

This repeated observation of the "fire-red flash" (to quote only one description) by so many watchers, scattered widely apart, is of more than pictorial interest. For evidently here we have the means of interpreting from these naked-eye observations of the chromosphere, other naked-eye observations made long ago. In the *Journal* for May, 1923 (Vol. 33, p. 285), M. Daniel Sviatsky gives extracts from the astronomical phenomena described in Russian chronicles, and "The Eclipse on May 1, 1185, is described in great detail: 'In the evening there was an eclipse of the Sun. It was getting very gloomy and stars were seen and in the men's eyes was a green light. The Sun became similar in appearance to the Moon and from its horns came out somewhat like live embers.'" " 'Live embers' is evidently a great prominence, observed before the total phase. In such a case it would be the most ancient record of prominences," is M. Sviatsky's comment. But "live embers" is a description very comparable with *Mr. Brindley's* "deep (lobster) red blotch" or *Mr. Scanlan's* "fire-red flash," or *Mr. Ford's* "bright spot of dazzling light tinged with red," which all seem to point to sunlight being coloured red by the chromosphere.

Of the light during totality, there are two "bracketing" observations by *Mr. A. R. Ford* ("The intensity of light seemed less than the full moon, but the visibility was better and there was a marked absence of shadow") and by *Mr. Smetherst* ("During totality the light seemed much greater than at full moon. This was based on the fact that only the planets and a few of the brightest stars were seen during totality, stars less than the 4th magnitude could be seen during full moon of October 5th.").

There is a very great difference between the numbers of stars and planets visible in this eclipse—up to 18 or more—and those observed in the annular eclipse of April, 1921—at the very most 6.

The foregoing has been compiled from the various notes by observers. The Report written by Miss Miriam Chisholm is given *in extenso*, as it is already drawn up in the form of a report.

Total Solar Eclipse of September 21st, 1922,

As seen by MIRIAM S. CHISHOLM and F. J. TINDAL.

Our party was quite an amateur one and our aims were as follows:—*To observe*:—(1) The contacts.—(2) The passage of the Moon over any sunspots.—(3) The shadow bands.—(4) The corona (and make at least two independent drawings thereof, not to be compared until after).—(5) The prominences.—(6) Baily's Beads (photograph).—(7) Effect on animal life.—(8) General colouring of landscape and sky, stars and planets visible during totality, anything unusual, striking or unexpected.

To photograph:—(1) The partial phases.—(2) The total phase.—(3) The shadow bands (if it seemed possible).

This seemed a very large order, but as we all knew that it would probably be the only total Solar eclipse we would ever see we had made up our minds to see it all. This was more easy owing to the long duration of totality and the programme was arranged in such a way as to enable, as far as could be expected, each person to do the work of the other, but at a different time. We thus hoped to collaborate our evidence, as it were, strengthen our opinions and be sure of what we saw. It turned out much better than we had dared to hope or expect, and our combined notes may contain something of interest to others.

We motored the six hundred miles from Sydney, but, owing to bad weather, we were delayed four days at the early stages of the trip. Consequently, we were unable to reach Goondiwindi, on the N. S. Wales border, from where we had hoped to make our observations, and were still some fourteen miles east of the town half an hour before the eclipse was timed to commence. We pulled up in the shade of a tall gum tree and in a place where there was a clear stretch of road and low trees on either side. There was little time to lose and our cameras, telescopes, etc., were very quickly unpacked and ready for mounting on their various stands. We had no idea of the exact time, so were ready for first contact early, so that we might set our watches to within a minute, at least!

The instruments were very modest ones, though they proved sufficient for our uses. They were as follows:—*Equipment*.—3-inch telescope, focal length of 36 inches, mounted on firm tripod; 1-inch telescope, focal length of 15 inches, mounted on stand and resting on wind-screen of car; two cameras (hand), focal length 5 inches, aperture about 1 inch; “Boy Proof” watch!; stop watch to measure to $\frac{1}{5}$ of a second; sheet for observing shadow bands; chalk and blue paper for drawings of the corona; map containing positions of stars and planets expected to be visible during totality.

