SCIENCE NEWS

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THE MICHELSON-MORLEY EXPERIMENT

EINSTEIN'S theory of relativity still stands. The Michelson-Morley experiment, which many years ago failed to show an expected motion of the earth through the ether of space, and led to the relativity theory as an explanation, still fails to show any such motion. At the meeting of the Optical Society of America in Washington on November 2, Professor A. A. Michelson, physicist and Nobel prize-winner of the University of Chicago, announced the final results of a repetition of his classic experiment.

Working at the Mt. Wilson Observatory in Pasadena with much improved apparatus, capable of detecting a motion as much as 2 per cent. of that expected, none was found. The very slight effect found was less than that to be expected by experimental error and not more than a tenth of what he found before.

Physicists regard this announcement as showing that Professor Dayton C. Miller, of the Case School of Applied Science in Cleveland, was mistaken in supposing a few years ago that he had found such an effect, though smaller than originally expected. So far, however, they are unable to explain the source of Professor Miller's error.

OUTDOOR TELEVISION

BIG television transmitters, or extremely sensitive photoelectric cells, contain the secret of successful outdoor television. This was the message brought to the Optical Society of America at its meeting at the Bureau of Standards by Dr. Frank Gray and Dr. Herbert Ives, who are chiefly responsible for the success of the Bell Telephone Laboratories' system of television.

When first publicly demonstrated the Bell method employed beam scanning. A narrow and intense pencil of light rapidly covers all parts of the subject and the light reflected is picked up by a battery of light-sensitive cells. This obviates the use of objectionably brilliant flood lighting of the subject. This method can not be used out of doors because of the interference of daylight, as well as its limited range. Ordinary daylight is not sufficient to operate the transmitter with ordinary equipment.

By using an extra large lens, with an extra large scanning disc, and extra large holes, several times as much light can be picked up and focused on the surface of the sensitive cell. But the picture also is larger, and so the relation of picture size to the size of the individual elements remains the same. The picture shows just as much detail as with the smaller apparatus. As photoelectric cells are becoming more sensitive, it is not necessary to make the scanning discs unreasonably large.

Dr. Gray stated that there was a curious optical illusion which helped them out in televising full length figures. "It has been held," he said, "that in order to produce satisfactory television images of full length figures or groups of figures it would be necessary to use a very much finer grained image than those that have been used thus far for the transmission of the human face.

"It has been interesting to find that with our 50-line, that is 2,500 element images, which are just sufficient for the transmission of clearly recognizable faces, the rendering of full length figures or even of two or three figures simultaneously is surprisingly satisfactory. The reason for this appears to be largely psychological. It appears that when full length figures are observed, one's expectation of rendering of detail is automatically reduced; that is, where with a face filling the whole field, one expects to see such details as nostrils and eyelids clearly defined, where we have full length figures we are satisfied if we see head, hands and feet clearly differentiated from the other details of corresponding large size.

"The effect is very much as though the observer were looking through a window. If someone on the other side of the window holds his face up close enough to fill the whole opening we expect to see fine detail in the face. If, however, the person walks away from the window until we see him at full length, we no longer expect to distinguish fine details of the face."

THE PANORAMOGRAM

A NEW camera that makes photographs that appear solid to the eyes, and which shows different sides of the object depending on which way one looks at the picture, was shown at the meeting of the Optical Society of America.

Dr. Herbert E. Ives, under whose auspices television was developed by the Bell Telephone Laboratories, described the new camera, which he designed. The pictures made with it are called "parallax panoramograms." They differ from the double stereoscopic pictures, used in the old-fashioned twin lens hand stereoscope, because no optical aid is required between the eye and the picture. Also, the old style stereograms only show the subject as it would appear to a pair of eyes in one position. With a panoramogram of a person's head, for instance, if one looks at it from directly in front, he sees a full view of the face. If the picture is looked at from the side, one side of the face is seen. It is in full stereoscopic relief all the time.

The pictures are a modification of an invention of Dr. Ives's father, Frederic E. Ives, pioneer in the invention of the half-tone process of reproducing photographs. With this parallax stereogram, as it was called, two pictures were taken with two cameras separated by the distance separating the average pair of eyes. These were then combined on a glass transparency, so that the picture consists of fine vertical strips, about 200 to the inch. One strip shows part of the picture seen by the left eye, the one next to it that of the right eye, then the left eye picture again, and so on.

Another glass is firmly mounted a short distance in front of the picture and on it are alternate clear and opaque vertical strips the same width as those of the picture. When the stereogram is held at arm's length and viewed against a light, the right eye sees only the strips of the picture made with the right hand camera. Those of the left hand picture are covered by the dark strips. But for the left eye the case is reversed. It sees only the left hand picture, and the right hand one is covered. Thus the two views are combined, and the picture is seen in stereoscopic relief.

