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ECLIPSES AND COMETS OF 1930

Two eclipses of the sun and two of the moon, one of each visible in the United States; the return of two periodic comets and perhaps several new ones; a gradual decline of sun-spots and solar activity, which will bring with it better radio reception—these are some of the chief events on the astronomical program for 1930.

The eclipse of April 28 is both annular and total, paradoxical as that may seem. When the eclipse starts, in the middle of the Pacific Ocean, the shadow falls just short of the surface of the earth at this phase, then it is annular. A few hours later, the eclipse reaches California, north of San Francisco. The earth being round, California is on the bulge towards the moon, and about 2,000 miles closer to it. By this time the shadow reaches the surface of the earth, and so the eclipse is total for a brief period. Then, as it passes on, the eclipse again becomes annular, crossing Hudson Bay and Labrador, and ending in the middle of the Atlantic. Even where total, however, the eclipse is very brief, and the corona, outermost layer of the sun that is seen only at total eclipse time, will flash out for but a second or two. An important eclipse observation is of what is called the flash spectrum, which appears at the instants of beginning and end of a total eclipse. In this case the duration is unimportant.

The year's second eclipse of the sun comes on October 22, and is much better from an astronomical viewpoint, for it lasts a minute and a half. But the only land from which it is visible is a tiny island of the Tonga group, in the South Pacific, called Niuafou Island, to which there is ordinarily but one steamer a month. As there are no harbors or docks, any astronomical equipment would have to be landed through the surf. Despite these difficulties, a New Zealand astronomer has decided to visit Niuafou at the time, and a party from the U. S. Naval Observatory may also go.

During the last few years the sun has been unusually active, for the eleven-year sun-spot cycle has been at its maximum. Now it has definitely passed, and the coming year should see a marked diminution in the number of sun-spots and their size.

Two eclipses of the moon are also coming this year, only one of which, however, and that a partial one, will be seen in the United States. It will occur on April 13.

Two comets, that have both made a number of returns in the past, will probably turn up in 1930. One is D'Arrest's, which comes every 6.6 years, and has been seen seven times since its discovery in 1851. The other is Tempel II, which, since its discovery in 1873, has been seen on six of its returns at 5.2-year intervals. Three other comets, Metcalf's, which was discovered by the Reverend Joel H. Metcalf, a New England Unitarian minister, in 1906, Daniel's and Perrine's, are also due, but they have not been observed on several recent returns, and may be missed again. A brilliant naked-eye comet has not been seen in the northern hemisphere for a number of years, and one may appear in 1930, but this is speculation, not prediction.

The meteor showers of August and November will come as usual. Probably the Leonids, in the latter month, will be more than usually numerous. The years 1833 and 1866 brought two very brilliant and spectacular showers of these shooting stars that seem to radiate from the constellation of Leo, the Lion. In 1899 an expected shower failed to materialize, but the following year or two brought unusually large numbers. As another 33-year interval has almost elapsed, and the Leonids of the last two years were more numerous than in the past, still more may come in November, 1930, and may herald another great shower in 1933.

WILK'S COMET

WILK'S comet, which was discovered on December 20, by an astronomer in Poland, will not become conspicuous to the naked eye, even though it is brighter than any comet discovered for several years. This announcement was made here to *Science Service* by Dr. A. O. Leuschner, director of the Students' Observatory of the University of California, following a calculation of the comet's path by E. C. Bower and F. L. Whipple.

These figures show that when the comet was discovered, it was 85,000,000 miles from the earth, and that it is now moving away from us. However, it is moving towards the sun, and on that account will brighten. This will counteract the greater distance from the earth, and so it will continue about the same brilliance for a few weeks. It is now about the seventh magnitude, too faint to be seen with the unaided eye even under best conditions, but a small telescope will reveal it. After January 8, it will be so close to the sun as to be lost in its glare. On January 22, it will reach perihelion, when it will be closest to the sun, at a distance of about 60,000,000 miles. After that it will probably appear to astronomers in the southern hemisphere for a few weeks.

When discovered, the comet was near the bright star Vega, seen low in the northwestern sky for a few hours after sunset, or low in the northeast for a few hours before sunrise. Since then it has been moving south and eastward, passing near Albireo, the bottom star in the Northern Cross, on December 28. On January 5 it will pass the constellation of Delphinus, or "Job's coffin," a diamond-shaped group of faint stars seen in the west above the bright star Altair, in the Eagle, just after sunset.

The calculation of the path was made with the aid of observations at Heidelberg, Germany; Yerkes Observatory, Wisconsin, and Lick Observatory at Mount Hamilton. In order to compute a comet's orbit, three positions are required, somewhat similarly to the way in which three points determine a circle. Any number of circles can be drawn to include a single point. Any number of

circles, with a diameter at least as large as the distance between them, may be drawn so as to include two points. But only a single circle can be drawn so as to include three given points. The farther apart the three comet positions are, the greater is the accuracy of the path. The calculations made at Berkeley, California, suggest that the comet may be the same as one of several visitors in the past, but a more accurate orbit will be needed to make the identification certain.

