Kodaikánal Observatory.

BULLETIN No. XX.

OBSERVATIONS OF HALLEY'S COMET.

Though the observatory is not equipped with apparatus specially suitable for cometary observations it was considered advisable to do the best we could with the instruments available, since the conditions were very favourable and photographs taken here would fill a blank between those taken in America and Europe.

The Lerebour and Secretan equatorial has attached to it a camera fitted with an old Grubb portrait lens of 5 inches aperture and 33·8 inches focal length which gives good images at the centre of the plate and fairly good definition over a half plate. From April 19 to May 5 the lens was stopped down to 4·85 inches and thereafter to 4 inches. Photographs were taken with this throughout the period when the comet was sufficiently bright See list A.

The camera being rigidly attached to the telescope which was used for guiding, the head of the comet could not be displaced from the centre of the plate and hence the extreme length of tail shown on these plates is only about 4½°. To obtain photographs showing a longer extension of the tail an ordinary half plate camera fitted with a Ross lens of 1·2 inches aperture and 7·8 inches focal length was attached to the telescope and the exposures shown in list B were made.

The guiding was done with a power of 60 on the 6-inch telescope. The eye-piece employed was a positive one in the focus of which was placed a disc of celluloid with a series of lines at right angles to each other ruled on it and a fine pin hole in the centre. In practice one set of the ruled lines was placed parallel to the diurnal motion and the head of the comet was brought into the centre of the pin hole. This was found to afford a very convenient method of guiding when the nucleus was not sharp enough for the use of cross wires.

The mounting of the Lerebour and Secretan equatorial is, unfortunately, not very rigid, which added greatly to the difficulty of good guiding; but the results are, on the whole, decidedly satisfactory.

The weather, though not by any means perfect, was quite as favourable as could be expected at the season, and from April 19 to May 16 there were only 6 days on which no photograph could be obtained.

After the comet became an evening object only a few photographs could be got owing to persistent cloud.

The observers were C. Michie Smith (C.M.S.), S. Sitarama Aiyar (S.S.), and G. Nagaraja Aiyar (G.N.).

List A.—Photographs of Halley's Comet taken with the Grubb Lens.

Scale 1 *mm.*=3′·96.

Date.	Plate.	Exposure. G.M.T. Begins.	Exposure. G.M.T. Ends.	Observer.	Remarks.
1910.		H. M.	H. M.		
April 18	W.W.I.	11 35	11 51	C.M.S.	Underexposed; clock driving badly.
„ 19	W.D.S.	11 15	11 45	„	Good.
„ 20	„	11 18	11 41	„	Good · at least 10 tails.
„ 21	„	11 00	11 43	„	Good; tail greatly contorted.
„ 22	„	11 05	11 45	S.S.	Good.
„ 24	W.W.I.	10 59	11 18	C.M.S	Fair, strong moonlight.
„ 24	D S.	11 19	11 38	„	Do. do.
„ 25	„	11 12	11 34	„	Good, strong moonlight.
„ 26	„	11 10	11 40	S.S	Fair, cloudy till near 11h 30m.
„ 28	„	10 58	11 18	C.M.S.	Good.
„ 28	W W.I.	11 19	11 45	„	Good, tail extends to border of plate.
„ 29	„	10 56	11 24	„	Good; cloudy.
„ 29	S.G E.	11 25	11 44	„	Do.
„ 30	„	10 49	11 11	S.S.	Very good
„ 30	W.D.S.	11 14	11 43	„	Do Many distinct tails.
May 1	„	10 49	11 19	C.M.S.	Very good.
„ 1	S.G E.	11 21	11 42	„	Do.
„ 2	W.W.I.	10 53	11 15	„	Good three principal tails.
„ 2	S.G E.	11 30	11 40	„	Image shifted on plate: clock driving badly.
„ 3	W.W.O.	10 44	11 24	„	Underexposed thin clouds.
„ 3	W.W I.	11 26	11 39	„	Do do.
„ 4	S.G E.	11 16	11 43	S S.	Good.
„ 5	W.W.I.	10 54	11 44	„	Fair: cloudy.
„ 6	„	10 43	11 09	C.M.S.	Underexposed cloudy.
„ 6	S.G.E.	11 11	11 30	„	Do. do.
„ 10	„	10 50	11 10	„	Useless do.
„ 10	W.W.I.	11 11	11 36	„	Poor do.
„ 11	W.D S.	10 55	11 35	G.N.	Fair.
„ 11	I.S.R.	11 36	11 45	„	Do
„ 12	„	10 48	11 04	S.S.	Fair / Good } cloudy from 10h 48m to 11h 04m.
„ 12	W.W I.	11 10	11 37	„	
„ 14	W I.	10 48	11 16	C.M.S.	Good; head very fine.
„ 14	I.S.R.	11 18	11 39	„	Do do.
„ 15	W.W.I.	11 16	11 38	„	Good.
„ 16	S.G.E.	11 14	11 38	„	Good.
„ 23	W.W.I.	2 06	2 38	„	Good; strong moonlight.
„ 24	I.S.R.	2 47	3 00	„	Fair do.
„ 24	W.W.I.	3 02	3 33	„	Good.
„ 25	S.G.E.	2 14	2 35	„	Good; cloudy; nucleus bright but very small, coma diffuse and almost circular.
„ 25	W.W.I.	2 39	2 59	„	Fair.
„ 27	S G.E.	3 20	3 42	S.S.	Fair / Fair } through passing clouds.
„ 27	W.I.	3 46	4 21	„	
„ 29	S G E	3 59	4 39	G.N	Head only
„ 30	W W I.	2 30	3 40	S.S.	Good.
„ 30	S G.E.	4 02	4 17	„	Poor.

