Shufeldt (R. W.)

WASHINGTON OBSERVATIONS FOR 1880—APPENDIX I.

OBSERVATIONS

OF THE

GREAT COMET OF 1882,

MADE AT THE

UNITED STATES NAVAL OBSERVATORY.

REAR ADMIRAL R. W. SHUFELDT, U. S. N.,
SUPERINTENDENT.

PREPARED BY
WILLIAM C. WINLOCK,
ASSISTANT ASTRONOMER.

WASHINGTON:
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2359 APP I——1

TABLE OF CONTENTS.

UNITED STATES NAVAL OBSERVATORY,

Washington, D. C., July 31, 1883.

SIR: I have the honor to present, herewith, according to your instructions, a collection of the observations of the Great Comet of 1882 made at this Observatory.

Very respectfully,

WILLIAM C. WINLOCK,

Assistant Astronomer.

Rear-Admiral R. W. SHUFELDT, U. S. N.,

Superintendent United States Naval Observatory.

INTRODUCTION.

All the observations made upon the Great Comet of 1882 (Comet II (*b*), 1882) at the Naval Observatory are here collected and arranged in a form in which they will be readily available. Observations of position, with the transit circle and equatorials, and descriptions or measurements of the nucleus, head, tail, and "outer-envelope," are arranged, first chronologically, and then summarized in tables, and illustrated by drawings.

Most of the work was done by the observers at such times as could be spared from more important duty, and this will, perhaps, account for the lack of completeness of the observations in some particulars; but it is hoped that the data presented will be found of value by any one desiring to make a complete discussion of this very interesting comet.

POSITION OF THE OBSERVATORY:

Latitude $= 38^{\circ}\ 53'\ 38''.8$* North.
Longitude $= 5^{h}\ 8^{m}\ 12^{s}.09$† West of Greenwich.

OBSERVERS.—The observers taking part in the observations were:

Prof. A. HALL, U. S. N.
Commander W. T. SAMPSON, U. S. N.
Prof. J. R. EASTMAN, U. S. N.
Prof. EDGAR FRISBY, U. S. N.
Assistant Astronomer A. N. SKINNER.
Assistant Astronomer WILLIAM C. WINLOCK.

INSTRUMENTS.—The instruments employed were:

The 26-inch Equatorial, with magnifying powers of 186 and 383 diameters. The value of one revolution of the micrometer screw, 9″.94790, or with sufficient accuracy for our present purpose 9″.95, is that given by Professor HOLDEN in Appendix I, Washington Observations, 1877, page 41. A full description of the instrument may be found in Appendix I to the Washington Observations for 1874, page 26.

The *finder* to the 26-inch Equatorial has an aperture of about 5 inches, magnifying power 30.

The 9.6-inch Equatorial.—The magnifying power was not particularly noted, but was, on nearly every occasion, that of 132 diameters. The value of one revolution

*Washington Observations, 1864, Introduction, p. xliv.

†Report of the Superintendent of the United States Coast Survey, 1874, p. 182.

September 23.8, 1882. Observer: Skinner. 9.6-inch Equatorial.

Two independent pointings were made upon α Hydræ to determine the corrections to the circles, then three independent determinations of the comet's right ascension, and two of declination.

September 28.7, 1882. Observer: Skinner.

Very brilliant and splendid object.

NUCLEUS very sharp and stellar.

TAIL reached from nucleus fully half way to α Hydræ (15°). At its extremity it was about 1°.5 broad. A dark streak extended down the tail. Tail slightly curved, with concavity on north side.

September 29.7, 1882. Observer: Frisby 9.6-inch Equatorial.

Five independent observations of the comet's position were made, and the corrections to the circles were found from three similar observations of α Hydræ.

The NUCLEUS was extended about 15″ in the direction of the tail, was quite irregular in shape, and not more than 3″ wide in the widest part.

The TAIL was well defined and sharp, about 15° in length, terminating suddenly.

October 1.7, 1882. Observer: Frisby. 9.6-inch Equatorial.