THE GLACIATION OF ALASKA

In spite of its far northern latitude, Alaska was at no time completely covered with ice during the Glacial Period, according to Dr. Stephen R. Capps, of the U. S. Geological Survey. Even during the so-called Wisconsin stage of the Pleistocene glaciation, when practically all Canada and most of the northeastern quarter of the United States was submerged beneath a great ice sheet, scarcely half of Alaska was glaciated. In the south, glaciers filled the valleys and crept down the slopes of the Alaska Range and of the coastal mountains; and a continuous ice front fringed the southern shores of Alaska. Similarly, in the north, glaciers descended from the slopes of the Brooks Range. But the broad central valley of Alaska, drained by the Yukon and Tanana rivers, was practically untouched by glacial action. Only small local ice streams descended from the few scattered elevations which here and there interrupt the level surface of the central valley.

The age of the principal glaciation in Alaska has been determined by a study of post-glacial peat beds and of the spruce stumps embedded in them. These stumps are remarkable for having, not one set of roots radiating out horizontally from the trunk as a center, but two or more parallel sets of radiating roots, one above the other. As the peat accumulated about the spruce trees and the line of permanently frozen ground rose higher, the roots of the trees were frozen and the tree was compelled to put forth a second set of roots. By measuring the distance between these sets of roots and counting the rings of annual growth of the trees, it has been possible to determine the length of time that has elapsed since the retreat of the glaciers. These calculations put the date of the principal glaciation in Alaska back from 20,000 to 30,000 years, and make it about contemporaneous with the so-called Wisconsin advance of the ice sheet in northeastern United States.

Transported boulders, scratched and grooved rocks, faceted pebbles and beds of boulder clay show that Alaska was glaciated at least four times during the Pleistocene period. Traces of these earlier ice invasions, however, have largely been obliterated by the last and principal glaciation, during the Wisconsin stage. The existence of similar beds containing glacial boulders shows that Alaska had an ice age as far back as the Silurian period of the early Paleozoic era; and some geologists believe that several glaciations occurred during the Paleozoic era.

At present, Alaska is believed to be in an interglacial period between two ice invasions. The total time that has passed since the retreat of the "Wisconsin" ice sheet is much less than the time calculated to have elapsed between glaciations during the Pleistocene period.

The effect of glaciation on southern Alaska was not altogether fortunate. Many rich accumulations of gold-bearing gravel were swept away by the advancing glaciers; the present placer deposits are merely the few remnants that somehow escaped destruction. In many places the top soil has been carried away by the ice and the land spoiled for farming. In other places, however, the land has been enriched by soil deposited by streams flowing from the melting ice front.

CURRENTS OF ELECTRICITY IN PLANTS

That all living things generate currents of electricity, minute but measurable, and this electricity is the force that influences their rate of growth and determines their form, was the subject of a paper by Professor E. J. Lund, of the University of Texas, given before the physiological section of the Botanical Society of America at its meeting at Ames.

The unit of electrical generation in the living plant or animal, just as in an electrical battery, is the cell. The voltage of each cell is added to that of the one in front of it in the direction in which the tiny current is flowing, and its amount and intensity have great influence in the activities of the organism as a whole.

It has even been possible to find electrical currents in living trees. In the Douglas fir and the white fir the current has been shown to flow continuously upward in the outer layers of wood and downward through the inner layer of the bark.

The existence of the currents is dependent on the activities of the living cells. They have been made to disappear by applying certain anesthetics and poisons to some cells, by depriving others of oxygen and by other means. Conversely, subjecting growing plants of various kinds to the flow of an outside current has caused marked modifications in their final form.

"The experiments distinctly indicate," Professor Lund concluded, "that the existence of continuous bioelectric currents will contribute to an explanation of how ordered growth and regeneration can occur in primitive and embryonic plant and animal tissues where no nervous or hormone mechanism is known. The facts appear to open up a new avenue of approach to many obscure and difficult problems in embryology, growth and regeneration."

Professor Lund was followed on the program by his associate at the University of Texas, Gordon Marsh, who told of experiments in passing electric currents through roots.

SOIL ACIDITY

The composition of the water plants take from the soil was the subject of a symposium before the Ecological Society of America, in which Professor J. F. McClendon, of the University of Minnesota; Professor E. Truog, of the University of Wisconsin; Professor Herman Kurz, of the Florida State College for Women, and Professor E. B. Powers, of the University of Tennessee, took part.

Professor McClendon opened with an outline of the theory of soil acidity and a description of the methods

available for testing it. The latter have progressed far beyond the simple slip of litmus paper that used to suffice and is still employed in many places. Several field kits, with graded series of delicate color tests in various solutions, can now be obtained by the student of soil acidity problems, as well as electrical apparatus for more direct measurements.

