A. Vibert Douglas "The 1932 Total Solar Eclipse" Publication 110

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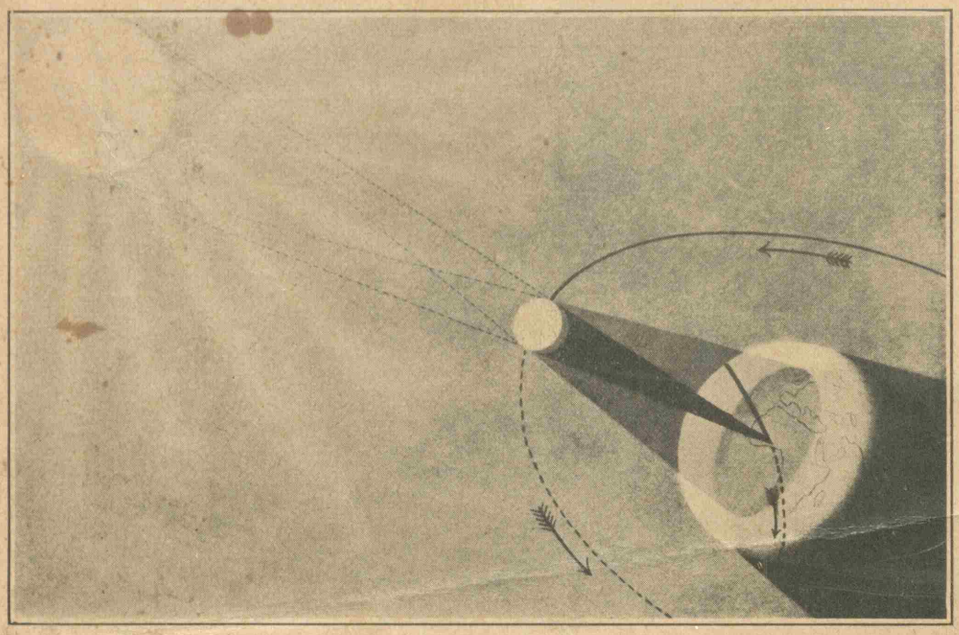
The 1932 Total Solar Eclipse

By A. VIBERT DOUGLAS



DIAGRAMMATIC SKETCH OF TOTAL SOLAR ECLIPSE.
(After drawing by Dr. A. E. C. D. Crommelin, F.R.A.S.)

A TOTAL eclipse of the sun is a phenomenon of such striking and unforgettable character that no persons who can possibly be within the favoured area at the right time should allow trivial circumstances or apathy to prevent them from making the attempt to see it. The majority of mankind live their lives through and die without ever seeing this solemn and impressive spectacle.

To have the path of totality come to one's very door is an event only likely to happen once in 360 years. Hence those whose span of life brings them on to the doorstep at the right time are extremely fortunate.

The total eclipse of the sun, which will take place in the afternoon of August 31st, 1932, will offer just such an opportunity to many thousands of people living within or visiting a strip of the earth's surface about one hundred miles wide running diagonally across part of the Arctic Ocean, the northerly islands of Canada, Hudson Bay, the Province of Quebec, Vermont, New Hampshire and a portion of the Western Atlantic Ocean. This track along which the great oval shadow will travel at about 40 miles per minute, crosses the St. Lawrence valley between the Island of Montreal and just beyond Three Rivers. The western edge of the shadow will be probably somewhere in Notre Dame de Grace, the eastern edge about 35 miles below Three Rivers. The following places are thus well within the path of totality—St. Gabriel, Joliette, Louisville, Shawinigan Falls, Nicolet, Sorel, St. John, St. Hyacinthe, Drummondville, Waterloo, Richmond, Sherbrooke, Coaticook.

In explaining the cause of an eclipse to a child the following points should be made clear by simple experiments, diagrams or models.

(1) Every solid body upon which light is shining from one side, casts a shadow. A round body casts a conical shadow, a section of which on any flat surface is a circle or an ellipse according to the inclination of the surface.

(2) The earth travels once around the sun in a year, being sometimes a little more and sometimes a little less than 93 million miles away from it. The sun is a million times bigger in volume than the earth and so hot that it radiates light and heat in all directions.

(3) The moon is smaller than the earth and is a cold solid body. It moves around the earth once every 27 1/3 days, being on the average 240 thousand miles away from the earth.

(4) The earth turns around on its axis once every 24 hours.