List B.—Photographs of Halley's comet taken with the Ross lens.

$1^{mm.}$=17′·5.

Date.	Plate.	Exposure. G.M.T. Begins.	Exposure. G.M.T. Ends	Observer.	Length of tail.	Remarks.
1910.		H. M.	H. M.		°	
May 3	W.W.I.	10 44	11 39	C.M.S.	9	Good.
„ 4	„	11 09	11 43	S.S.	10	
„ 5	W.W.D.S.	10 54	11 44	„	17	
„ 6	„	10 41	11 30	C.M.S.	5	Poor, very cloudy.
„ 10	„	10 48	11 35	„	6	Very poor, very cloudy.
„ 11	„	10 55	11 45	„	28	Good.
„ 12	„	10 48	11 37	S.S.	32	Very good.
„ 14	„	10 47	11 39	C.M.S	26	Good.
„ 15	W.W.I.	11 16	11 38	„	20	Fair. Through clouds.

C. MICHIE SMITH.

Mr. Evershed sends the following account of the apparatus used by him.

For large scale photographs of the comet a reflecting telescope having a parabolic mirror of 9¼ inches aperture and 74 inches focal length was mounted horizontally in an open space outside the observatory buildings. It was supplied with light from a 16 inches coelostat lent by the Joint Eclipse Committee of the Royal and Royal Astronomical Societies.

The telescope was bolted to an iron base consisting of two girders, 6 feet long, placed one above the other and capable of movement with respect to one another through a small arc in azimuth. The girders were supplied by the Cambridge Instrument Company for the purpose of cutting curved slits for the spectrohelio-graph and served admirably as a mounting for the telescope. A fine-threaded screw was attached to one end of the lower girder, its end bearing on the upper moveable girder carrying the telescope. A very delicate slow motion in azimuth (practically equivalent to declination) was thus afforded, the girder being kept in contact with the screw by means of a heavy weight so that the telescope would respond to the smallest movement of the screw in either direction without any "backlash."

Provision had to be made for the considerable motion of the comet in declination after the end of April and the iron supporting frame was itself supported on heavy wood blocks resting on the planed surfaces of thick planks fixed about 2 feet above the ground. By sliding the blocks on the planks the telescope could be readjusted from time to time in azimuth to allow for the varying declination of the comet.

For guiding, a 3 inches telescope of 36 inches focus was attached to the reflector tube near the open end. It was provided with a diagonal eyepiece and cross wires.

Guiding in R.A. was effected by means of an endless cord attached to the slow motion of the coelostat.

A plate holder was constructed of thin brass to carry plates, 3¼ inches square, placed directly in the focus of the mirror and in the centre of the incident beam of light. The box was very little larger than the plates and cut off about $\frac{1}{7}$th of the total light falling on the mirror. It could be readily attached to or detached from its mounting by means of a single clamping screw.

