SCIENCE NEWS

Science Service, Washington, D. C.

THE AMERICAN ASTRONOMICAL SOCIETY

THE American Astronomical Society, whose membership of over four hundred includes practically every professional astronomer in the United States and Canada, held a unique session when their annual summer meeting opened in Chicago on September 3. This meeting was held at the Adler Planetarium and Astronomical Museum, which recently opened on a small island just off shore in Lake Michigan and near the Field Museum, Soldiers' Field and the new Shedd Aquarium.

One session of the meeting was held in the planetarium dome, with projected images accurately and realistically reproducing the skies above their head. But the familiar motions of the sun, moon and planets among the stars were shown to the astronomers far more rapidly than they are ever observed in nature. In seven seconds they saw the planets go through their normal motions of a year. Even the "great year" of 26,000 ordinary ones, during which the Southern Cross and other southern constellations become visible from northern countries, was reproduced in a few minutes.

The planetarium instrument that makes this possible is a German invention that projects on a white dome 80 feet in diameter all the naked-eye celestial objects and reproduces their motions. The one in Adler Museum is the first to be erected in the United States, and the meeting was the first opportunity most of the American astronomers have had to see it in operation.

In addition to the demonstration of the planetarium, which was arranged by the director of the museum, Professor Philip Fox, there were five sessions for scientific papers, at which many of the astronomers told of their latest researches. Dr. C. G. Abbot, secretary of the Smithsonian Institution, discussed "Solar Variation and Weather." Other papers were presented on the recent eclipse of the sun in California, measurements of the ultraviolet light from the sun, the absorption of light in space as it travels from a star to us and observations to be made of the tiny planet Eros, which will make a very close approach to the earth during the coming winter.

The discovery by Dr. C. G. Abbot, secretary of the Smithsonian Institution, that there is a close correspondence between changes in the sun's radiation and in temperature at Washington, D. C., "seems to offer promise for weather forecasting nearly a week in advance." Dr. Abbot made the first announcement of these new results which are based on studies extending over a period of more than thirty years.

Regular observations of the sun's radiation are made from a station at Mount Montezuma, Chile, a mountain 9,000 feet high in the Atacama desert, and these show that the sun does not always radiate the same amount of heat. Instead, it varies from day to day, even after allowances are made for the effect of the earth's atmosphere. In a study of these variations since January, 1924, Dr. Abbot has found 98 cases of rapid increase of the radiation of heat and 91 of decrease, in each case the change taking about four or five days.

Dr. Abbot has studied the temperature variations at Washington at the times of each of these increases and decreases. Taking the temperature just before the beginning of the solar change as normal, he finds that as the solar radiation varies the temperature also changes, and that the change in temperature continues until at least four days after the maximum or minimum of radiation. A change in the radiation of eight tenths of a per cent. is accompanied by a temperature change of about five degrees. At times when increase of radiation is accompanied by an increase in temperature, a decrease of radiation is generally accompanied by a decrease in temperature. This is taken by Dr. Abbot as rather conclusive proof that the changes are not mere coincidences.

A curious feature of the results is that an increase of radiation is not always accompanied by an increase in temperature, or vice versa. From mid-November to March, and also in May, increase in temperature and radiation ordinarily go together, while in April and from June to mid-November, the temperature goes down when the radiation goes up. This leads Dr. Abbot to believe that the effect of the sun's heat is not a direct one on the earth, but that there is some intermediate atmospheric effect not yet understood. Even in March and other months when temperature and radiation follow each other most closely, there are isolated occasions when the reverse happens. These, Dr. Abbot thinks, are the chief difficulties in the way of weather prediction from solar radiation. But he explains them as being "doubtless caused frequently by one solar change treading too quickly on the heels of another. Again, they may sometimes be caused by delayed receipt from distant centers of action of waves of temperature effect arising from former solar changes."

The changes in temperature are not the same for different places. Though his most detailed studies are for Washington temperatures, Dr. Abbot has also studied the effects in Yuma, Arizona, and Williston, North Dakota. He finds that there the magnitudes and tendencies of the effects are much the same as at Washington, though the months during which there is a direct change and those during which it is reversed are different.

"My results thus far are tentative," he concluded his paper. "I propose to study barometric pressures as well as temperatures, and to extend the investigation to other parts of the United States and of the world. I have made preliminary studies, too, of ten-day mean values of solar radiation and temperature, and hope that in this way if reliable weather forecasting data are really secured they may be extended to months and seasons in advance."

Why do some stars seem "the other side of nowhere"? Or, as the astronomers express it, why do stars have negative parallaxes? Dr. Oliver J. Lee, of the Dearborn Observatory at Northwestern University, discussed some reasons for this paradoxical effect.

Astronomers measure the distance of nearer stars by determining their parallax. This is the amount that a star seems to shift in the sky as observed at times six months apart. During this time the earth makes half of a revolution in its orbit, and in June, for instance, is about 186 million miles away from its position in December. By making photographs through large telescopes at these times, and measuring the position of a star as compared with other stars on the same plate but at such great distances that they show no appreciable displacement, the parallax can be measured, and the star's distance determined.