Five observations of the position of the comet were made and the circles corrected by a pointing on α Hydræ.

October 2.8, 1882. Observer: Winlock. 9.6-inch Equatorial.

Examined the NUCLEUS of the great comet with a magnifying power of 132 diameters. It presented a woolly appearance and was almost circular, with a slight indication of "wings" projecting on each side. No record was made of any elongation or division.

Seeing was not very good, and the comet was lost in the mist and twilight.

The TAIL extended about 0.9 of the distance to α Hydræ (19°) and seemed remarkably narrow.

The rapid approach of daylight prevented an accurate observation of position.

October 4.7, 1882. Observer: Frisby. 9.6-inch Equatorial.

"Comet *north, following* star." Eight comparisons of star and comet were made in right ascension and four in declination. The star was identified as Weisse X, 539, or Schjellerup 3883. In the reduction, half weight was given to the Weisse place.

The NUCLEUS was somewhat longer and was more spread out than on previous mornings. There was a small central condensation, about 0.75 of the length of the nucleus from its upper end, *i. e.*, from the end nearest the tail. This central condensation was the point observed.

The TAIL was 17° to 18° long.

October 6.7, 1882. Observer: Frisby. 9.6-inch Equatorial.

"Comet *north, following* star." Thirty-one comparisons of right ascension were made, and seven of declination. The star was identified as Weisse X, 515, or Lamont 753.

"The NUCLEUS this morning has at least two condensations of light, possibly three; it is, however, continuous. The north side of the tail has another faint but well-defined envelope extending beyond the head. A vacant space commenced about half way up the tail and extended out to the extremity farthest from the head."

October 6.7, 1882. Observer: Winlock. 9.6-inch Equatorial. 4-inch Comet-Seeker.

I examined the nucleus with the 9.6-inch equatorial, magnifying power of 132, and the outline of the head and tail, with the comet-seeker having an eye-piece magnifying thirty times.

NUCLEUS.—The nucleus seemed to be made up of three bright points; the middle point being the largest and brightest; the following point, or one towards the sun, scarcely visible, and the preceding point indistinct and prolonged in the direction of the tail. The light was nowhere discontinuous between these points, and in the comet-seeker the nucleus presented itself as an oblong, nebulous mass.

The width of the main point of condensation, and its accompanying envelope, from a rough measurement with the micrometer, was 0.29 rev. (1 rev. = 15″.378), or about 4″, and its length about three times its width, or 12″. The whole length of what we may call the nucleus, that is, of the nebulous mass immediately surrounding and connecting the three bright points, was estimated at 25″ or 30″.

HEAD.—The head was not symmetrically disposed about the nucleus, but extended farther out on the upper or southern side than on the northern side. I noticed, also, that the axis of the head was slightly inclined to that of the nucleus. The head was a little flattened on the north. Nucleus and head disappeared in the 9.6-inch at 17h 50m, Washington mean time.

TAIL.—The tail extended about seven-eighths of the distance to α Hydræ, or about 17°. On the northern side it was slightly concave, and was brightest about 8′ from the head, near the southern side, while just north of this bright part was seen an almost black "fissure" extending 4′ or 5′. At its extremity the tail was about 3° wide, but was broken and ragged on the northern edge.

OUTER-ENVELOPE.—There was noticed, for the first time, what appeared to be a faint, nebulous "outer-envelope," some 30′ to 45′ in width, projecting about 65′ beyond the head, but not completely surrounding it. At first I could trace this envelope on the northern side only, extending in an almost straight, faint, but very sharp line, in a direction generally parallel to the axis of the head, and about 0°.5 distant, till it was lost, about 1° beyond the head. A little later, as the twilight was increasing, I made out a streak south of the head but much closer in, extending no further than the head. This envelope was brightest near the outer edge and faded away till there was hardly a trace of it close in to the head proper. I followed it back several degrees in the direction of the tail. On the south side it passed outside a star of the 7th magnitude, afterwards identified as Weisse X, 515, while on the north it passed just inside a 9th

magnitude star identified as Weisse X, 526. The observations were made at about $17^h.5$, mean time.

