PART TWO
EDITORIAL
PAGES ONE TO TWELVE

THE OMAHA SUNDAY BEE

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SOCIETY
PAGES ONE TO TWELVE

VOL. XLI—NO. 49. OMAHA, SUNDAY MORNING, MAY 26, 1912. SINGLE COPY FIVE CENTS.

HOW THE SUN SPOTS CONTROL OUR WEATHER

A Sun Spot Is Like an Enormous Electric Dynamo. Its Tremendous Whirl Generates an Enormous Magnetic Field, Just as the Whirling Armature of a Dynamo the Same Size Would Generate.

This Magnetic Force Given Off by the Sun Spot Is Conveyed by the Ether to the Atmosphere of the Earth, Thereby Disturbing Its Equilibrium and Causing Violent Storms and Periods of Unusual Cold and Heat.

Science's Newest Discovery That Solar Cyclones Cause Our Floods, Tempests, Late Springs and Other Unseasonable Weather and That Their Effects Can Be Predicted Weeks in Advance Is Explained by Professor Garrett P. Serviss, the Distinguished Astronomer

By Professor Garrett P. Serviss.

THE amazing vagaries of the weather during the past few months—devastating floods first in the old world and then in the new; a warm Winter in Alaska, such as has never been known there before, coinciding with a severe Winter here; an unprecedently early and abundant release of the icebergs from Greenland, and their disastrous invasion of the steamer lanes; a late Spring in the United States, with sudden and violent changes of temperature; snowstorms in March; cold and warm waves abruptly following each other in April and May; thunderstorms in early May; a series of terrific tornadoes sweeping whole towns to destruction in the West and Southwest—all these things reawaken interest in the question of the influence of sunspots upon the weather. Interest that is emphasized by the fact that outbursts of such spots have lately occurred, to which some observers attribute all this unwonted atmospheric disturbance.

Some go as far as to aver that they can predict great storms and weather changes by means of the spots on the sun. Among these is Father Picard, of the Santa Clara College Observatory, California, who ascribes sunspots to the influence of the larger planets. Inasmuch as the positions of these planets can be foretold, and inasmuch as their arrival at certain positions in their orbits is alleged to exert an influence upon the sun, tending to make spots burst out, the possibility of predictions like those that Father Picard and others have made cannot be denied, provided that we grant their assumptions. Father Picard claims that his past predictions have been verified "to the very date," and he makes another series for May, and suggests that one can be made for June, based on "a great solar manifestation" which a French astronomer has foretold for that month.

In view of these things it becomes highly important to review what the leaders in astronomy have learned, and believe, concerning the influence of sunspots on the earth.

First, what are sunspots?

Recently it has been discovered that sunspots are vortexes, in which the whirling motion carries matter from the surface outward. They have been likened to waterspouts at sea, the trumpet-shaped part being at the top, and the material within being whirled upward.

Since there is a great variety of substances in the sun, such as iron, calcium, silicon, sodium, copper, magnesium, and in short almost every element known to us on the earth, and since these substances are brought into violent frictional contact by the whirling motion, it is believed that powerful charges of electricity are produced in the spots, and as the charged matter is spun around in the vortex great electric currents are set up, which, in turn, produce in every sunspot a gigantic magnetic field. A magnetic field means a space within which lines of magnetic force are in action. Thus a sunspot might be regarded as resembling a tremendous dynamo, creating electric currents of unimaginable power.

Everybody knows that a dynamo consists of two essential parts—first a powerful electro-magnet, which creates around its poles a magnetic field, and second an armature, consisting of wires wound round an iron wheel, or a cylindrical core, which is caused to rotate rapidly in the magnetic field. The change in the number of lines of magnetic force flowing through the coils of the rotating wires sets up a current of electricity in the coils, and this current can be led away by other wires into an external circuit, by which lamps may be illuminated or mechanical work done. In short, the dynamo is a machine for converting mechanical energy into electrical energy by means of electro-magnetic induction, and the electrical energy thus produced can be turned back into mechanical energy to be utilized in a different way and a different place from that in which it was first used. While it is in the form of electrical energy it can be carried long distances by wires and rechanged into mechanical energy at the place where it is needed to do work.

