Total Eclipse of the Sun Next Saturday: Jet Disk Will Move Swiftly ...
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Total Eclipse of the Sun Next Saturday

Jet Disk Will Move Swiftly from Pacific Coast Southeastward Across Continent—Partly Visible in New York Early in the Evening

By CHARLES JOHNSTON.

AT 3:55 in the afternoon of June 8 (Pacific time) a huge circle of darkness, black as night, a jet *disk seventy miles in diameter*, will rush in from the ocean to the mouth of the Columbia River, and begin a drive southeastward across the United States at a speed that would make the swiftest airplane seem to be standing still. The huge circle cut from the garment of night will sweep across the American Desert and the Rockies, gradually shrinking in diameter as it goes; it will stride the Mississippi at 6:37, (Central time,) and pass a few minutes later across Southern Alabama and Florida. Then once more, now measuring only forty-four miles across, it will rush out from the Florida beaches into the Atlantic Ocean and vanish.

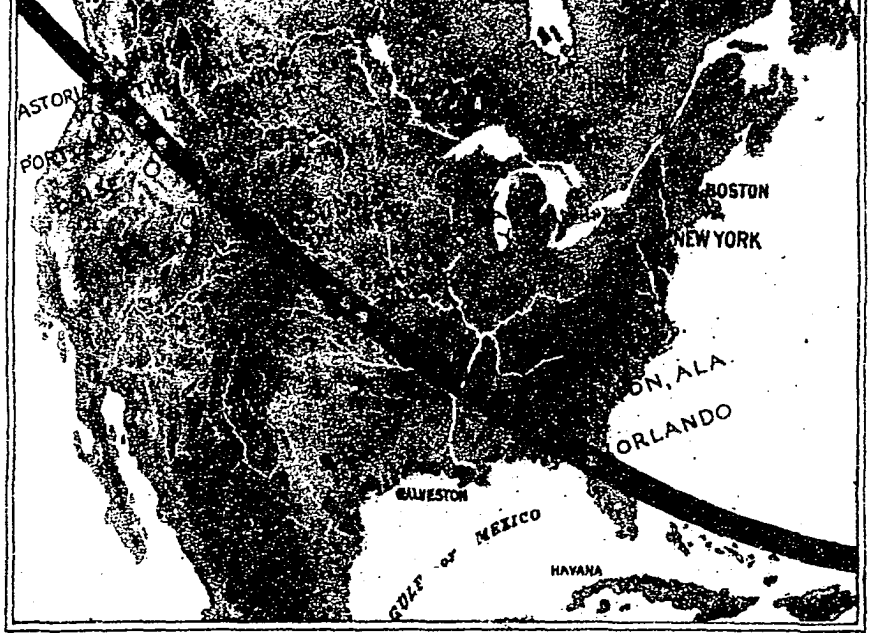
That is exactly what would be seen by any one watching the eclipse from the *moon*. And it is probable that, from the peaks of the Rockies near Denver, it will be possible to see much the same thing: the huge black circle of shadow coming from the west, rushing down upon the plains, and disappearing toward the east. And the coming of the shadow will be a magnificent and perturbing sight. The birds, we are told, are so deceived by this brief counterfeit night that they go to roost, tucking their heads under their wings, and coming back to life bewildered a minute or two later, to find the world once more sunlit.

If any one standing near the mouth of the Columbia River, instead of gazing out over the ocean, looks up into the western sky (with a piece of smoked glass to temper the sunlight) he will see this: Almost an even hour before the coming of the huge moving inkblot there will be a faint indentation of blackness on the rim of the sun, which will steadily grow, always with a rounded outline, cutting off more and more of the solar disk and the solar radiance until, just as the circle of darkness sweeps inland from the ocean, the sun's whole disk will be blackened; and, for something over two minutes, the sun will be blotted out. The sky will take the hue of night; the brighter stars will shine out, the constellations that illumine our Winter skies; Orion, or at least its greater luminaries, Betelgeux and Rigel and, perhaps, the Giant's Belt, will be clearly seen, with Aldebaran, the red eye of Taurus the Bull; and, at the top of a triangle which has Betelgeux and Aldebaran as its base, the great planet Jupiter will glow with unwinking eye; the sun, now a jet circle, hanging between Jupiter and Aldebaran.