What crop plants like and do not like in soils was the subject of Professor Truog's address. It used to be flatly assumed that acid soils were bad for all crops, but the modern doctrine is not so simple as that. There are some crops, to be sure, so sensitive that they will not yield well if the acidity to which their roots are exposed rises above a very low minimum; but there are others, normally neutral-soil plants, that will tolerate a considerable concentration. Such plants are useful "breaking-in" crops for newly drained peat and muck lands, and other places where the acidity is still high. Finally, there are some cultivated plants which in their native state demand a really highly acid soil. Blueberries and cranberries belong to this class. These must be cultivated on land as much like their native habitats as possible. Realization of the acid requirements of plants has done much to help farmers and horticulturists to adapt their crops to the land available.

Professor Kurz told of studies of the relation of plant distribution to soil acidity. A sufficiently skilled botanist can walk on to a piece of land new to him and by counting certain plants tell the acid concentration of the soil with considerable accuracy before a chemical test is made at all. The pioneer work in this field was done thirteen years ago by Dr. Edgar T. Wherry, of the U. S. Department of Agriculture, who is both chemist and botanist. Since his time the work has been carried on actively by scores of researchers all over the world. It is possible not only to estimate the soil acidity by studying the plants that grow on it, but to predict with a considerable degree of accuracy the probability of finding a given species of plant if the chemical state of the soil is known.

Animals as well as plants are influenced by the chemical nature of the water to which they are exposed. This is especially true of aquatic animals, which are not only very intimately exposed to the water, but are free to move away from a locality they do not like or into one which they do. This aspect of the problem was the subject treated by Professor Powers.

BACTERIOPHAGE

"A SYSTEMATIC study of the properties of bacteriophage failed to substantiate its living nature," according to Dr. J. Bronfenbrenner, professor of bacteriology at the Washington University School of Medicine, in an address before the Society of American Bacteriologists meeting at Ames, Iowa. The evidence seems to indicate that the bacteriophage is an inanimate chemical product of bacterial metabolism, having no cell-dissolving properties of its own.

Bacteriophage has been hailed as a most potent germ-killer, being made itself from germs, but ever since its discovery by Dr. F. d'Herelle it has been a subject of scientific controversy.

"It seems to exhibit a stimulating effect on homologous or closely related bacterial species. As a result, the rate of intracellular metabolism is abnormally increased with a consequent increase in osmotic pressure within the cell and if water is available in the surrounding medium, bacteria take it up, swell and finally burst."

The activity of the phage in suppressing the effects on animal tissue of a definite germ without harming the tissue was compared with the activity of certain chemicals. The phage was active at a much wider range of dilutions than any of the five chemicals, mercuric chloride, phenol, formalin, tincture of iodine and chloramine, according to John E. Walker, of the research laboratories of E. R. Squibb and Sons. The phage was active at dilutions ranging from full strength to a dilution of 1 to 512, while the nearest chemical, mercuric chloride, could only be diluted to one sixteenth of the strength causing tissue destruction and still be active.

ITEMS

AMERICA'S most beautiful shade tree, the stately elm, may follow the chestnut to destruction if infected by the Dutch elm disease, which has already devastated the elms of Holland, Belgium, France and Germany, according to Dr. Christine Buisman, professor of plant pathology of the University of Utrecht, who spoke before the American Phytopathological Society. Methods of controlling the disease have not yet been found. The only thing that can be done now is to test varieties of elms to determine their resistance and propagate the most promising ones. There is nothing to show that the disease will decrease in the course of time. A tree first shows the effects of the disease when the twigs curl and the leaves of the whole tree or some of its branches suddenly wither and turn down. The leaves do not fall immediately, those in the top remaining for several weeks. In the wood of a diseased tree conspicuous reddish-brown streaks become visible. A tree thus affected may die within the year or it may live for several years. Most of the affected trees are from 15 to 40 years old, accounting, perhaps, for the rarity of the malady in nurseries. The disease first appeared in Holland in 1920. It has gradually spread through Belgium, France and Germany, and since 1927 it has been reported from England. The spores of the causal agent are principally disseminated by the wind and enter the wood through small wounds.

IT may soon be possible to determine the hardiness of plants by laboratory tests, as the result of experiments conducted by Professor S. T. Dexter, of the University of Wisconsin, described by him before the American Society of Plant Physiologists. When a wilted carrot or potato soaks up water and becomes crisp again, it does so largely by a process called osmosis. Just the opposite happened in Professor Dexter's experiments. He put several varieties of alfalfa roots in freezing water at different seasons. The loss of sap was measured and it was found that the hardiest varieties lose least sap in the winter. "If the measurements in the experiments can be standardized," Professor Dexter believes that "they may serve as indices of plant hardiness."