Astronomy & Science

Notes on Eclipses of the Sun

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When any one body obscures the view of another, the latter is said to be "eclipsed," either partially or wholly, according as that view is partially or wholly obscured But, as a rule, the term "eclipsed" is confined to the interposition of one celestial body between two others. Thus, an "eclipse of the moon" happens when the Earth is in line between the Sun and the Moon, and "an eclipse of the Sun" happens when the moon gets exactly in line between the Sun and the Earth.

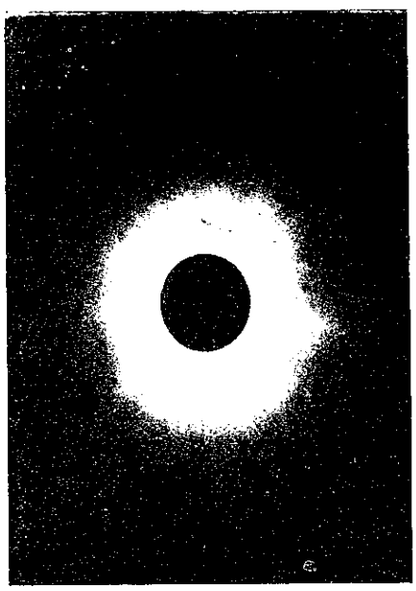
In astronomical importance a lunar eclipse cannot compare with a solar eclipse, and herein the lunar will be neglected. The Moon's orbit—or path through the heavens—does not lie in the same plane as the Earth's orbit, but it is inclined to it at an angle which may be as large as 5° 20′ or as small as 4° 58′. Thus, suppose the Moon, when "new," or just born, happened to be as far as possible "north" of the ecliptic, then it would gradually approach the ecliptic until in about a week's time it would cross it, and, continuing on, in another week it would be as far south as it could get, when it would, as it were, turn back, and in about a fortnight's time it would return to near its starting point. The two points where the Moon's path crosses the ecliptic are called the Moon's nodes.

If the Moon and Earth followed the same path in the heavens, there would be an eclipse of the Sun every time there was a new moon, but owing to this movement of about five degrees either side of the ecliptic, the Moon will pass sometimes above and sometimes below the Sun. When, however, the sun happens to be near one of the nodes at the time when the Moon is crossing the ecliptic, then there will be an eclipse, and the nature of the eclipse will vary with the positions and apparent magnitudes of the Sun and Moon.

Suppose that the centre of the Moon passed exactly over the centre of the sun —as seen by an observer in Wellington— then, if the Moon's disc is "apparently" bigger than the Sun's, it is manifest that the Sun will be entirely hidden from view. This would be a "Total eclipse of the Sun," and its duration would depend on how much bigger the Moon's disc apparently is. Should the two discs appear to be exactly the same size, there would be "total eclipse" but of only a moment's duration. If the Moon's disc was apparently "smaller" than the Sun's then there would be an "annular" eclipse, so called because there would be a "ring" of sunlight all round the moon. The Moon's distance from the Earth varies between 252,972 and 221,614 miles; manifestly the closer it is to the Earth the larger it will "appear" to be. The Earth's distance from the Sun varies between 91 and 94 millions of miles, and the Sun appears smaller the further it is away from the Earth. Now, when the Moon is at its nearest point and the sun at its farthest—if there is one—the Eclipse will be of longest possible duration to an observer on the Equator, and, under the most favourable conditions, the greatest duration will be 7 minutes 58 seconds. The shadow of the Moon on the surface of the Earth is only about 167 miles wide, so that an observer, say 90 miles to right or left of the path of the shadow would see a "partial" eclipse, whilst an observer, just inside the shadow's path would have a total eclipse of briefest duration. The Moon travels along its orbit about 2100 miles in an hour, and if the Earth did not rotate on its axis the shadow would pass the observer at that speed. But the Earth turns from west to east at the rate of 1040 miles per hour at the Equator, and where the shadow would pass the observer at the "difference" between these rates—that is, at about 1060 miles in an hour. The further the observer is from the Equator the quicker the shadow travels until, under certain circumstances, it would pass at something like 4000 to 5000 miles an hour. It has been calculated that in 100 years the Sun is totally eclipsed for about "twenty-four hours only," but taking into account the loss by clouds and bad weather, and the fact that a solar eclipse is only visible from a limited portion of the Earth which might be near the frozen poles or the shadow might pass (as did the last one) almost wholly over an ocean, only about twelve hours of eclipse are available in a century to astronomers in which to make observations which are possible at no other time. It will readily be understood from this why astronomers spare neither time, trouble, nor money in their endeavour to get successful observations of a total solar eclipse.

The last total solar eclipse took place this year on April 29th (Eastern date), and five different parties went to Neiafu (in Vavau) to observe it. The most northerly site was chosen by Mr. J. H. Worthington, who was assisted by Messrs. Johnson and Cruickshank, of Hobart, and by Mr. J. Short, photographer, of the Sydney observatory.

Mr. P. Barrachi, of Melbourne Observatory, and leader of the Australian Party, had his instruments fixed about 100 yards further south than Mr. Worthington, both of them being on vacant allotments in the town of Neiafu. Mr. Barrachi was assisted by Mr. W. A. Cooke, Govt. Astronomer of Western Australia, Mr. Dodwell, Govt. Astronomer of South Australia, Messrs. Byrnes and Merfield, of



No. 1.—Total Eclipse of the Sun as seen at Flint Island.

—*Photo. by J. Brooks*

No. 2.—Transit Instrument Electrically Connected with the Chronograph.

—*Winkelmann, Photo.*