

Partial Phases Also of Interest To the Astronomer

Corona Not Visible, But Shadow Bands Appear And Other Phenomena May Be Observed

ALTHOUGH the total eclipse of the sun will be of greatest interest, the partial phases should also be observed. The total eclipse will be seen for a hundred seconds or less, about 3:30 p. m., Eastern Standard Time, along a path a hundred miles wide crossing eastern Canada and New England. But the partial eclipse will be seen over this same area for about an hour before and afterwards, and also over the entire United States and Canada.

The path of totality is formed by the passage of the moon's shadow, about a hundred miles long, and sixty miles wide, across the surface of the earth. This part of the shadow is called the umbra, it is the region in which the sun is completely obscured by the moon. Because the sun is so much larger than the moon, 864,000 miles in diameter as compared with 2,160, the umbra forms a cone, its base at the moon, its apex about 232,000 miles away, on the side away from the sun. Even at best, when the earth is closest to the moon, the tip of the shadow does not reach more than 18,250 miles beyond the earth's surface. Then the shadow on the ground is about 167 miles in diameter. On August 31, the tip of the umbra will be much nearer the earth's surface, and the shadow spot will be about sixty miles in diameter. But because the sun is low in the sky, about 30 degrees above the horizon, this is spread out into an ellipse, about a hundred miles long. The direction of its motion is practically parallel to the short direction.

Half Shadow

Around the umbra, there is a "half shadow," the penumbra. This is the region in which the moon covers only part of the sun's disc. It is also conical in shape, but is a cone which becomes larger as the distance from the moon increases. Consequently, it covers, on August 31, the whole of North America, and parts of Asia and South America. Over this entire area a partial eclipse will be viewed, a greater amount of the sun being covered by the moon the nearer the point is to the path of totality.

As far away as San Francisco and Los Angeles, California, 15 per cent. of the sun's diameter will be covered when the eclipse is at its height. Galveston, Texas; Denver, Colorado; Helena, Montana; and Juneau, Alaska, will get about 50 per cent. obscuration. New Orleans, Louisiana; Abilene, Kansas; Medicine Hat and Edmonton, Alberta; will have about 60 per cent. Atlanta, Georgia will have about 73 per cent; Nashville Tenn., the same; Minneapolis, Minn., 78 per cent.; Winnipeg, Manitoba, 78 per cent.; Chicago, 79 per cent.; Detroit, 85 per cent.; Cleveland, 87 per cent.; Pittsburgh, 88 per cent.; Washington, 89 per cent.; Buffalo, 91 per cent.; Toronto, 92 per cent.; Philadelphia, 93 per cent.; New York, 95 per cent.; New Haven, 96 per cent.; Albany, 97 per cent. and Boston, 99 per cent.

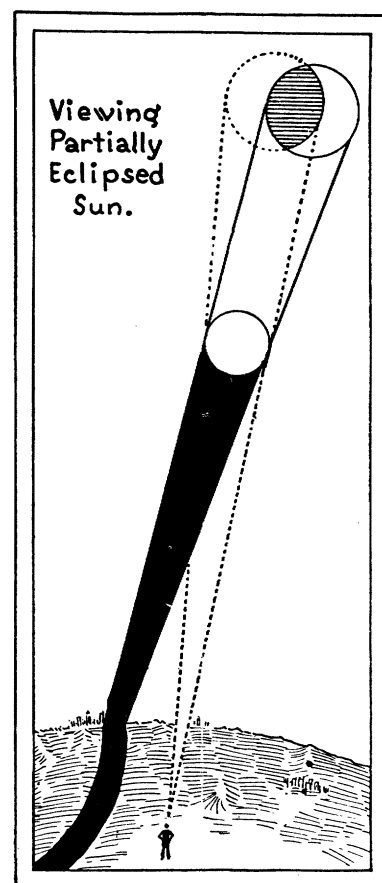
Hour and Half in California

In these places, around noon, or in the early afternoon, a small nick will appear in the edge of the sun, if it is viewed with proper protection for the eyes. This nick will increase, and the moon's circle will be seen passing above the upper edge of the sun, from right to left. As the maximum is reached, the crescent of sunlight, which remains, will slip around underneath the moon, and will then start to get larger as the moon moves away. Even in southern California the partial eclipse will last about an hour and a half, and nearer the path of totality it will be still longer.

Where the partial eclipse has a magnitude as much as 15 per cent. many effects can be noticed. The circular spots of light which appear under trees, images of the sun formed by the pinhole-like interstices between the leaves, become crescent shaped, reproducing the appearance of the sun. Where the eclipse is about 60 per cent. or more, the sun's light is noticeably reduced and it takes on a peculiar color, because the light

then comes mostly from the outer part of the solar disc, which is quite different from that of the inner part, with which it is ordinarily mixed. Where the eclipse reaches 90 per cent. or more, the shadow bands may appear. These are fleeting strips of light and shade, which flit across the ground. Really they are shadows of layers in the atmosphere of different temperature, made visible when the light comes from the slit-like crescent of the sun. A similar effect causes twinkling of the stars. When the eclipse is as much as 95 per cent., the animals may notice it, chickens may go to roost, and flowers may close. However, even where totality reaches 99 per cent., the corona does not come into view, for the remaining crescent, small as it is, gives sufficient light to hide it. After the maximum eclipse is passed, the crescent enlarges, and the phenomena previously observed are seen again, in reverse order. All these things, of course, are also seen from the total eclipse area, before and after totality.

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CAUSE OF PARTIAL ECLIPSE

This diagram shows why the sun will appear only partially eclipsed to those outside the narrow band of totality.