Now, it would appear that in a sunspot, where first a tremendous magnetic field is produced by the friction of different materials brushing against one another, and then vast currents of electricity are set up by the whirling of great quantities of matter in this magnetic field, we have a kind of natural dynamo of the most gigantic power. Something of the same kind appears to occur (though on a relatively very small scale) in a volcanic eruption, as of Vesuvius, when electrical currents are set in motion and tremendous discharges of lightning occur.

Thus, it is not difficult to account for the fact that the sun, when disturbed by the outbreak of great spots, becomes a centre of immense electrical disturbance. But the next question is, How is this disturbance transmitted to the earth? The current produced by a dynamo is led away by wires, but there are no wires between the earth and the sun. That the solar disturbances should create around the sun an electric field sufficiently extensive to involve the earth at a distance of 93,000,000 miles, or that this field should act upon the earth by induction at such a distance may seem incredible. But the difficulty may be explained in this way:

The experiments which led to the invention of wireless telegraphy have taught us that when an electric discharge takes place, as when a spark is caused to leap from a conductor, electric waves are set up in the ether which speed away on all sides with the velocity of light, 186,000 miles per second. The electric waves that we are able to produce travel thousands of miles in the fraction of a second.

Now, it is known that in and around sunspots tremendous electrical discharges must frequently occur, incomparably more powerful than any we can produce with our petty instruments. And some of these solar outbursts have been caught in the act of darting their waves to the earth.

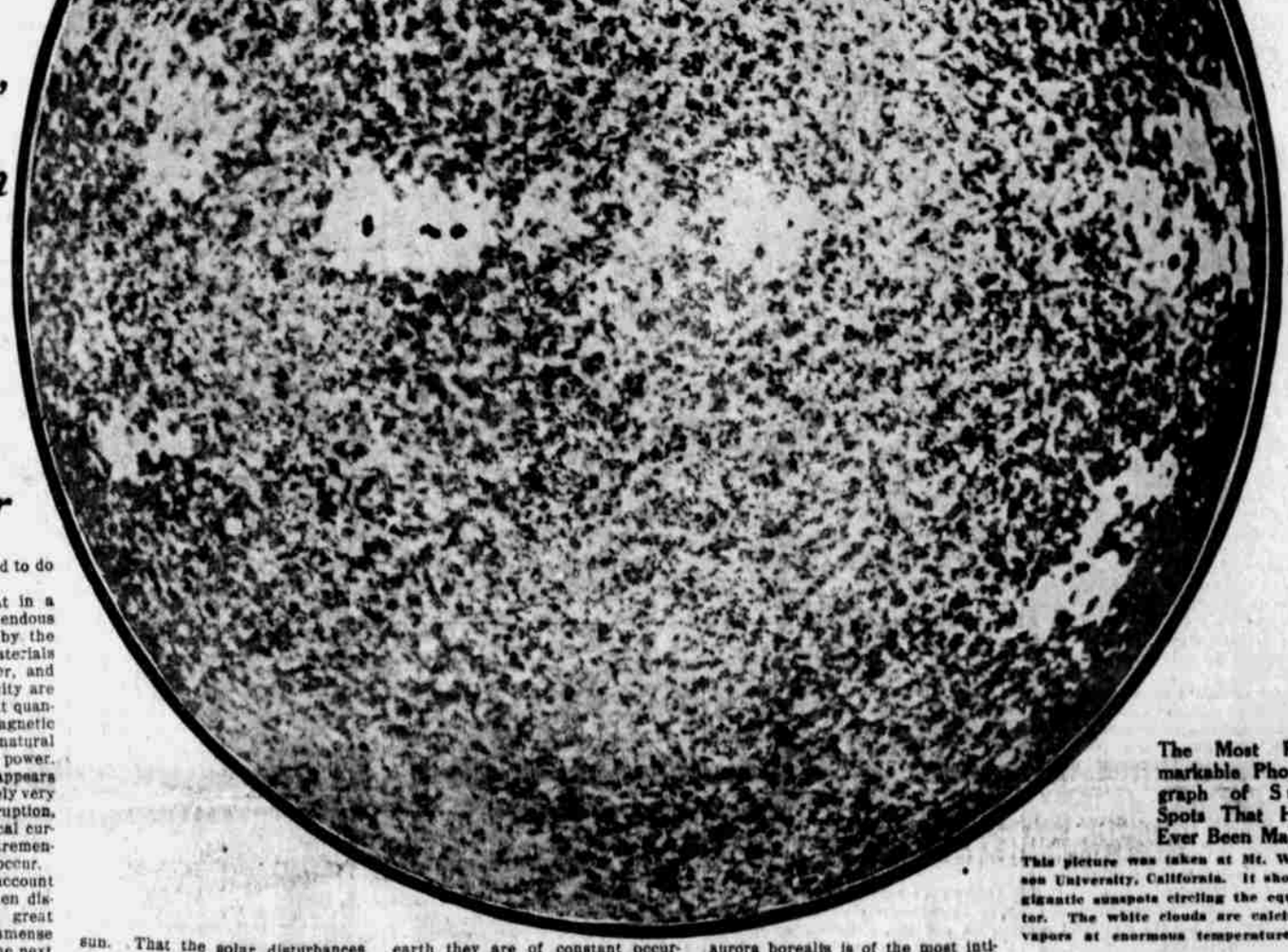
Everybody has heard of the northern lights, or the aurora borealis, and many have seen these strange phenomena, even here in New York. Around the magnetic poles of the earth they are of constant occurrence, but they become visible in the temperate zones only when the earth's magnetism is greatly and violently disturbed. Such disturbances generally occur coincidently with some sudden outburst around a big sunspot. In fact, it has now come to be recognized that the association of sunspots with the aurora borealis is of the most intimate character, and that whenever the average number and size of sunspots increases, as it does periodically about every eleven years, the number and brilliance of the auroral displays increase also. When there are few sunspots there are few aurorae.