The plates obtained with this instrument show the region of the comet's head on a scale of 1mm.=110″. Owing to the smallness of the field possible with a reflector not more than 2½ degrees of the tail are shown even with the nucleus placed near one corner of the plate. The guiding in R.A. was found to be very difficult on account of the irregularities in the driving of the coelostat, the origin of which was not traced. Star images are in consequence somewhat more elongated in R.A. than is accounted for by the motion of the comet during the exposures. In spite of this defect nearly all the plates show interesting details of structure which could not have been so well obtained with the smaller instruments.

The following is a list of exposures made —

List C.—Photographs of Halley's Comet.

Taken with reflector 9¼ inches aperture, 74 inches focal length, 3¼″ × 3¼″ plates in focal plane.

No	Date.	G.M.T. Begins	G.M.T. Ends.	Plate.	Remarks.
		H. M.	H. M.		
1	April 20	11 23	11 47	W. W. Drop shutter ...	Fair.
2	„ 21	11 14	11 47	Do. ...	Very good.
3	„ 22	11 9	11 47	Do ...	Good.
4	„ 22	11 55	12 0	Do. ..	Fogged by daylight (rejected).
5	„ 24	11 30	11 45	Do. .	Good, but underexposed.
6	„ 25	11 20	11 40	Do. ...	Good, yellow screen used to cut out 3,883 radiation.

Note.—Mr. Evershed left Kodaikánal on 3 months' privilege leave on the afternoon of the 19th and so has not been able to revise the proofs of this Bulletin.—C.M.S.

LIST C.—PHOTOGRAPHS OF HALLEY'S COMET—*cont.*

Taken with reflected 9¼ inches aperture, 74 inches focal length, 3¼″×3¼″ plates in focal plane.

No.	Date.	G.M.T. Begins.	G.M.T. Ends.	Plate.	Remarks.
		H. M.	H. M.		
7	April 26	11 25	11 40	Imp Lantern	Poor.
8	„ 28	11 0	11 36	W.W. Instantaneous ...	Good, two narrow rays branch off on south side.
9	„ 29	11 3	11 35	Do. Drop shutter ...	Fair, tail underexposed.
10	May 2	11 2	11 40	Do. Instantaneous ...	Very good.
11	„ 4	11 18	11 42	Do. Drop shutter ...	Good.
12	„ 11	11 10	11 40	Do. do. ...	Good although very poor sky.
13	„ 12	11 10	11 38	Do. do. ...	Very good, about 12 narrow streamers issue from head.
14	„ 16	11 25	11 47	Do. do. ...	Fair

For small scale photographs showing the outer extensions of the tail, the following exposures were made with small cameras attached to the Cooke Equatorial.

LIST D.—PHOTOGRAPHS OF HALLEY'S COMET WITH SMALL CAMERAS.

Nos. **1** *to* 9 *inclusive taken with camera of* 1·5 *inches aperture*, 11·5 *inches focus.*

10 *to* 13 „ 0·45 „ 5·0 „

No.	Date.	G.M.T. Begins.	G.M.T. Ends.	Plate.	Remarks.
		H. M.	H. M.		
1	April 25	11 11	11 42	Imp. Lantern	Fair, strong branch on south side of tail.
2	„ 26	11 15	11 42	Do.	Fair, tail branched on north side.
3	„ 28	10 53	11 44	Do. . .	Good; tail with 2 branches on south side.
4	„ 29	10 49	11 37	W.W. Drop shutter ...	Fair, but fogged by cirrus.
5	„ 30	10 49	11 40	Seed Gilt edge	Good, tail very irregular at outer end.
6	May 1	10 51	11 44	Do Do.	Do do. irregular but bends in opposite direction.
7	„ 3	10 34	11 42	Seed Process	Underexposed.
8	„ 4	10 55	11 44	Do. Gilt edge	Fair.
9	„ 6	11 5	11 30	Do. do.	Poor, thick clouds.
10	„ 12	11 0	11 40	Do. do. . ..	Good.
11	„ 14	10 45	11 45	Do. do.	Do.
12	„ 16	11 10	11 47	Imp. special rapid ...	Fair.
13	„ 17	10 15	11 32	Do. do .	Upper portion of tail only shown. Guiding was on a star; extremely faint in photograph.

