

THE TOTAL SOLAR ECLIPSE, AUGUST 30.

(1) THE SOLAR PHYSICS OBSERVATORY EXPEDITION.

Palma, August 26.

IN another four days the eclipse will be an event of the past, and we shall be packing up the great amount of material which we have been setting

have been previously calculated, give us 16 seconds and 5 seconds respectively before the commencement of totality. The object of employing these times is not so much to assist the observers in the camp generally, as to warn the workers with the prismatic cameras, who begin making their exposures three seconds before the commencement of totality. Both

Mr. Butler and myself utilise these two signals to begin our series of snap-shots for photographing the lower chromosphere.

Undoubtedly the three minutes three seconds, the length of totality at this station, is a long time, and when the strong voices of the timekeepers are heard shouting out "163 seconds," "153 seconds more," &c., one somehow feels that one is not utilising to the fullest extent the time available.

With the prismatic camera, of which I am in charge, it is hoped to secure fourteen photographs. The three large 6-inch prisms of 60°, and the object-glass of the same diameter, form together a powerful weapon of research. The programme of work is to make

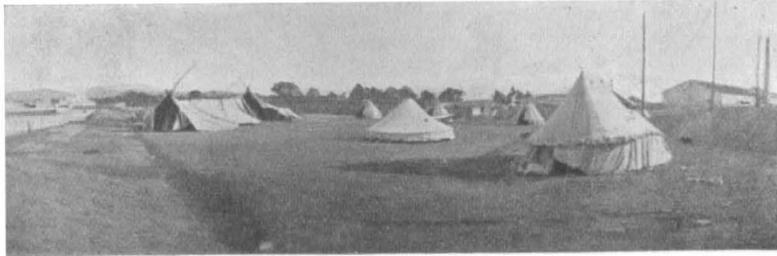


FIG. 1.—Our camping ground as seen from the south-east end. In the long tent on the left is the 76 ft. prismatic reflector, and all the other instruments are beyond it. Notice the poles for the discs in the right-hand corner.

up with so much care since August 11. The greatest keenness has been displayed in every party told off for its particular duty, and I think that everyone will be glad when the eventful day arrives.

We have settled down to routine work every day. Those in charge of instruments go to the camp at about 6.15, and work at the adjustments and small items so necessary for successful photographs. At nine o'clock the whole band of volunteers, now about 150 in number, arrives at the camp, and three drills are then gone through in fairly quick succession. The organisation of the division of labour at each instrument is now very satisfactory, and the various movements that have to be performed at stated times occur in clockwork fashion.

As I have mentioned before, the whole work of the camp is organised according to signals given by the



FIG. 2.—The camp as seen from the south-west end of the ground. The 31-inch McClean equatorial in the foreground, 16 ft. coronagraph under tent on left, 76 ft. prismatic reflector under canvas on the right. All these instruments are housed with sails and spars from H.M.S. *Venus*.

four snap-shots at about the commencement of totality and five about the end. The remaining five plates will be exposed for intervals varying from 5 to 90 seconds, and it is hoped that the two long exposures on each side of mid-totality will add to our knowledge of the wave-lengths of the coronal rings. This prismatic camera is designed to give results suitable for determining accurate wave-length of the chromospheric and corona arcs; the image of the sun is therefore small, and the dispersion large.

The prismatic reflector of 76 feet focal length, in charge of Mr. Butler, provides a solar image of about 8 inches diameter, and, since the light is made to pass through one prism twice, the dispersion is not excessive. The large chromospheric arcs should, however, provide us with much matter for thought.

This latter instrument is practically ready for the eclipse, and a few words may here be said as regards the erection of it. The camera end itself forms part of the dark room of the camp, and is to the south of it. Just outside, but a little to the west of the north and south line, is the siderostat, which throws the solar rays on to the long-focus mirror situated to the south about 70 feet. This concave reflector throws the image towards the north, into the portion of the dark room in which is fitted a screen. An arrangement is adopted for inserting, during some periods of totality, a prism in front of the mirror. The light from the siderostat has thus to pass twice through the prism, giving a very useful