As the time drew near for first contact I watched eagerly through the 3-in. telescope for the first flattening of the solar limb. At the first sign I set going the stop watch and from it set the “Boy Proof” watch to show 3^h 7^m at the instant of first contact. The stop watch was then made ready to record the disappearance of a spot visible on the solar disc. *Sunspot's appearance* as compared with the black lunar disc was brownish, and about half as dark in colouring. The atmosphere was rather unsteady and as the Moon almost touched the spot it seemed lighter and rather pinkish. The spot did not disappear instantly as a star does when occulted. It faded slowly. It became invisible at 17^m 10^s after first contact.

The light now began to seem different, crescent suns were reflected through the leaves of trees, and the vegetation became gradually colourless and the sky a deep blue. Venus was very plain, but we had seen her before the eclipse commenced when she was close to the zenith.

Effect on Animals.—The first time that the eclipse was seen to affect the animals was about half an hour before *first* contact! When we began to unload the telescopes, etc., from the car we were surrounded by a mob of cattle, which suddenly came from the bush near at hand. They were intensely interested in the arrangements and at one time I thought they might charge the whole outfit. But they disappeared almost silently and were not seen until after everything was over. About ten minutes before second contact the swallows and martins became aware that “something was going to happen.” They swept in excited circles above our heads, uttering startled cries and making very much more noise than when they go to roost in the evening. During totality there was absolute silence from all animals (except the human element and even we were conscious of a strong desire to speak in whispers).

The wind, which had blown strongly all day from a westerly direction, died down, and only came in fitful gusts which seemed to descend from nowhere and, after scattering our papers and drawing materials in various directions, disappeared as mysteriously as it had come, leaving no trace of swaying trees to mark its passage. It simply “swooped” and was gone.

The Shadow Bands.—For observing these we had spread a sheet stretched firmly and held down by weights. We had no compass, but used the position of the Sun to guide us. Its position was guessed to be a little north of west, so our compass points are very approximate. About 5 min. before totality I saw a very faint shadow cross the sheet, it was too ill defined to be quite sure; but 2 min. later we all saw them. They appeared to me to be at first about $1\frac{1}{2}$ inches broad and perhaps 10 inches long. At first the distances from crest to crest were irregular and quite impossible to measure. They became much more distinct and measureable about 3 min. before second contact, and were travelling from about 8 to 10 miles an hour, and their direction was from the west-south-west. I scraped a mark in the ground alongside the sheet to show direction, and then stood by the telescope to watch for totality. After third contact the bands were very large, broad and distinct, and had changed their direction and were moving from the south-west at about the same pace as before. Mr. Chisholm saw them 30 yards away, and his estimate of their proportions is given below, together with Miss Tindal’s and mine. We saw them together and our estimates coincide fairly nearly:—

<i>Mr. Chisholm</i> (after)	<i>Miss Tindal</i>	<i>Miss Chisholm</i> (before)	After.
Width, 3 ft.	$1\frac{1}{2}$ inches	$1\frac{1}{2}$ inches— $2\frac{1}{2}$ inches	4–6 inches
<i>Tip to Tip</i> , 12–14 ft.	—	12 inches—18 inches	4 ft.
<i>Crest to Crest</i> , 10 ft.	6–10–12 inches	18 inches	3 ft.

The bands were curved slightly and were compared by Miss Tindal to wind ripples over wheat. They reminded me of the shadows cast by smoke from a tall chimney. My impression is that it was quite easy to follow the course of one “band” from the time it touched the sheet until it had raced across

the intervening ground (some 10 yds.) to be lost in the shadow of a near-by tree.

Baily's Beads.—About 1 minute before totality Mr. Chisholm and I took up our positions for observing Baily's Beads and photographing them. He stood by the camera, a quarter plate 4 + 5 Century, working at f. 128 and instantaneous exposure, ready to snap when I, watching through the telescope, gave the word "Now." The Beads looked like lines which appeared to jump across from the encroaching Moon to the edge of the crescent Sun. They changed rapidly and appeared all along the fine bright line of the Sun, reminding me of an irregular line of black keys on a piano key-board. At one time they were quite invisible and then there was a sort of "outburst" of them on either side of the crescent. All this happened a few seconds before totality, but how many, I could not say. In my notes I have estimated their first appearance at 5 seconds before, but on consideration it seemed too short. The Beads were not especially looked for after totality. Mr. Chisholm was at the 3-in. telescope looking at prominences at the time of second contact, and did not notice them.