We may picture this action to the imagination in this way: On one side we have the sun in a state of intense electro-magnetic activity, owing to the outburst of sunspots. On the other side we have the earth, itself a magnetized body, and surrounded by an atmosphere whose electric condition is subject to the slightest disturbance. A specially intense outburst occurs on the sun, and electric waves start off into space, crossing the 93,000,000 miles to the earth in about eight minutes. A telegraph operator on the earth happens to be seated at his instrument sending a dispatch. Suddenly it ceases to work; then sparks of fire leap from it, and he starts away in alarm. The impulse from the sun has arrived and set up wild currents upon the earth, which flow lawlessly through the telegraph wires. At the same time the sky in the north begins to flame. Great sheets of lambent fire, sometimes colored red, wave and flicker in the sky, obscuring the stars with their brilliance. Vast glowing columns appear to rise from the northern horizon in the direction of the earth's magnetic pole. In the zenith a shining circle makes its appearance, appearing and disappearing as by magic. Such a disturbance may last for many hours, and the telegraphs and ocean cables may be interrupted all over the earth. This is called a magnetic storm, and there can no longer be any doubt that its source is to be sought in the sun.

The question remains: How can sun spots affect such things as winds, rains, storms and warm and cold waves? A magnetic storm is not a storm in the ordinary meaning of that word. But it has been observed that clouds are more prevalent in times of great auroral activity, and this gives a clue to the manner in which electrical impulses from the sun may directly affect the general state of the weather. The effect of electric discharges is to "ionize" the air through which they pass. This means that inconceivably minute centers are formed in it which bear a charge of negative electricity, and these negatively charged "corpuscles," as they are called, become centers of condensation of moisture. Thus the state of the air as to clearness or cloudiness may be affected by the electric waves emanating from the sun.

The condensation of the moisture sets up other activities. Air currents are produced; differences of barometric pressure result; winds spring up; cold air is brought into temperate regions from the polar areas, resulting in a cold wave; or, as a final result of the electrical changes, warm air flows over colder regions, and thus an extraordinary melting of ice and snow is produced in high northern latitudes.

The latest sun spot maximum, that is, the period when sun spots were most numerous, occurred in 1906. We are now at a point in this cycle when the spots of a new period are beginning to appear, and it usually happens that at the beginning of such a period the electro-magnetic effects of the sun are most noticed. As a whole, the temperature of the earth is lower at the time of maximum sunspottedness, but at such times continual and sudden changes are going on which produce similar changes on the earth. The result is the production of extraordinary storms.