In the new method, which is the invention of Dr. C. W. Kanolt, formerly of the U. S. Bureau of Standards, although Dr. Ives designed the camera that makes them, the picture is made from different angles. The Ives camera moves along a track in front of the subject during the exposure, so that the center of the subject is always on line with the center of the plate and the center of the lens. Just in front of the plate is a glass grating of alternate vertical light and dark strips, but the clear spaces are only one tenth the width of the dark ones. The finished picture consists of strips, but one part of each strip shows the picture from one angle, while another part shows it from another angle. A similar grating is placed over the finished transparency, and so no matter what angle the picture is viewed from the proper picture appears. Unfortunately, so far as can be foreseen, there is no practicable way of applying the method to the movies.

MOTION PICTURES OF THE PLANET JUPITER

SCIENTISTS attending the meeting of the American Optical Society at the Bureau of Standards paused from listening to papers on research to see a movie. They applauded it with as much vigor as any screen star ever received in a theater. The star of this movie was a heavenly "star"—the planet Jupiter, appearing on the screen for the first time in America.

Jupiter came into view, slowly and steadily turning as if driven by an electric motor. The great red spot and other details of its surface familiar to astronomers passed across its face. One of the moons of Jupiter came on to the screen from the side, rapidly approached the planet, then its shadow appeared on the planet's surface. Finally the grayish disc of the moon itself was seen silhouetted against the bright planetary background, though not as dark as the shadow.

These motion pictures, the first of their kind ever made, are the work of Professor W. H. Wright, of the Lick Observatory, in California, and Dr. C. E. K. Mees, director of the research laboratory of the Eastman Kodak Company. Every minute or so during the whole of one night, Dr. Wright made photograph after photograph of Jupiter with the observatory's great 36-inch telescope. Jupiter turns completely in 10 hours, but as the best results could only be obtained when the planet was fairly high in the sky, it was necessary to repeat this on several other nights. Thus every aspect of Jupiter left its record on the sensitive plates.

Dr. Wright then turned the negatives over to Dr. Mees, and he combined them on a motion picture film. This was particularly clever work, for each successive image must be in exactly the same place, or else the planet will seem to wabble when shown on the screen.

At a meeting of the Royal Astronomical Society in London last summer Dr. Wright showed these for the first time. There they proved a genuine sensation to the astronomers.

LIGHT REQUIREMENTS OF PLANTS

IT might seem to the layman as if a growing plant out in the open undergoes such extremes of light and darkness that it would thrive under almost any conditions of quality or intensity of radiation. But this is not the case, and plants are easily affected by changes in color or duration of light, members of the Optical Society of America were told by Dr. John M. Arthur, of the Boyce Thompson Institute.

Though plants can be grown under electric light, some do not thrive if the light is kept on all the time. The tomato, he said, is killed by continuous illumination. After about five days a leaf injury appears and this increases until most of the leaves have withered and dropped off. In general, 18 or 19 hours a day of light gives as rapid growth as when the light is continuous. Buckwheat takes almost anything that is offered, for it flowers with anywhere from five to twenty-four hours of light a day.

Just as the short rays of light, known as the ultra-violet, cause sunburn and damage to the human tissues, so do they affect plants. Dr. Arthur also told of recent experiments which show that the very short waves will soon kill plants. Ultra-violet rays were produced with a quartz tube mercury vapor arc lamp. Filters were placed over the lamp to cut out some of the shorter rays.

In this way it was found that when rays as short as 237 millionths of a millimeter, about one hundred thousandth of an inch, were used, a large part of the leaf area of a tomato plant was killed in 30 seconds. But when the shortest rays were 286 millionths of a millimeter, there was no injury at all. In sunlight at sea-level, the shortest ultra-violet rays are about 300 millionths of a millimeter in length. The shortest visible violet rays are about 400 millionths, and the longest red rays that we can see about 700 millionths. All of the visible colors come between these limits.

CATHODE RAYS AS A LABORATORY TOOL

THE wonder-working cathode rays, first obtained in large quantities in the open air two years ago by Dr. W. D. Coolidge, of the General Electric Company's research laboratory, are now at the disposal of any well-equipped research institution. The effects of the rays on all sorts of living and mineral matter can now be studied.

This is possible with a new form of the tube, simpler than an X-ray tube, and hardly more complicated than an electric light bulb, which has been perfected by Dr. C. M. Slack, of the Research Department of the Westinghouse Lamp Company, at Bloomfield, N. J.

