Association, the small arteries of the heart muscle itself are closed. Blood therefore can not get through to nourish the muscle and keep the heart at work pumping blood into the rest of the body.

Physicians have lately been treating this heart ailment by giving drugs that would dilate the closed or dangerously narrowed arteries, on the theory that widen-

ing the arteries would help to keep the blood flowing through them. They learned which drugs to use by studying the drug's action on the heart arteries of experimental animals.

The use of the artery-expanding drugs in human cases of heart disease has, however, not been entirely satisfactory, Dr. Kountz observed. His research seems to show why. In human hearts, he found, the state of the heart or the tone of the heart muscle is the chief factor influencing the flow of blood through the heart's arteries.

Dr. Kountz tried the effect of various common heart medicines, such as the nitrites, liver extract, theobromin, digifolin and adrenalin, on the hearts he had revived. Their action on the heart was entirely different when the heart muscle was contracted than when it was relaxed. Nitrites, for example, which ordinarily increase the flow of blood through the heart's arteries, increased it still more when the heart muscle was contracted, but lost their effect entirely when the heart muscle was relaxed.

Dr. Kountz concludes that physicians will know better what drugs to use in treating heart disease if they classify heart ailments according to the state of the heart as far as it can be determined by studies of the patients.

ITEMS

MAUNA LOA, in eruption again, is one of the busiest of the world's volcanoes, but also one of the least troublesome, so far as destruction of human life is concerned. In all recorded history, and through all the traditions of the Hawaiian natives, it has never killed a man, though its lava-rivers have occasionally done considerable property damage. Nevertheless its demonstrations, like all volcanic outbursts, are awesomely impressive. Its last preceding outburst occurred a little less than two years ago, on December 4, 1933. This outbreak had been predicted in 1931 by the well-known government volcanologist, Dr. T. A. Jaggar. He foretold an eruption as due within three years, and Mauna Loa "came through" with a liberal time-margin to spare. During the period of slightly over a century since the white man's history of the islands began, there have been about thirty eruptions of Mauna Loa. The mountain is the loftiest peak of the islands, and one of the notable cones of the entire world, with an altitude of approximately fourteen thousand feet.

THE official altitude figure of 72,395 feet (13.7 miles) for the highest up of the National Geographic Society-U. S. Army stratosphere flight of November 11, just determined by National Bureau of Standards calibration of the sealed meteorograph, is a record that will probably stand for some time. It is higher by not quite a mile than the unofficial figure for the ill-fated Soviet balloon of 1934 that crashed in landing with fatal results to its crew of three. It is more than 2 miles (11,158 feet) higher than the official record set in 1933 by the Settle-Fordney American flight, the official mark of which was 61,236.691 feet. The routine flights of instrument-carrying balloons used in weather observations do not often reach higher than the new record for man-carrying strato-balloons just announced. Sounding balloons, or small balloons that do not carry anything but themselves aloft,

often go higher than the new world's record. The American record for these sounding balloons dates from 1913 and is 20 miles. The highest claimed is 22 miles in Germany, but there is doubt about these records, as there are theoretical reasons for doubting whether balloons can rise much beyond about 19 miles. Rockets seem to be the most promising in attempts to probe farther out in space.

SURVIVING conditions where man would die, tiny spores of important plant diseases are growing in a laboratory of the Department of Agriculture, in Washington, after journeying nearly 13½ miles into the stratosphere with the balloon *Explorer II*. Discovery that spores can still live after being sent to an altitude of 72,395 feet is the first scientific conclusion from the recent ascension sponsored by the National Geographic Society and the U. S. Army Air Corps. The spores carried aloft by Captains Albert Stevens and Orvil Anderson to a new world's record had to withstand: (1) Temperatures lower than 65 degrees below zero Fahrenheit; (2) such a low atmospheric pressure that man could not live in it; (3) ultra-violet rays from the sun which never reach the surface of the earth and which are capable of killing some forms of life; (4) ozone; (5) extreme dryness.

COSMIC rays, no longer the mystery they once were, are now used as highly valuable working tools in the scientific laboratory. Their newest use is to help investigate the nature of magnetic forces inside a magnet, according to papers presented before the Baltimore meeting of the American Physical Society. The nature of such internal magnetic forces has been almost impossible to investigate hitherto. The forces outside the magnet could be studied with great precision, but what was happening inside the magnet remained a mystery. High speed and piercing cosmic ray particles, however, are capable of passing through great thicknesses of iron. By seeing how much their paths are bent in going through the magnet, physicists are now able to acquire knowledge of the magnetic field strength in the magnet's interior. The technique is similar to the way one might estimate the force of a hurricane storm by the extent to which a ship has been driven off its course. Two reports describing the theory and experimental studies were presented to the society by Professor W. F. G. Swann, of the Bartol Research Foundation, and his colleague, Dr. W. E. Danforth.

IN spite of the increase in automobile deaths in the United States, accidents cost no more lives now, in proportion to the population, than they did in 1900. Deaths from railroad and street car accidents, drowning, burns, poisonous gas, food poisoning and suffocation, have dropped from an average of 47.7 per 100,000 population during 1900-1905 to 17.9 during 1931-1934, an improvement of 29.8. The rate from automobile accidents was practically zero in 1900 and 28.4 in 1934. The one about balances the other. One out of every 13 deaths in Illinois is due to accident, and more than one third of these are attributed to the automobile, according to a bulletin sent out by the Illinois Department of Public Health. Out of 6,928 fatal accidents last year, 2,576 were caused by motor vehicles. Accidents are now a greater hazard than any disease, except heart disease, cancer and nephritis.