THE SPECTRUM.

Attempts to photograph the spectrum with two slit spectrographs failed owing to unfavourable weather at about the time of the comet's greatest western elongation from the sun The slit spectrograph from which most was expected was designed for use with the reflecting telescope It had a silver-on-glass reflecting slit placed in the focus of the 9¼ inches parabolic mirror, when the latter was not employed for direct photographs of the comet.

The slit, collimating lens of 7½ inches focus, and prism of 60 degrees angle and 1 inch effective aperture, were all mounted in one piece in the central axis of the mirror, the whole cutting off less than 5 per cent. of the light incident upon the mirror. The camera had a lens of 2 inches aperture and 11½ inches focal length placed about 6 inches from the prism and well outside the beam of light entering the telescope.

As the prism was somewhat larger than the image of the 9-inch mirror projected upon its face by the collimating lens, it was used in the position to give greater dispersion than at minimum deviation, no loss of light resulting, and the greater angle of deviation produced was an advantage in arranging the camera.

The whole arrangement was found to be very convenient in use and the comet's head could be plainly seen on the reflecting slit through an aperture in the side of the telescope, without any supplementary mirrors or lenses. By loosening a single screw the entire mounting, carrying slit, collimator, and prism could be removed, and the $3\frac{1}{4}$-inch plate holder substituted for direct photographs

After the spectrograph was completed, only two opportunities occurred for photographing the spectrum, viz., on May 15th and 16th. On both dates the sky was much obscured by streaky cirrus cloud and an exposure of 30 minutes duration in a partially clear interval on the 15th was insufficient to give a measureable image of the spectrum on a pinacyanol plate. The 17th was clear but it was not possible to get an exposure on this date owing to the low altitude of the comet and the brightness of the sky near the point of sunrise.

Viewed in the camera with a pocket lens, the spectrum appeared to be very bright, the comet lines in the green and blue extending entirely across the field of view crossing the narrow continuous spectrum of the nucleus, they could be traced a long distance into the tail and some considerable distance in the opposite direction.

Two spectrographs were attached to the Cooke Equatorial

A direct vision slit spectrograph was mounted in a long wooden box with a collecting lens of $3\frac{1}{4}$ inches aperture and 36 inches focal length. The slit was fixed in the direction of the diurnal motion and a fine screw adjustment was provided in declination so that with a slight movement of the entire spectrograph any object bisected by the cross wires of the main telescope, which was used for guiding, could be brought into exact coincidence with the slit

The camera end of the spectrograph being close to the eyepiece of the large telescope this essential and delicate adjustment could be easily controlled.

With a photographically corrected collimator of 8 inches focus and a visual camera lens of $11\frac{1}{2}$ inches focus a long range of spectrum could be focussed satisfactorily with a slight inclination of the plate.

Several exposures were made with this instrument but only one gave a measurable spectrum, which is much underexposed. It shows details of the blue band at λ 464 to 474 and the two cyanogen lines at 3871 and 3883, quite sharply defined.

The other spectrograph mounted on the Cooke Equatorial was the prismatic camera previously employed in photographing the spectrum of comet 1907 d (Daniel) but modified by using a camera lens of half the focal length and employing two prisms of 60° instead of one. The prisms are the same as were used at the eclipse of 1898 and are very transparent to ultra violet light. They have an effective aperture of nearly 2 inches ($42^{mm} \times 50^{mm}$) and the lens has a focal length of $11\frac{1}{2}$ inches. The prisms were arranged so that the plane of dispersion was normal to the diurnal motion and one of the cross wires in the guiding telescope was carefully adjusted parallel to the diurnal motion. In making the exposures the comet's head was usually bisected and held stationary at the centre of the field, then for the comparison spectrum the telescope was turned on Altair (or Venus) which was brought to the upper edge of the field, bisected by the wire, and allowed to drift along it by the diurnal motion (the driving clock being stopped) until very near the place previously occupied by the comet, when the exposure was stopped. The star or planet was not allowed to impress the plate on the other side of the comet because in that position it would have interfered with the images of the tail.