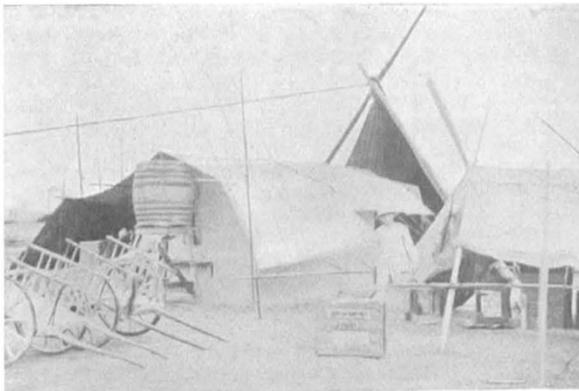


FIG. 3.—The north end of the 76 ft. prismatic reflector, showing the dark room with the wine-tub for water, the two handcarts leaned up, and on the right, under the small awning, the 3-prism 6-inch prismatic camera.

eclipse clock. There are, however, two further signals given from the angles subtended by the cusp at the centre of the dark room. These angles, which

spectrum. The large size of the image involves the use of very great photographic plates, and in this case plates 2 feet square and 2 feet by 1 foot will be used.

In order to keep out the light from the cloth tube connecting the mirror with the camera, sails have been erected on large spars, making the whole tube a very imposing structure.

Two new additions to eclipse drill have been introduced to render the organisation more perfect and flexible in exceptional circumstances, and both of these have been proved to be necessary. During one

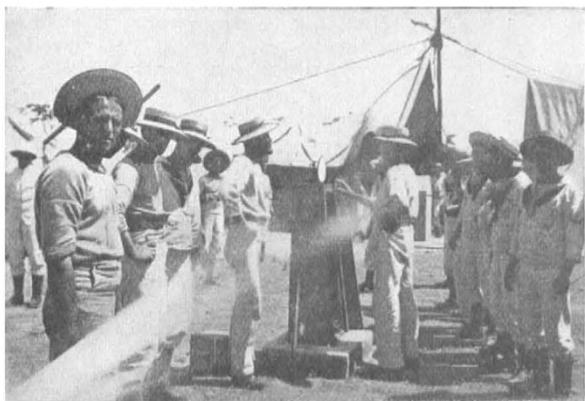


FIG. 4.—The timekeepers at work with the eclipse clock, and their audience.

of the rehearsals the other day the eclipse clock stopped owing to the hand coming in contact with the dial over which it moves. Such an occurrence has never been known in our eclipse history before, and the timekeepers remained dumb after counting "163 seconds more." In future, a man with a stop-watch will stand with the timekeepers and keep a tally of the 10 seconds as they pass.

The second innovation was prompted by the possible absence on the day of the eclipse of any one member of a group working an instrument. Unfortunately, I



FIG. 5.—The celostat end of the 16 ft. coronagraph, which is under the tent on the right.

had to spend the whole of Saturday, August 26, in bed by the doctor's orders; but my instrument was very efficiently worked by the navigating officer, Lieut. Horne, who will make the cusp observations from my siderostat during the eclipse. In each party, then, the work of each member was changed, and drills were carried out under this scheme with success. I should like to take this opportunity of thanking

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most heartily both Staff-Surgeon Clift and Surgeon Jones, of H.M.S. *Venus*, for their very kind and efficient assistance on that occasion.

The camp at the present time practically fills the whole of the enclosed ground placed very generously at our service. Through the kindness of the local authorities, extra tents have been provided, and much material loaned in the way of wood for the shadow-band party, handcarts for the use of the men bringing water and provisions from the ship, &c.

To avoid the inconvenience of any dust arising from the road to the north of the camp, the same authorities will keep this well watered on the day of the eclipse, and for some days previous to it, and they have also arranged that the manufacturers' chimneys, which are very numerous here, shall not smoke during the time of the eclipse.

WILLIAM J. S. LOCKYER.

(2) REPORTS OF OBSERVATIONS.

Up to the time of writing very few details as to the actual scientific results obtained during the total eclipse of the sun on August 30 have arrived in this country; but it is very clear that the hopes expressed in these pages on August 24 have not been completely realised on account of the prevalence of cloud during totality at several stations.

Telegraphing from Castellon, Prof. Callendar states that, although the first and last contacts were observed in a clear sky, totality was entirely obscured by clouds. Good records of radiation and temperature were, however, secured. Similarly, Mr. Evershed, who had set up a very fine prismatic camera near to Burgos, says in a telegram to the Royal Society, "Thick clouds; no results." This forms a striking contrast to the reports of the Press correspondents, which state that all the observations at Burgos itself were successfully carried out during a temporary break in the clouds. A reproduction of a photograph of the corona, taken with a camera of 48 inches focal length by Mr. J. T. Pigg at Burgos, appeared in the *Daily News* for September 2.