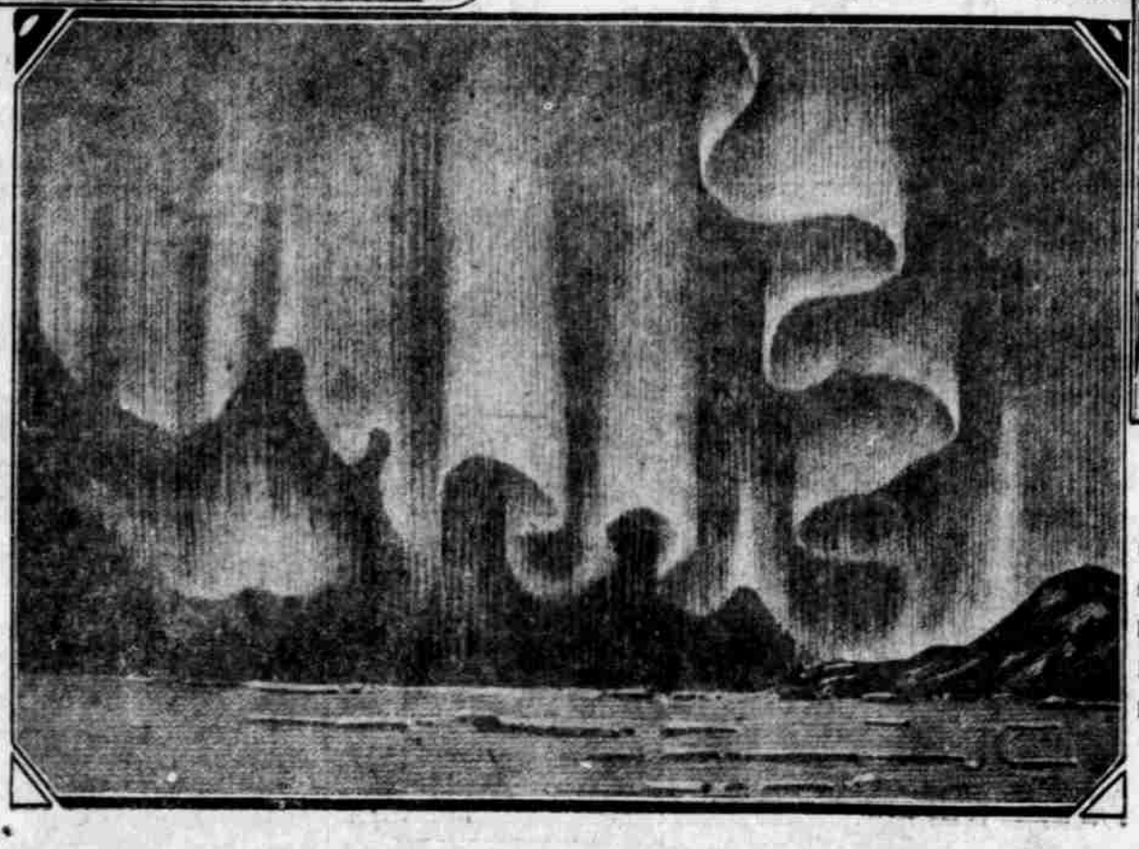


The Most Remarkable Photograph of Sun Spots That Has Ever Been Made

This picture was taken at Mt. Wilson University, California. It shows gigantic sunspots circling the equator. The white clouds are calcium vapors at enormous temperature.

One of the First Photographs Taken of the Solar Cyclone Surrounding a Sun Spot. The Leaping Flames Are 100,000 Miles High, and Are a Source of the Magnetism That Affects Our Weather.

In H. G. Wells' Strange Story, "The Men on the Moon," the Moon Folk, Highly Developed Insects, Who Live Underground, Expressed Wonder That Earth Folk Should Be So Unscientific as to Live on the Surface of a Planet and Be Subject to Storms and So On. Here the Scientist Who Invaded the Moon Is Seen Sending Magnetic Messages to the Earth



An Auroral Curtain—a Wonderful Phenomenon Produced by a Bombardment of Magnetism From the Sun