Strong images of the spectrum of the comet's head with 7 or 8 monochromatic images of the tail have been obtained with this instrument whenever the weather was favourable, but the portion of spectrum more refrangible than K is in all cases underexposed owing to the exceedingly moist condition of the atmosphere

and the tendency to a slight veiling of the sky by thin cloud. Much drier conditions prevailed during April but long exposures could not then be obtained.

All the plates obtained are essentially similar, and from a preliminary examination there appears to be no evidence of change in the spectrum between April 19th and May 15th.

The best plates show the following features:—

(1) A continuous spectrum due to the nucleus in which are faintly shown the principal Fraunhofer lines such as Hδ, Hγ, 4325, 4310, 4270, 4227, Hε, H and K. These are displaced towards the violet with respect to the same lines in the Venus spectrum by a measurable amount notwithstanding the very small scale of the spectra ($1^{mm} = 73$ Å at 4227). Measures of the line 4227 in Venus and the comet on the plate of May 2nd give the displacement = 1·08 Å equal to a relative speed of approach of 77 km. per second. The comet was approaching the earth on this date at about 68 km. per second but to this has to be added the speed of recession of Venus.

(2) A discontinuous spectrum of the gases immediately surrounding the nucleus. Of the bright lines recorded, the cyanogen pair at 3871 and 3883 are by far the strongest and appeared to account for at least two-thirds of the total emission from the head of the comet. Other lines characteristic of the head are shown at the following approximate positions, determined graphically from the dispersion curves obtained from the Venus and Altair spectra:—

4014	
4040, 4049	Probable pair.
4196, 4211	Do.
4255	
4360, 4370	Probable pair.
4630	
4645, 4744	Very strong band in which 5 or 6 separate lines can be seen on some of the plates.

(3) A series of monochromatic images of the tail at the following approximate positions:—

3585	Strong.
369	Faint and broad, perhaps double.
379	Faint, narrow.
4014	Very strong, seems coincident with line in head.
413	Faint.
426	Strong.
456	Strong.
473	Faint.

These radiations appear to be identical with those photographed in comet 1907 d and, as noted in that comet,* they are not prominent radiations in the head excepting 4014 and, perhaps, 473. From the nature of these objective prism spectra the wave-lengths of the tail lines cannot be determined with any precision. The radiation at 3585± in Halley appears relatively much stronger than in 1907 d, but this may be due to the very poor atmospheric conditions prevailing at the time of the 1907 apparition.

The spectrum of the comet as a whole appears to be identical with that of 1907 d so far as can be judged from the above preliminary results. The cyanogen emissions predominate in the head and the carbon spectrum discovered by Fowler in high vacua seems to represent the radiations of the tail. It is unknown to the writer, however, whether the three ultra violet tail images agree in position with the lines in Fowler's carbon spectrum.

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* *Monthly Notices*, LXVIII., 17.

The following is a list of exposures made with the prismatic camera :—

LIST E.—PHOTOGRAPHS OF SPECTRUM OF HALLEY'S COMET.

Prismatic Camera with two 60° prisms, 1·7 inches effective aperture and lens of 11·5 in. focus.