At Palma, Majorca, the expedition from the Solar Physics Observatory, South Kensington, under the direction of Sir Norman Lockyer, and assisted by the officers and crew of H.M.S. *Venus*, were apparently only a little more successful, for as the crucial moment of totality arrived dense clouds came up and obliterated the sun. At about mid-totality, however, a break in the clouds occurred, and some photographs were secured which, it is hoped, may at least show the form and extent of the corona. Several good drawings of this feature, which was of the "maximum" type seen in 1871 and 1882, were made by the "disc" sketching parties.

At Saragossa, cirrus clouds prevented observations being made.

Encouraging but brief reports have been received from the observers at the North African stations.

Mr. Newall, at Guelma, appears to have been singularly fortunate, for he reports "superb weather conditions, observations successfully made," and states that he observed a brilliant corona of the "maximum" type having remarkably long streamers—one of which extended towards Mercury for more than three degrees—and unusually dark rays. Splendid prominences were also observed by him.

Sir William Christie's report from Sfax is not quite so sanguine, for he states that the sky was partially cloudy; nevertheless, photographs were secured with all instruments, and the eclipse was satisfactorily observed. A Reuter telegram from this station says that during the period of totality no clouds interfered with the observations.

At Assuan, where Prof. Turner set up his coronagraph and polariscope apparatus, the atmospheric conditions were perfect, except for a slight haze, and the *Times* correspondent reports that eight photographs in polarised light were obtained and successful corona pictures were taken. Mr. Reynolds with his 120-foot reflector evidently experienced the great drawback common to all users of long-focus cameras, viz. bad atmospheric tremors, for the local fire brigade had to be requisitioned to flood the site in order to check the radiation from the heated ground.

Dr. J. Larmor sends us the following observations made by Mr. S. L. Walkden on the Orient steamer *Ortona*, situated on the central line of the eclipse in the Mediterranean near the Spanish coast. The observations contain a good naked-eye record of the eclipse, and agree with Dr. Larmor's impressions:—"Rainbow colours visible on small cloud about 5° from sun about $\frac{1}{2}$ minute to 1 minute before totality. Pulsation of light from strip of sun was observed by Mr. Campbell and myself as if the moon advanced by stages. (Probably another aspect of shadow-bands phenomenon.) No approach of shadow observed by myself, though keenly looked for; but found no one else who observed it except Mr. Campbell, who caught it in the sky not far from sun's limb at time of approach of totality. *Totality*.—Venus first noticed about one minute before totality, and Regulus as soon as totality complete. Mercury searched for with Zeiss field-glass and naked eye, but not caught after about 10 to 15 seconds' search. *Corona*.—Very fine and very detailed, so that general description difficult. *General impressions*.—(1) Some streamers seemed to cross, and were certainly not all radial. (2) Obvious extension seemed about two sun diameters. (3) Streamers distributed all round sun, but chiefly at left-top (45° from top) limb. Long thin streamer at left-left-bottom limb ($67\frac{1}{2}^{\circ}$ to left of bottom). *Prominences*.—Distributed more or less all round, but chief one observed at left-top corner. Height about $\frac{1}{4}$ of sun's radius; but this should be corrected for irradiation, which made the prominence appear to trespass into the moon's surface, exaggerating its size and producing general local glare. Colour of prominence was much less marked than expected, being merely of a violet or faintly rosy-pink hue. Shadow bands observed on deck at end of totality (looking down from boat deck). They 'rippled' along a little faster than could be easily followed by eye. They were parallel to the strip of the sun after totality, and travelled in direction of shadow. Dark strips about 6 to 8 inches wide, distance apart about 18 inches. During totality depth of darkness seemed practically independent of depth of our immersion in shadow. Clouds formed a good deal after $\frac{3}{4}$ of sun's diameter had gone. *Lightness* of eclipse very marked, and in itself disappointing. Time by watch always plainly visible. Sky illumination greatest round horizon, and a yellow glow (like sunset) in points *opposite* to sun (about N. point). Coast lights were visible a few miles away, and one hill to N. appeared as if perforated, with the sky showing through. This was observed by one other passenger. Venus still visible nearly 5 minutes after end of totality. Whole black disc of moon was visible shortly before totality, say 5 to 10 seconds before."