(5) There is always a large tapering shadow cast by the earth, and there is likewise a smaller tapering shadow cast by the moon. If the moon gets exactly behind the earth from the sun it passes into the earth's shadow and there is a **lunar eclipse**, the surface of the moon becoming gradually darkened until it is all a dull copper brown. When the moon comes round to the sunny side, however, it sometimes gets in direct line between the earth and sun, and then its shadow may fall upon a small portion of the surface of the earth. But both moon and earth are moving and the earth is also rotating, so that the shadow moves

rapidly over a part of the earth before the earth has passed right out of the shadow into full sunlight again. This is an **eclipse of the sun.** Observers situated inside the path of the shadow witness a **total** eclipse, if the moon is near enough to the earth to cover up the entire solar disk. Sometimes the moon is at apogee or furthest from the earth in its elliptical orbit and its surface does not entirely blot out the solar surface but leaves a ring or rim of the sun in view—this is not so spectacular and is called an **annular** eclipse. Observers outside the path of totality will see a **partial** eclipse as the moon moves across the face of the sun obscuring a portion of its surface but moving off again without having covered the entire surface. This, too, is an interesting but not a spectacular sight.

(6) We do not get an eclipse of the sun and an eclipse of the moon every month because the plane of the moon's orbit is inclined to the plane of the earth's orbit and so the three bodies do not come into exact alignment twice every month.

The last total solar eclipse visible in Canada was in 1925, from a narrow strip of Central Ontario; previous to that was the 1905 eclipse visible in Labrador. In 1927 the path of totality passed across Central England and southern Norway; in 1929, Sumatra and the Philippines; in 1930, the South Pacific and Patagonia; in 1932 we shall have our own special eclipse; in 1934 an eclipse will be visible in Borneo; in 1936, Greece to Central Asia and Japan; in 1937, Peru; 1940, Brazil, South Atlantic and South Africa; 1943, China and Alaska; 1954, Northern Canada, Scandinavia and Russia. These few facts from tables calculated by an astronomer twenty-five or more years ago will serve to indicate the travelling that must be done if one would attempt to observe several successive total eclipses.

There are several things to be noted in observing a total eclipse of the sun.

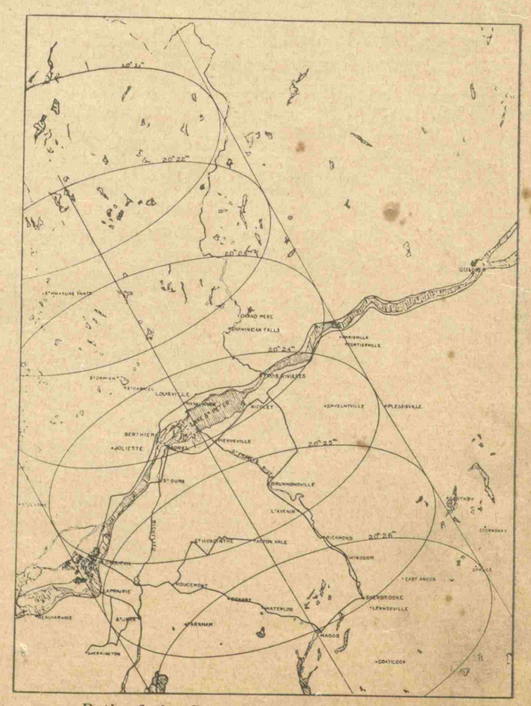
(1) Provide yourself with dark glasses or a piece of smoked glass to observe the partial phases, as until the instant that totality begins, even a small exposed rim of the sun's surface gives off too much light to be viewed with the unprotected eye.

(2) Watch for the onrush of the shadow, turning your back upon the sun for the moment. In 1842 Dr. J. D. Forbes went to Italy to see an eclipse and he thus described the approach of darkness: "I perceived a black shadow like that of a storm about to break. It was the lunar shadow coming towards us. I confess it was the most terrifying sight I ever saw!"

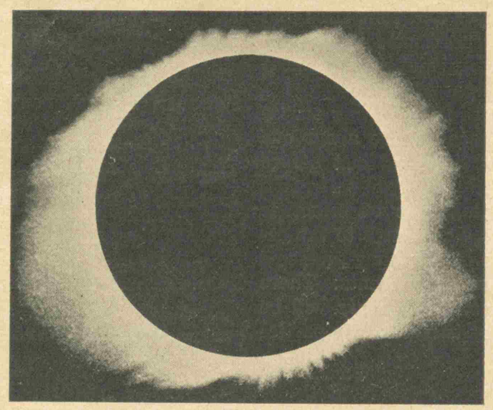
(3) Watch for the shadow bands. Boy Scouts and Girl Guides and adults can provide valuable observations of the fleeting shadows that race along the ground before and after the main shadow. It is best seen if a white sheet is spread on level ground. A few straight sticks should be at hand to place on the sheet, indicating the direction of the shadow bands and the line of their motion. They differ before and after totality and with the position of the observer relative to the central line of totality. There is still much to be explained about these shadowy ripples and all careful observations should be reported.