No.	Date.	G.M.T. Begins.	G.M.T. Ends.	Plate.	Remarks.
	1910	H. M.	H. M.		
1	April 18	11 29	11 49	W.W. Panchromatic ...	Cyanogen lines and faint continuous spectrum only.
2	„ 19	11 8	11 50	Do. Drop shutter ...	Good.
3	„ 20	11 6	11 49	Do. do.	Good.
4	„ 21	10 57	11 48	W. Pinacyanol bathed ...	Underexposed.
5	„ 22	11 9	11 47	W.W. Drop shutter ...	Fogged and poor focus (1 prism only)
6	„ 24	11 8	11 45	Do do ...	Fogged and under-exposed (1 prism only).
7	„ 25	11 11	11 42	Do. do. ...	Do. do.
8	„ 26	11 15	11 42	Do. do. ...	Altair accidentally superposed on comet spectrum (1 prism only).
9	„ 28	10 53	11 44	Do. Instantaneous ...	Good.
10	„ 29	10 49	11 37	Do. Drop shutter ...	Good but fogged by cirrus and moonlight.
11	„ 30	10 49	11 40	Do do. ...	Very good.
12	May 1	10 51	11 44	Do. do, ...	Very good.
13	„ 2	10 42	11 42	Do. do. ...	Good, comet allowed to drift in R. A. to lengthen lines.
14	„ 3	10 34	11 42	Do. do. ...	Fair.
15	„ 4	10 55	11 44	Do. do. ...	Good.
16	„ 6	11 5	11 30	Do. do. ...	Poor, thick clouds during last 10m of exposure.
17	„ 10	11 7	11 30	Do. do. ...	Thick clouds, plate useless.
18	„ 11	10 53	11 42	Do. do. ...	Very good.
19	„ 12	11 0	11 40	Do. do. ...	Good.
20	„ 14	10 45	11 45	Do. do. ...	Poor.
21	„ 15	11 15‡	11 40±	Cadett. Royal Standard ortho	Very poor, sky thick.
22	„ 16	11 10	11 47	do.	Plate useless. Comet's head very low in sky Altair impressed on the plates for comparison up to April 30th From May 1, Venus impressed as a comparison spectrum.

JOHN EVERSHED.

THE TRANSIT ACROSS THE SUN'S DISC.

The following programme was arranged for the morning of the 19th when the comet was expected to transit the sun :—

(1) A detailed examination of the sun's disc by eye observations with the 6 inches Lerebour and Secretan equatorial.

(2) A series of photographs of the sun to be taken with the photoheliograph on lantern plates with short exposures.

(3) A series of photographs of parts of the sun on a scale of about 40-inches to the sun's diameter with the 40-foot lens and a negative enlarging lens.

(4) A series of monochromatic photographs to be taken with the spectroheliograph, with the camera slit set on the head of the cyanogen fluting at wave-length 3883.

Long exposures were to be given before ingress and after egress, short exposures during the transit. By the former it was hoped to photograph the comet as a bright spot outside the sun's limb and by the latter the comet was expected to appear as a dark absorption marking on the bright back ground of the photosphere.

(5) Two or three photographs to be obtained during the transit with the camera slit set on the calcium line K for comparison with the others.

(6) At about the time of mid transit some spectrum photographs of the cyanogen fluting at 3883 were to be taken with the large grating spectrograph, using the 3rd order spectrum and observing at the same time

in the region of the blue band in the comet's spectrum, with a telescope directed to the first order spectrum. The guiding arrangement used for photographing sun spots was to be employed in "feeling" for the comet by giving small movements to the sun's image on the slit plate.

The calculated time of the comet's ingress, as communicated to us some time before, was $7^h\ 50^m$ and so everything was in readiness at $7^h\ 40^m$ but the sky was almost completely overcast, except for a short gleam of sun which enabled the instruments to be finally adjusted. It seemed evident that we could not hope to carry out any part of our programme, but at 8 o'clock we received a Kiel telegram giving the corrected time of ingress and egress as $8^h\ 59^m$ and $9^h\ 59^m$ I.S.T. This was fortunate, for the sky remained almost overcast till after 9 o'clock, but there were a number of clear intervals between 9^h and 10^h, though the sun was never quite free from thin drifting clouds. This was in some ways an advantage since the definition, which usually deteriorates very rapidly after 9 o'clock, remained remarkably good and the finest details of the sun's surface could be seen clearly even with powers of 120 and 200 on the six-inch refractor. No long exposures spectroheliograms were attempted as the sky near the sun was never clear enough, but a few photographs of the disc were obtained in the cyanogen radiation, the last being exposed at $10^h\ 19^m$ I.S.T. after which there was another long interval of cloud. Excellent photographs were obtained with the photoheliograph, but those taken on a large scale with the 40-foot lens were less satisfactory.

RESULTS.

1. The direct observations were carried out under very favourable conditions of seeing but yielded no result—not a trace of the comet being even suspected at any time.

2. Photographs of the sun on a scale of 8 inches to the sun's diameter were obtained as shown in the following list:—

LIST F.

No.	Exposed. I.S.T.			Remarks.
	H.	M.	S.	
1	9	31	59	Good.
2	9	38	16	Do.
3	9	54	39	Do.
4	9	58	12	Thin passing clouds.
5	10	05	51	Fair.
6	10	16	58	Do.