According to a correspondent writing to the *Times*, some interesting observations of a simple character were made by the amateur astronomers on board the P and O. mail steamer *Arcadia*, which for the time of the eclipse waited off the coast of Spain not far from Castellon. Members of the British Astronomical Association were on board, and organised themselves to watch various features of the phenomena. Mr. and Mrs. Johnson report that they saw the whole

contour of the moon projected on the corona immediately after the first contact. Thermometric observations showed a fall from 90° to $72^{\circ}.6$ in the sun, and from $82^{\circ}.4$ to $72^{\circ}.5$ in the shade, temperature. Mr. Bacon, first officer of the *Arcadia*, made successful observations of the approach and of the recession of the moon's shadow from a point of vantage at the mast-head.

As regards the observations made by foreign astronomers, those located at Castellon, Burgos, Guelma, Sfax, and Assuan shared, of course, in the conditions enumerated above. M. Trépied, of the Algiers Observatory, was apparently very successful at Guelma, and obtained numerous photographs of the chromospheric spectrum and the corona. A fall of temperature of 5° C. (from 33° to 28°) was recorded, and Mercury, Venus, and Regulus were observed.

At Tripoli, Prof. Todd, of Amherst College Observatory, M. Liber, of Paris, and Prof. Millosevich, of Rome, were favoured with a clear sky. Prof. Todd secured some 250 photographs of the corona with his automatic coronagraph. Very good observations of the shadow-bands are said to have been made at this station.

A disappointing feature of the eclipse was the failure to secure observations at both ends of the shadow's path. As mentioned before in these columns, arrangements had been made by the Lick Observatory to photograph the corona in Labrador and in Egypt with exactly similar coronagraphs. Mrs. Maunder, accompanying the Canadian party at Hamilton Inlet (Labrador), was also to use a coronagraph identical in scale with that used by Prof. Turner at Assuan. A Reuter telegram from St. John's, Newfoundland, announces, however, that the Lick observers experienced a total failure owing to clouds; a second message from a telegraph station on Hamilton Inlet stated that fine weather prevailed from 7 a.m. to 6 p.m. on the day of the eclipse, and that the phenomena were perfectly visible, and it was hoped that the Canadian party had been successful in making good observations. A later telegram, dated September 3, states, however, that the expedition was entirely unsuccessful, owing to the cloudy weather, and no photographs were secured.

A communication from Mr. J. Y. Buchanan, F.R.S., to the *Times* of September 5, contains some interesting notes of visual observations made during the period of totality at Torreblanca, a small village on the east coast of Spain. Having been present at the 1882 eclipse, when he assisted Sir Norman Lockyer at Sohag, on the Nile, and not having seen the whole of the phenomena, Mr. Buchanan only took with him an ordinary camera and a field-glass, so that he might devote all his attention to visual observations. His choice of Torreblanca, where, with the exception of the local railway employees, he seems to have been the sole observer, was justified, inasmuch as the eclipse took place in a blue sky. As the last vestige of sun disappeared behind the eastern limb of the moon a magnificent bunch of prominences, of a light violet hue, appeared at the same part of the limb; but these subsequently disappeared, and a careful search at mid-totality failed to reveal any prominences at all. A similar group, however, burst into view on the opposite limb just before the end of totality, thus indicating that the apparent diameter of the moon was sufficient to cover the whole of the prominence layer of the sun's limb at mid-totality.

The corona was clearly visible near to the western part of the moon's limb eight seconds before the advent of totality, and throughout totality it was very clearly defined. On an average it extended to rather more than one lunar diameter from the limb, but a streamer on the lower western limb was judged

to extend to at least twice this distance. The whole corona had an appearance of movement, suggesting to Mr. Buchanan certain features which occur when a search-light illuminates the atmosphere.

Observations of the partial eclipse are of no great interest as compared with those made during totality, but a number of thermometric readings were recorded at numerous stations. Mr. Spencer Russell, in a communication to the *Standard* for September 2, gives a table of fifteen-minute observations of a wet and dry bulb thermometer, made at Epsom between 11.45 a.m. and 2 p.m. on the day of the eclipse. Whilst the wet bulb readings remained constant at 53° F., the dry bulb showed a minimum temperature of 54° F. between 12.45 and 1.30 p.m. Photographs of the partial eclipse were secured by Messrs. Spencer and Butler during a balloon journey from Wandsworth to Caen in Normandy.

An interesting record of a series of "pin-hole" images of the crescent sun reaches us from Sir Joseph Fayer, F.R.S. Whilst sailing in a ten-ton boat having a large mainsail, he observed the partial eclipse under favourable conditions in Falmouth Bay. About 1 p.m. a slight breeze caused the sail to incline from the perpendicular, and a number of well defined crescent images were projected on to the whitened deck of the boat, and occasionally on to the water. An investigation showed that these images were formed by a series of eyelet holes, used for the balance reef, high up in the sail. The phenomenon was so vivid and the images so sharply defined as to appear worthy of record.