Dr. A. J. Cannon, of Harvard Observatory, describes the "dance of the mystical shadow bands" at the 1925 eclipse. "I saw them clearly about one minute before totality, and they almost took my breath away. They were narrow pencils, dark greyish....". Other observers recorded "broken waves or ripples paralleling each other and moving with express-like rapidity towards the sun" for 10 or 15 seconds at the beginning of totality, while at the end of totality (which, under different circumstances, may last from a few seconds to several minutes) the direction was not reversed but at right angles to the original direction. All such details as to time, duration, direction, will be of value from every point on the path.

(4) Immediately upon totality, the blinding glare of sunlight being cut off, there becomes visible the **corona** or outer radiance surrounding the sun. This appears all around the dark disk of the moon



Path of the Central Shadow of the Eclipse of August 31, 1932, Across Quebec.
Journal of the Royal Astronomical Society of Canada.



Prof. E. E. Barnard's 1900 Photograph of Corona.

which is obscuring the face of the sun and is thus described by the late Professor Baily, "I was electrified by the sight of one of the most brilliant and splendid phenomena that can well be imagined. For at that instant the dark body of the moon was suddenly surrounded with a corona, or kind of bright glory similar in shape and relative magnitude to that which painters draw round the heads of saints".

(5) Look specially for **prominences;** red, fiery tongues of light at the inner edge of the corona. These are sometimes very fine, sometimes missing entirely. They are due to cyclonic storms in the outer atmosphere of the sun, hurling glowing hydrogen gas and hot vapours to immense heights, and their bright radiations stand out in marked contrast to the paler, softer glow of the corona. Baily describes the prominences visible in 1842 as "red, tinged with lilac or purple....perfectly steady".

(6) Watch for "Baily's beads" or the "diamond ring" effect. The surface of the moon being very mountainous, its outline is in some places irregular and hence it is possible for some light from the intensely bright edge of the sun to shine through a lunar valley at the rim of the lunar disk, and this gives a flood of intense light at some point or points around the rim.

(7) A snapshot of the corona and "beads", if any, may be obtained with an ordinary camera. Time exposures of more than a few seconds are unwise on account of the relative movement of earth and sun. Astronomers take as long exposures as they can by means of a clockwork drive that keeps the image stationary by compensating for the rate of rotation of the earth.

(8) The exact determination of the edge of the path of totality is very important as a check upon the accuracy of the calculations made in advance. It is therefore of special interest if persons situated along the edge will send in records of their observations as to what road, building, hill or other physical feature was definitely in shadow in contrast to some neighbouring building, crossroads, railway track, river, or other feature which can be accurately located on a map, and which was definitely in the sunlight all the time.

(9) Astronomers are particularly interested in the "flash spectrum" just visible for a brief instant at the beginning and end of totality.

The spectrum of sunlight is a rainbow-coloured band of light crossed by the narrow dark Fraunhofer absorption lines, but just at totality these dark lines are reversed, that is, they shine out as bright lines, the more intense background of the light from the surface of the sun having been cut off. A pocket spectroscope will show this flash spectrum.

(10) The change in temperature during the progress of the eclipse may be noted, also the degree of darkness may be roughly estimated by noticing what size of type cannot be read—newspaper print and headlines form a handy scale. An observer, in Australia, of the 1922 eclipse reported that by the above methods of estimation it was found that the amount of illumination during totality was equivalent to the light thrown by one candle three feet behind you in a dark room.

(11) Those who are interested in wireless telegraphy may take note of the fading effects which may accompany the passing of the lunar shadow. Radio experts will study this in detail.

(12) It is interesting to notice the effect upon birds, animals and insects of the oncoming of darkness and the hush of all nature is commented upon by many observers. Definite observations regarding the behaviour of animals, birds and insects will be of value.

It is not surprising that primitive people have been terrified by a total eclipse and that rites and rituals and even sacrificial ceremonies have been adopted to stay the supposedly malign influences which appear to cut off the light of day.

Near the centre of totality in the coming eclipse the duration of the total phase will be about one and a half minutes. In this time and just before and after it, astronomers and physicists will make great efforts to obtain photographs of scientific value. Every total eclipse is a challenge to the astronomer to solve a few more of the many problems that the physical nature of our sun presents. There will be elaborate preparations, instruments will be brought over from England by two scientific parties from London and from Cambridge, and Canadian scientists will likewise make every effort to obtain new information and valuable photographs.

There is one critically important thing which, however, no astronomer can arrange beforehand, namely, a clear sky with no clouds. For the sake of the few professionals and the thousands of amateur sun gazers we can only hope and hope and continue to hope that the day may be fair and the sky clear.

The writer will gladly receive from any observers, old or young, any observations made carefully and conscientiously, (Address: A. Vibert Douglas, McGill University, Montreal), stating name, address, exact point where observations were made, time and observations.

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