The farther away a star is, the smaller the parallax, so that a star at infinite distance should have a parallax of zero. However, despite the most careful work of astronomers, some stars do actually come out with negative parallaxes, that is, less than zero. It has been facetiously suggested that they are "the other side of nowhere."

Dr. Lee called attention to three reasons why they should occur. In the first place, he said, it may be a matter of chance. Parallaxes are always very small quantities, and like any measurement are subject to a certain possible error, which may be in one direction or the other. If the possible error is larger than the quantity measured, it may throw the value determined under zero. Another reason is that double stars, consisting of two separate bodies, might act differently at different times in building up the image. Under certain atmospheric conditions the image might be principally of one, while other plates might show mainly the other star, thus introducing a shift not due to the earth's revolution.

The third cause suggested by Dr. Lee is that the comparison stars, presumed to be much farther than the star under measurement, are really nearer, and that under such circumstances, the measure would be a positive parallax of the comparison stars. He urged a study of negative parallaxes with a view to learning more about the distances of the stars with which they were compared.

Our galactic system of stars, which includes all that we can see, may be considerably smaller than was previously supposed. Some of the most distant objects in this system may be distant tens of thousands of light years, instead of hundreds of thousands. Even the former figure means distances of hundreds of quadrillions of miles, inconceivably great.

Dr. Piet van de Kamp, astronomer of Dutch birth now at the Leander McCormick Observatory of the University of Virginia, told of his researches on the absorption of light in space. It used to be assumed that all that was in the sky was what could be seen or photographed, with either small or large telescopes. Once a ray of light left a star, and started in our direction, it was supposed that it traveled right on without interference, as there was nothing between to stop it.

This assumption was called into question, however, because luminosity and hence visibility is not a necessary attribute of celestial matter. Meteors are continually bombarding the earth and they are dark and invisible until they are heated to incandescence by the friction with the earth's atmosphere. Huge dark areas have been observed in many parts of the sky, and are almost certainly due to dark masses blotting out the bright material beyond. In addition, space may be full of fine cosmic dust that would absorb light something like a cloud of smoke.

The light of a series of objects at different distances varies according to the famous inverse square law, that is, the brightness is inversely proportional to the square of the distances. Therefore a light which appears to be of a brightness of one candlepower at four meters would appear only one quarter as bright at a distance of eight meters, and not one half as bright. The light would vary in the proportion of sixteen to sixty-four and not of four to eight. But if you observed the two lights at different distances in a corridor filled with smoke, the farther one would be fainter than you would expect from the inverse square law, because the longer path over which the light traveled would cause more of it to be absorbed.

If two lights at different distances are known to be of the same actual brightness, an estimate could be made of their relative distance by estimating how much fainter the more distant one is. But if there is smoke between, then the distant light will seem fainter than it should, and so its distance will be over-estimated.

This principle is used by astronomers to measure the distance of far away stars. Nearer ones can be measured by the displacement they seem to undergo as they are observed from opposite sides of the earth's orbit, 186,000,000 miles apart. But there are various ways of determining the actual brightness, or candlepower, of a star, such as a measurement of the intensity of certain of the dark lines in its spectrum. Such measures have been used as the basis for distance determinations of very distant stars. Direct photographs have shown how bright they appear, the spectrum shows how bright they really are and the difference has been interpreted as being due to the distance. But if there is absorbing matter in space, then the star would appear fainter than it ought, while the absolute brightness would be the same, and the distance so determined would be too large.

In recent work at the Lick Observatory of the University of California, Dr. R. J. Trumpler has found good evidence that there actually is some absorption in interstellar space. He has studied some of the open star clusters and, by assuming that clusters of the same constitution have approximately the same linear dimensions, he concludes that within our Milky Way system light is absorbed at the rate of .67 of a magnitude in 1,000 parsecs. The parsec is the astronomer's measuring stick, and is equal to 206,265 times the distance from the earth to the sun, or 19,200,000,000,000 miles. Another way of expressing the absorption calculated by Dr. Trumpler would be to say that 39 per cent. of the light is absorbed every time it travels a thousand parsecs.

This rate of absorption refers to the light that affects a photographic plate, the shorter waves of the blue and ultraviolet. The longer waves of yellow light that we mostly see by are only absorbed about half as much. But measures of star magnitudes, used in determining distances, are mainly by photography, so the higher figure is the one to be considered. He also found that the absorption takes place mainly in the region of the Milky Way. Our system of stars is approximately the shape of a grindstone and we are somewhere near the center.

When we look towards the edge of the grindstone we look through a much greater depth of stars than when we look to the sides. This concentration of stars to the edge causes the appearance of the Milky Way. The fact that the absorption takes place mainly in this region suggests that the absorbing stuff is distributed in the form of a thin sheet through the middle of the grindstone.