Programme for Totality.—Mr. Chisholm had consented to have his time divided up as follows:—The first minute to make a sketch of the corona; the second, to take a photograph; the third, to make notes on any prominences visible in the 3-in. telescope.

Miss Tindal had a specially prepared chart on which she was to mark off the stars visible and the rest of the time was to be used to note anything unusual.

My own time was:—The first minute notice any prominences; the second, help to identify stars visible; the third, make a sketch of the corona.

Also, with the stop watch, to note the duration of totality.

Totality.—The above programme was carried out in full by Mr. Chisholm, who made two sketches of the corona, took the photograph, and marked in the positions and peculiarities of the prominences on a prepared circle

The Prominences.—There were four or five quite distinct, one of them detached, and of a peculiar pinkish colour. They extended, using the clock dial method, from 8 to 5 o'clock and the detached one was at 7, in an inverting telescope. They were not visible to me with the naked eye, though I must admit that I only concentrated specially for a few seconds as I was busy sketching the corona at the time they became visible, some 20 seconds before third contact.

Miss Tindal carried out her part of the programme excellently, and a list of the stars identified is given below:—

Stars Visible.—Four stars in the Southern Cross; The Pointers (α and β Centauri); Antares and several other stars in the Scorpion; Vega; Arcturus; Spica (and two stars unidentified between the zenith and the eastern horizon, about half way up). Corvus not seen.

Planets Visible.—Mercury; Jupiter; Saturn; Venus (seen before first contact); Mars? (not sure).

The Corona.—My part of the programme was, I am afraid, not strictly adhered to. I looked up from the telescope just an instant before totality and thought I saw the Corona, a pale fringe round the Sun but more pronounced on the south-western side. I ejaculated, "The Corona," and then the light went out and we saw it in all its glory. I went back to the telescope for about 10 seconds, but as there was very little to see and the naked eye view was so glorious I spent my time gazing. I had started the stop watch a little late, as, in the excitement, I found I still had the "Boy Proof" watch in my hand and it took a few seconds to pick up the other. During the first 70 seconds I also helped identify some stars and planets and then took Mr. Chisholm's place at the table and drew what I could see of the Corona. The streamer on the south-western side was, to me, the longest of the four visible. It was also brighter than the others and, although my sketch does not show it, it seemed to be broader near the Sun, ending fairly abruptly, except on the south side, which continued in a bright streaming and rapier-like shaft toward the west, where it ended in a diffused light about one and a half diameters away from the black lunar disc. On the south side the light was feathery, more so than on the north (The Polar regions?) The long streamer on the north-east seemed bent more than expected. In fact none of the streamers seemed to radiate exactly from the centre of the disc, as drawings of other eclipses indicate. The light from the Corona did not end abruptly. It seemed to melt into the sky and it was very difficult to show its limits, they were so indefinite. The colour of the streamers was pearly white or soft white.

The Sketches.—We had no "plumb line" to guide us, nor did we divide the circles into four as is usual. The drawings are untouched since they were made during the actual phenomena. Mr. Chisholm's shows a broader outline than mine and his north-eastern streamer makes a bigger angle with the equator. The breadth of outline seems to me to be accounted for by the fact that he was taking a photograph up till actual totality, and not watching the Sun; whilst I was at the telescope and, for the last few seconds, did not use a dark glass, as far as I can remember; also I had been using the telescope more than he had. The prominences were put into Mr. Chisholm's sketch out of proportion to the size of the sketch, but as they appeared in the 3-in. telescope using a power of about 40. I glanced up for perhaps 10 seconds, and searched the limb of the Sun when I was told prominences were visible in the telescope, but saw nothing with the naked eye, so they do not appear in my sketch, which, I am afraid, is rather rough and unfinished.

The End of Totality.—The light returned suddenly as if a searchlight was turned upon us. Brilliant white as is Venus in her greatest glory and then daylight returned with a rush; the corona melted away, birds began to fly about, the cattle

we had seen earlier in the day came out from their shelter, and the shadow bands swept by, vanishing suddenly. It left one with a question as to whether those three minutes were but a vivid dream. The length of the total phase, by the stop watch showed $3^m 15^{\frac{3}{8}s}$.