A correspondent to the *Daily Graphic* (September 2), the Rev. Frederick Ehlers, rector of Shaftesbury, Dorset, records the remarkable phenomenon of an evening primrose unfolding itself during the eclipse as if evening had arrived. Observers at the Solar Physics Observatory, South Kensington, were prevented by clouds from seeing the eclipse, except for one or two breaks of short duration. About one minute before last contact, however, the sky suddenly became clear for a short distance around the sun, and brilliant sunshine prevailed as the last trace of the moon left the solar disc.

TECHNICAL EDUCATION IN NATAL.¹

THE report of the commission appointed to inquire into technical education in Natal has just been received. It is signed by eleven out of twelve of the commissioners, and Mr. C. I. Mudie, superintendent of education, has forwarded a minority report.

The commission, under the presidency of Sir David Hunter, K.C.M.G., held eleven meetings and examined fifty witnesses; some of the members were also sent to Johannesburg to confer with the council and board of studies of the Transvaal Technical Institute. Delegates from the Orange River Colony also attended the conference.

The commission finds that Natal, with its European population of 97,109, has as yet but meagre provision for technical and higher education, and, indeed, states that boys who had received primary and secondary education in the colony were frequently found to be so deficient in general knowledge that they were not well qualified to enter upon technical education.

The result of inquiries as to the probability of youths availing themselves of instruction should it be placed within their grasp was decidedly encouraging, and the commission concludes, from the evidence and

statistics, and from the fact that considerable sums are being expended by individuals in Natal on American correspondence classes and private tuition, that there is an urgent necessity for more adequate provision to equip the youth of the colony for the battle of life.

The resolutions of the conference held at Johannesburg point out that there is a present and immediate need for a full teaching university in South Africa, and that the colonies in which the university may not be situated should each have one or more colleges or institutes devoted to higher or technical education which should be recognised by the university council as integral parts of that teaching university, and that the university should grant diplomas in professional subjects, and degrees in arts and science, in the faculties of (1) education; (2) engineering, including mining; (3) agriculture; (4) law; and (5) medicine.

The recommendations of the commission are based upon the resolutions of the conference, and suggest that immediate steps should be taken by the Government to provide for higher education; that a council be appointed by Government to organise and control technical education in Natal which shall be independent of the education department, although that department should be represented on the council. It suggests that specialists be obtained as lecturers in (1) chemistry and metallurgy; (2) physics and electro-technics; (3) natural science (botany, zoology, geology, physiology); (4) pure and applied mechanics; (5) modern history and literature; while other subjects would be taught by local part-time men.

It is suggested that Pietermaritzburg has first claim for this college, but that Durban also has claims, and the commission thinks that the foregoing lecturers should be peripatetic, in the first place teaching at Pietermaritzburg and Durban only, but as occasion required going farther afield.

While appearing to have somewhat wide views as to the subjects that should be taught—for twenty-six branches are mentioned in the list of subjects in which the commission finds there is a need for classes—the estimates of cost are strictly moderate, for the annual expenditure is taken at 6500*l.*, and the initial expenditure to provide the necessary equipment for engineering, chemical, physical, natural science, and other laboratories is estimated at about 2000*l.* It is true that no provision is made in this estimate for rent or capital expenditure on buildings, but we should think even without these the estimate was likely to be exceeded.

All institutions, however, must have a beginning, and those which start with the highest aspirations have a good chance of attaining some, if not all, of their objects. There can be no doubt that technical education should be conducted everywhere quite apart from the education department, and as much as possible under the guidance of men who are acquainted with some at least of the subjects that are being taught. Technical education, especially in the colonies, should be made accessible to everyone, and should more especially offer inducements to those who are working for their living to improve their knowledge of the sciences which underlie their handicrafts. If this be the first object in view, it will be evident that evening classes and evening laboratory work must be undertaken before any attempt is made to form day classes. It appears to be chiefly on this subject that Mr. Mudie dissented from the report of the commission, for he thinks the college at Pietersburg, which, as he says, covers a preparatory, a high school, and a college proper, should form the nucleus of a university college in Natal. It would not seem to be a desirable thing to commence operations in this way for many reasons, the principal of

¹ Colony of Natal. Report of the Technical Education Commission May, 1905. (Maritzburg: P. Davis and Sons, 1905.)