No trace of the comet has been found on any of these plates, which show much detail of the sun's surface, but a more complete examination will be made when the exact path of the comet over the disc has been determined.

3. Four large scale photographs were obtained. Their quality is much inferior to that of the 8-inch plates.

4. Eight monochromatic photographs of the disc in the cyanogen radiation 3,883 were obtained at the following times:—

No.	Mid exposure. I.S.T.			Remarks
	H.	M.	S.	
794	8	59	04	Image moved during exposure, photographs not round.
796	9	32	13	Fair, much cloud.
797	9	35	08	Poor do.
798	9	38	07	Fair } Good definition of details.
799	9	56	01	Do. }
800	9	59	04	Poor, much cloud.
801	10	02	14	Very poor and underexposed.
802	10	19	05	Good.

All these plates are much streaked with cloud, but Nos. 796. 798, 799, and 802 are otherwise good and show much detail all over the disc. If the times of ingress and egress as transmitted to us from Kiel are not greatly in error, the three plates 796, 798 and 799 should show the comet. A preliminary examination however gives a negative result and it is certain that if the comet is shown at all it must be too small and faint to be readily distinguished from the innumerable small markings, both dark and light, which appear in all parts of the disc.

Plate No. 802, curiously enough, shows an intensely dark spot (light in the negative) with ill-defined edges. This cannot be the comet seeing that the plate was exposed 20 minutes after egress and the spot is situated north instead of south from the centre. Under a lens the spot does not look like a defect in the film.

C MICHIE SMITH.
JOHN EVERSHED.

OBSERVATIONS OF THE TAIL BEFORE AND AFTER THE DAY OF TRANSIT.

On the mornings of May 17th and 18th the tail was a magnificent spectacle between 4 and 5 A.M. Passing over the star θ Aquilae it could be traced as far as the milky way, or between 90 and 100 degrees from the head. The portion of tail nearest to the earth and 90° from the sun did not appear any wider on the 18th than on the previous day, although its actual distance from the earth must have decreased greatly during the 24 hours.

On the 19th the sky was much obscured by hazy cloud through which the tail could be plainly seen. Its width was estimated from a rough measurement to be $6\frac{1}{2}$ degrees at about 20 degrees altitude.

On the morning of the 20th the sky was entirely overcast at the place of observation near Kodaikánal Road Railway station. In the evening of that day when at sea off Tuticorin the head of the comet was visible shortly after sunset. It had a short and evidently much *foreshortened* tail directed away from the sun.

On the 21st, when nearing Colombo, the tail was again observed in the east at 4–30 A.M. no broader than on the 18th but apparently fainter. Passing centrally through the square of Pegasus, which was nearly filled with the faint light, the tail could be traced as before right up to the milky way. The star η Pegasi was nearly in the centre of the band of light and the star θ Aquilae near its southern edge.

This was the last observation I was able to make of the sky before dawn. It seems remarkable that the tail should have remained visible in the morning sky as a narrow band of light nearly two days after the head of the comet had passed to the other side of the sun. A part of the tail on the 19th must have been rapidly approaching the earth and it might have been expected to widen out and disappear, since it must have enveloped the earth on the 20th at latest.

At $4^h\ 30^m$ I.S.T. on the 21st the comet's head had passed far to the east of the sun and was presumably developing the tail seen the previous evening in the normal position, *i.e.*, directed away from the sun and towards the east. Yet the greater part of the tail remained on the west side of the sun, apparently still many millions of miles from the earth judging by its small width. If continuous with the head it must have passed right through the sun's position and might have been expected to appear as an abnormal tail on the sunward side of the comet.

No trace of a tail directed towards the sun could be seen on the evening of the 20th (or on the 21st) although specially looked for, but the sky was very bright with the evening twilight and with moonlight.

The extraordinary persistence of the light in the eastern sky may perhaps be explained by supposing the tail to be strongly curved and very broad in the direction of the comet's motion although narrow and straight in the direction at right angles to this. If so, the passage of the earth through the tail must have occupied much more time than a single day.

KODAIKÁNAL OBSERVATORY,
22nd June 1910.

J. EVERSHED.

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