Dr. van de Kamp, who has been working on the same problem independently, confirms Dr. Trumpler's results. He has studied a number of stars of spectral types B and A, which are bluish in color. But he finds that the farther away they are, the less bluish they appear. As there is no reason to suppose that the color of their light actually varies, depending on how far they are away from us, he concludes that their light is absorbed in its passage, and that the blue light is absorbed more rapidly than the red, or longer waves. He believes also that the absorbing stuff is concentrated in a thin sheet in the plane of the Milky Way, and agrees with Dr. Trumpler that it is probably about 175 parsecs in thickness.

Dr. Harlow Shapley, director of the Harvard College Observatory, in a study made a few years ago of nebulae which are completely outside our galactic system, came to the conclusion that their light was not absorbed appreciably. Evidently space outside our system is quite transparent. As none of these nebulae is observed in the direction of the Milky Way, the absorption of their light after it reaches our system would be negligible. Hence the vast distances determined for these objects, tens of millions of parsecs, are still apparently valid. But the distance of stars in our own system and in the direction of the Milky Way may have to be modified considerably. Dr. van de Kamp estimates that stars really only 5,000 or 10,000 parsecs away, for example, would seem to be at 23,000 and 220,000 parsecs, respectively, when no allowance is made for absorption.

In his report to the Astronomical Society, Dr. van de Kamp did not make any suggestions as to the nature of the absorbing stuff. Dr. Trumpler, however, recently suggested that in addition to fine cosmic dust and large meteors, it might consist of free electrons or pieces of atoms that have become ionized and had some of their electrons removed, and free atoms of calcium, sodium and other elements. There is other evidence for highly rarefied clouds of calcium floating around between the stars.

The question as to why ultraviolet light from the sun failed to vary with the number of sun spots during the year from June, 1928, to June, 1929, was discussed by Dr. Edison Pettit, of the Mt. Wilson Observatory, who told of his researches on the variation of the sun's ultraviolet radiation since May, 1924. When three-month averages of the number of sun spots are plotted against the intensity of the ultraviolet light during the past six years, they are found to agree very closely, except during the year mentioned, when the curves run counter. Dr. Pettit believes that there was nothing wrong with his instruments to produce this effect.

He has also found, he announced, that in June, 1924, the ultraviolet radiation was less than during any month since then. Taking the average for that month as the unit, he finds that the highest intensity was during the month of November, 1925, when it was 1.57. In February and April, 1927, it was 1.51 and last January 1.52. The lowest monthly averages have been January, 1928, with 1.18; September, 1928, with 1.12; June and November, 1929, with 1.19, and April, 1930, with 1.15. The ultraviolet rays from the sun are the ones that produce sunburn, are mainly concerned in taking photographs, and produce certain other bodily effects, such as the prevention of the disease rickets.

Dr. Pettit's method is to observe the sun through lenses of quartz, as glass is opaque to the ultraviolet rays. He uses two lenses, one covered with a thin film of silver, the other with a similar film of gold. The former is transparent to the ultraviolet, while the latter is opaque, but transmits visible light of a green color. By means of a vacuum thermocouple, which converts radiant energy into an electric current, he measures the intensity of the sun image as made by each lens. The green light remains relatively constant, so the difference is due to the change in ultraviolet.

Though he has used the same lenses and films of silver and gold ever since he began the measurements, he finds that their constant exposure to sunlight has not made them more or less transparent.

The total eclipse of the sun visible in California last April 28 was 1.7 seconds early, according to Dr. Edison Pettit, of Mt. Wilson Observatory, who described the determination of the time that he and his colleague, Dr. Seth B. Nicholson, made from a talking movie news reel.

The movies were made from Honey Lake, California, where the Mt. Wilson party was stationed. They were made at the rate of twenty-four pictures a second, and in the sound track along the side of the film were recorded Dr. Pettit's counts of the time. From the film Drs. Pettit and Nicholson have found that the middle of the eclipse occurred at 19 hours 5 minutes 51.4 seconds, Greenwich civil time, which is five hours ahead of eastern standard time. The predicted time for the Mt. Wilson station, allowing for their 4,000 foot altitude, was 19 hours, 5 minutes, 53.1 seconds.

ITEMS

INJECTIONS of extracts of the anterior pituitary, a small gland located beneath the brain, cause a marked increase in milk production in cows and goats. This extremely practical discovery was announced to members of the Second International Congress for Sex Research meeting in London by Dr. F. Greuter, a Swiss student of the endocrine glands. The hormones of the anterior pituitary gland control several phases of sexual activity. Dr. Grueter's discovery added another hormone to the list of the anterior pituitary's products. He concludes that this hormone stimulates milk secretion, but is only effective when the milk gland has, under the influence of one of the sex glands, already reached a certain stage of activity. It increases rather than initiates milk secretion. Since the effect of the hormone is most marked and prolonged in cows, it is expected that the dairy industry will certainly try to utilize it. Besides the anterior pituitary, another endocrine gland, the thyroid, appears to have an effect on milk production. The surgical removal of this gland causes a fall in the yield and composition of milk and a change in color.