Cathode rays were first studied as they were produced inside glass tubes made by the English scientist, Sir William Crookes. Then, in 1894, a German, Professor P. Lenard, first succeeded in getting them in feeble quantities in the air. Dr. Coolidge, in 1926, invented a tube in which they were obtained in large quantities in the open air.

The rays consist of speeding electrons, the "atoms" of an electric current, and of which the atoms of matter are supposed to be built. In the Coolidge cathode ray tube they are produced by a glowing electric light filament, and given their great velocity by the application of an electric potential of several hundred thousand volts. This is sufficient to drive them through a thin nickel window at the end of the tube, where they cause the air to glow, as well as other curious effects.

Dr. Slack's improved tube dispenses with the nickel window and uses a bubble of glass, but so strong is it that the pressure of the air on the outside is not sufficient to break it, and destroy the essential vacuum within. Some of these windows are only one five thousandth of an inch thick and an inch in diameter.

They are made by drawing in a bubble of molten glass on the end of the glass tube, and then allowing it to freeze. Thus it automatically assumes the shape so that the air pressure afterwards is the same as that during its formation, and it will stand surprisingly high pressures. The glass is so thin that the electrons, or cathode rays, can sneak through the spaces between the glass atoms, even though these spaces are not large enough for the air atoms to squeeze through in the other direction.

SOUTH SEA FIELDS OF PUMICE

VAST fields of pumice and volcanic ash, floating on the surface of the south Pacific Ocean between the Fiji and Tonga groups of islands, are the first indication of a new submarine volcano. Perhaps it may finally lead to the formation of a new island, for Falcon Island, 120 miles to the southeast, appeared about a year ago, formed from similar volcanic material.

The announcement of the floating pumice was made to *Science Service* by Dr. Andrew Thomson, director of the Apia Observatory. A British ship, *H. M. S. Carisso,* was the first to report it. It was first observed on the evening of October 3, about 240 miles east of Suva, Fiji. During that night patches each several miles in extent were passed, the last one sighted about 70 miles southwest of the first. On October 7 another ship, *H. M. S. Veronica,* sighted some more floating pumice about 30 miles west of this, about a mile in diameter. A sounding was made, but with the line let out for 1,200 feet no bottom was found. The next day, farther east, they encountered the largest field of all, about a half mile broad, and extending for many miles in a north and south direction.

"The position of the submarine volcano which has thrown out the immense quantity of material reported can not be located with the information now available. The surface drift of the ocean in this area is from the northeast and east so that the probability is that the volcano is eastward but not far from where the pumice was first seen at 17 degrees 25 minutes South Latitude, 176 degrees 09 minutes West Longitude.

"The ocean floor between the Tongan and Fiji islands is fairly level to the west of longitude 173 with an average depth of 1,500 to 2,000 fathoms. It is an area of great seismic activity for no less than ten violent earthquakes have occurred in 7½ years (1913–1920) at two principal centers.

"The pumice fields lie about 75 miles south of one of these epicenters.

"A large earthquake took place on September 6, at 8:50 A. M. Greenwich time and the locality, about 100 miles southwest of Samoa, is known to have yielded pumice on at least one previous occasion within the records of this observatory. It seems probable that if the present field had come from this epicenter at the beginning of September, it would have been observed before now."

ITEMS

THE bark of a California Big Tree is, on large specimens, as much as three feet thick and is almost as resistant to fire as asbestos. A sample of the bark twelve inches square was placed in a lumber mill furnace, surrounded with dry pine and fir wood and burned for eight hours. When taken from the furnace the Big Tree bark was merely charred on the outside. This resistance to fire is one reason for the longevity of the California Big Tree, which is known to attain an age of four thousand years and may reach six thousand or more. A mature specimen, twenty feet or more in diameter, sustained scores of forest fires in the days before the national parks and forests were protected. Other conifers of the western mountains, notably the sugar pine, yellow pine, red and white fir, also possess thick fire-resisting bark, but the *Sequoia gigantea* is the Shadrach, Meshach and Abednego of the forest world.

ULTRA-VIOLET light is now proving a boon to the stock-farmer. Besides maintaining cows, race-horses, etc., in good health during the sunless months of winter, it is improving their condition so that they bring a higher price in the market, according to the results reported by V. M. Weall, of Surrey, England, who experimented with pigs. Twelve pigs were given treatment with ultra-violet light for three minutes daily when they were 10 to 12 weeks old, the time of treatment being gradually increased to 20 minutes. This was maintained until the animals were sold at the age of 20 weeks. Twelve similar pigs were kept as controls without light treatment. All 24 were sold on the same day and in every case the irradiated pigs sold for a far higher price than the untreated animals. Economically the experiment was highly successful because the extra money obtained for each pig was 14 times the cost of the operation of the quartz lamps which were used for the irradiation.