On the very rim of the sun's blackened disk will be seen for a few moments flickering spots of rosy light, faint points of red flame, in reality tens of thousands of miles high. And something else will be seen, around which the whole interest of the eclipse will centre: the sun's corona, a halo or aureole of pearly light, stretching forth millions of miles into space; an aureole not symmetrical in outline nor of fixed form, but with huge, dim streamers stretching out from it, strongly recalling the streamers of the northern lights, the aurora borealis, and equally mysterious. Then, after two minutes' darkness, a thin, radiant rim of sunlight will reappear, instantly blotting out the corona; Jupiter and the stars will fade; the rim of radiance will steadily grow, rounding out the circle, and, an hour later, the setting sun will be once again a complete luminous disk.

As the circle of black sweeps across the continent from west to east, gradually shrinking, the period of total darkness will grow less, lasting, at Denver, a minute and a half; in the State of Mississippi a minute, in Florida only fifty seconds.

North and south of the track of the blot of shadow, the darkness will not be complete; or, looking at the sun, one will see its disk only partly blackened; for every thirty miles from the shadow's path, 1 per cent. of the sun will be added to the part which remains luminous; thus, 300 miles north or south of the path of blackness, one-tenth of the sun will shine at the moment of greatest darkness. Only some 3,000 miles from the path of darkness will the whole sun remain clear. Since, northward of the line, this takes us well up into the arctic, therefore the whole of North America will see the eclipse, whether as total (at all points within the shadow path) or as partial. At Boston, it will begin at 6:31 P. M., (Eastern time,) reaching the maxi-



Path of the Total Eclipse of the Sun, Saturday, June 8, 1918.

imum at 7:23, and ending at 8:12, 63 per cent. of the sun being darkened.

At New York, the eclipse will begin at 6:32 P. M., culminate at 7:26, and end at 8:16, with 68 per cent. of the sun hidden. At Philadelphia, it will begin at 6:32, reach the maximum at 7:27, and end at 8:18, 71 per cent. of the sun being eclipsed.

At Raleigh, N. C., the eclipse will begin at 6:36, culminate at 7:33, and end at 8:26, with 82 per cent. of the sun hidden. At Tallahassee, Fla., it will begin at 5:40, (Central time,) culminate at 6:40, and end at 7:35, with 99 per cent. of the sun covered. Immediately south of this the eclipse will be total.

This, broadly, is what takes place. What is the cause? The sun is a globe 800,000 miles in diameter, so that 100 earths, strung on a wire, would just stretch from the north to the south pole of the sun, within its globe. And the sun revolves about once a month. Some 93,000,000 miles away, the earth and the moon circle around the sun, the earth about 8,000 miles from pole to pole, the moon about 2,000; four moons strung on a wire would just reach from our north to our south pole, within the earth. Or, seen from the moon, the earth looks four times as large across its face as the moon does when seen from the earth; so, seen from the moon, the earth is a huge globe, its continents and oceans quite plainly visible, when not hidden by clouds. Lunar children, if there were any, would find it charming to study geography.

Both earth and moon, illumined by the huge sun, throw long cones of shadow into space, away from the sun. The shadow-cone of the moon comes to a point some 240,000 miles behind the moon, and is sharply defined because the moon has no thick layers of air about it, to soften the rim of the shadow, as has the earth. Now, it happens that the moon circles about the earth at almost that distance (240,000 miles) from the earth. Therefore, when the moon, on its circular path, passes immediately between the sun and the earth, the point of its shadow-cone draws a black blot across the earth, the very circle of darkness whose passage across the continent we have traced. Looked at from within the blot of shadow, the dark moon just covers the sun, cutting off all its light, and thus allowing the corona, the sun's aureole, to be seen; at all other times the corona is blotted out by the sun's brightness.