Third to Fourth Contacts.—There only remained to observe last contact and the re-appearance of the spot. I was busy collecting and making notes and the spot reappeared before I was ready for it, but I observed fourth contact at $5^h 15^m 33^s$, making the time of the whole eclipse to have taken $2^h 8^m 33^s$ by the "Boy Proof" watch, which gains considerably and is not constant!

MISCELLANEOUS.

Colouring.—The effect of the rapidly diminishing sunlight on the surrounding landscape was weird and uncanny. The open trees and glorious blue sky gradually became neutral tinted and lifeless; then, as the light faded yet more, an ashen hue covered everything; all nature died and the grey light became her winding sheet. The sky during totality was remarkable. The centre of interest was, of course, the eclipsed Sun, the Moon being a black ball in the centre of a pearly radiance, bright yet soft! The streamers seemed to melt into the illuminated sky surrounding them. The sky itself deepened in colour until it reached, some distance away, a deep lifeless steel blue. On the northern and southern horizons and continuing, perhaps, ten degrees toward the zenith the sky was primrose or yellow, fading or rather, deepening, into green and from that colour to the deep blue before described. Yet all these colours which suggest life and beauty were without *life*, almost ashen if one can picture an ashen yellow. The Moon looked black at first, yet later seemed that deep, deep brown which one sees in the centre of a Catherine wheel, which to me does not look dark enough to be called "black."

Chromosphere.—The chromosphere was not seen for certain, but at one time, during or just after the time I was paying particular attention to Baily's Beads, I noticed an orange or pinkish rim to the Sun, more especially on the right hand, lower side (inverting telescope). At the time, I put this colouring down to the telescope itself, but on hearing others describe it, and the time they saw it, I am inclined to think that I, too, noticed the chromosphere.

Shadows.—The Sun was not directly overhead, as the eclipse commenced at $3^h 7^m$. Consequently, the crescent suns which appear under tall trees were rather elongated and out of proportion. At $3^h 55^m$ we noticed that all shadows, including our own, had a double outline, giving the appearance that a photographic plate has when it has been moved during exposure. The shadows were dark and well defined on their "principal" outline, the second outline was blurred and much fainter.

During totality I remember seeing no shadows thrown by the light of the Corona. I am almost sure that, though the light was brighter than a Full Moon considerably, there were no definite and marked shadows under the trees, etc. It was darker under trees, but the shadows, as far as I remember, were more like that thrown on a dull day. Perhaps other observers noticed this?

Lunar Cusps were noticed about 5–10 min. before totality (roughly) to be blunted considerably. This may have been due to atmospheric disturbance.

PHOTOGRAPHS.

I took a series of snapshots—using f. 45, $\frac{1}{100}$ th sec., and a speed film 250 H & D—of the partial phase, all on the one negative, at intervals of 9^m, 15^m, 5^m, 6^m, 9^m, the irregularity caused by the fact that I had so many things to prepare that I generally forgot until minutes after. I had intended these pictures to be taken at 5^m intervals. I took no photographs of the phase after totality.

Baily's Beads were also attempted; the exposure is mentioned elsewhere. Plate speed was about 220 H & D., but I purposely used an *old* plate, as it should be slower. It was unbacked.

Corona and Eclipsed Sun.—Exposure:—F. 8, 1^s. Backed, colour sensitive plate, speed 500 H & D.

Temperature.—At first contact, 68° F.; totality, 60° F.; last contact, 60° F.

GENERAL APPEARANCE OF LANDSCAPE AND SKY.

After a certain time during the oncoming of totality, the sky below the Sun, toward the West, gradually changed from light blue, through all the darker shades, to what must be described as a translucent black, for want of a better term, because as all trace of blue faded from the sky, yet there was blackness, into which the eye seemed to punctuate during the few minutes immediately preceding totality. During totality, from our position close to the centre of the eclipse belt, a wide band of pale blue light, shading to orange on its upper edge, was visible on either horizon. This band, indicating the limits of the region of totality, extended towards the zenith for about 10 degrees before fading out.—M. S. CHISHOLM, *per* F. K. C.

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