But the moon does not keep at a quite [illegible] distance from the earth [illegible] when she is a little further off, her dark disk will not quite cover the sun which, at the culmination of an eclipse, will then show as a rim of brightness around the moon's disk, causing an annular or ringlike eclipse. Nor does the moon always pass directly between sun and earth; her path sways slightly, so that she sometimes passes above the sun in the sky, sometime below; in fact, the moon passes directly across the sun from once to four or five times only in each year, so that the sun is eclipsed at least once, at most four or five times, in any year. Nor are all these eclipses total; nor, at total eclipses, does the circle of shadow always pass across convenient regions, as it will next Saturday; it may run over the arctic regions, or waste its sweetness on the South Pacific, gladdening remote Easter Island. Of Saturday's eclipse two-thirds will be lost in the Pacific, between Japan and the Columbia River.

And here comes an odd point about this eclipse; it really begins at sunrise on June 9, at the Island of Borodino, off the coast of Japan, and rushes out across the Pacific; then the circle of shadow (the point of the moon's shadow-cone) crosses the "road to yesterday," (the 180th meridian of longitude,) and finds itself on June 8, reaching our Pacific Coast in what is there the afternoon. Next year there will be a total eclipse of the sun on May 28, when the blot of darkness will flit down the Amazon Basin, cross the Atlantic to the Congo Basin, and finally reach Lake Tanganyika.

In fact, since the American civil war there has been no eclipse so convenient for us as the present one. Groups of eclipses recur in a period of 18 years 11 1-3 days, so that the present eclipse is the reincarnation (if you wish to call it so) of the eclipse of May 28, 1900.

This period of eclipse returns was known to the ancient Chaldeans, who called it the Saros. And since, at the time of an eclipse, the moon is traveling almost in the plane of the earth's orbit, it often happens that, passing directly between the sun and the earth at new moon, she passes directly through the earth's shadow-cone a fortnight later, at full moon. This will happen at the present eclipse; a fortnight after the eclipse of the sun on Saturday there will be a partial eclipse of the moon on June 23. And there will be an annular eclipse of the sun on Dec. 3 this year.

The point of a total eclipse of the sun, in the astronomer's view, is that, for a *minute or two*, the whole of the sun's light is cut off; therefore it becomes possible, for a few precious seconds, to see things near the sun (whether really or apparently) which are hidden at other times by his splendor.

When eclipses of the sun began to be observed with the newly invented telescope, Galileo's "optic glass," the rose-colored points of flame which flicker around the rim of the obscured sun for a few seconds were the absorbing interest. The spectroscope, invented later, showed that they were great tongues of incandescent hydrogen, in some form unknown to us, and that the luminous globe of the sun (the photosphere) lies within a veil of this rose-colored hydrogen, (the chromosphere.) But a little less than fifty years ago Norman Lockyer found that, by opening the slit of the spectroscope, it was possible to see these rose-colored "flames" or pillars and waves of incandescent hydrogen in full sunlight, practically on any clear day in the year; so they are observed now at other times, when the sun is not eclipsed.

The spectrum of the sun is a rainbow ribbon crossed by dark lines, caused by many elements in forms unknown to us. For a minute space of time during a total eclipse this spectrum is reversed; the ribbon is made of bright lines, from red to violet, on a dark ground. To observe and record this reversed spectrum *ribbon is one of the problems of an* eclipse. There is also the question of the *infra-red and ultra-violet* rays.

But the absorbing interest is the corona, which can be seen at no time except during a total eclipse of the sun, because its faint radiance is blotted out by the sun's splendor. During the minute or two of totality, it is a splendid vision, whether marked by long, curved streamers of pearly light or a more evenly rounded *globe of misty radiance*, a huge sphere, in fact, of some kind of shimmering substance, with the sun (for a few moments hidden) as its centre. It will be watched with the naked eye; it will be observed with telescopes, large and small; it will be photographed, all along the path of the shadow circle; the quantity of its light will be measured with photometers; its quality will be tested by spectroscopes.

There are other problems: Does the shimmering sphere of the corona (not, of course, strictly spherical in form, but ceaselessly changing in unison with the throbbing changes of the sunspots) rotate as the sun rotates, in from twenty-five to twenty-seven days? How does its light affect the light of the stars which passes through it? And, a more general question, does the sun's gravitation pull bend aside the star rays which pass to us close by the sun? This eclipse is not very favorable for a test of this last problem, since no star larger than the fifth magnitude will be very close to the sun. But there are many absorbing problems, and there is the superb spectacle, with its magnificent beauty.