Plate V, *October* 6.71, will show, as accurately as the scale will permit, the outlines of the outer-envelope and tail, plotted by the help of α Hydræ and the Weisse stars mentioned above.

October 7.7, 1882. Observer: Winlock. 9.6-inch Equatorial. 4-inch Comet-Seeker.

NUCLEUS.—When the nucleus first appeared above the fog, I failed to make out any bright points of condensation; later, however, as the seeing became better, the condensations were seen by Professor EASTMAN and Commander SAMPSON. At $17^h.3$, mean time, thick fog prevented further observations.

TAIL.—The tail, to the naked eye, extended to within 1° of α Hydræ (*i. e.*, 17° in length), though with the aid of the comet-seeker it was followed by Professor EASTMAN up to that star. It was nearly 5° wide at its extremity, and 2° wide at a distance of 3° from the head. The southern side was sharp, well defined, and, near the middle, very bright, with the same black fissure noticeable immediately next this bright part; the northern side was broken and discontinuous.

OUTER-ENVELOPE.—I think this "envelope," especially on the southern side, was a little more pronounced than it was yesterday morning. There were no stars conveniently situated for plotting the exact outlines, but a sketch from careful estimations is given in Plate V, *October* 7.71. The light extended but very little beyond the head of the comet.

October 8.7, 1882. Observer: Frisby. 9.6-inch Equatorial.

"Comet *precedes*, *south* of star." Twenty-two comparisons in right ascension were made, and seven in declination. The star was Weisse X, 472, or Lamont 742.

NUCLEUS.—The condensation of parts of the nucleus was much more decided than on previous mornings. At least three of these condensations were seen: the brightest one beyond the middle, towards the tail; one near this, towards the tail, and one rather spread out, towards the head.

TAIL.—There appeared to be a fan-shaped division in the tail.

October 9.7, 1882. Observer: Eastman. 9.6-inch Equatorial.

Compared comet with 9th-magnitude star, *south*, *preceding;* six comparisons of right ascension, and four of declination. Both ends of the nucleus were observed, the difference of right ascension between the ends being $2^s.12 = 31''.8$.

The star was identified as Weisse X, 437. In the table on page 36 the right ascension of the *following* end of the nucleus is given, and the declination of the center. To reduce the observed right ascension, to the center of the nucleus, a correction of $-1^s.06$ must therefore be applied.

October 9.7, 1882. Observer: Winlock. 9.6-inch Equatorial. 4-inch Comet-Seeker.

NUCLEUS.—The comet-seeker showed the nucleus as a hazy but very bright, elongated mass, still a little eccentric with regard to the head. With the 9.6-inch

equatorial and the usual power of 132, I could not, at first, make out the "grains" composing the nucleus, but at $17^h\ 10^m$, mean time, with twilight increasing and a much clearer atmosphere, I made out four distinct points and a "tail." These points were situated on a curve slightly convex towards the south.

The nuclear mass was narrower than when last observed; its length about five times its width.

A sketch of the nucleus and head as they appeared at this time in the 9.6-inch equatorial is given in Plate I.

TAIL.—The tail, to the naked eye, extended 0.9 of the distance to α Hydræ, or 14°. In the comet-seeker it was followed to α Hydræ, a distance of about 16°. The fork in the tail near α Hydræ had become more conspicuous.

OUTER-ENVELOPE.—The outer-envelope was better defined than before, and extended farther around the head. The head and envelope were plotted from the positions of the stars Weisse X, 435, 437, 450, and two faint stars not identified. Plate V, *October* 9.71.

October 10.7, 1882. Observer: Winlock. 9.6-inch Equatorial.

NUCLEUS.—The beaded appearance of the nucleus was still its most prominent characteristic. I could not distinguish more than three of the bright points, the middle one being broader and rounder than any I had seen on the previous morning. This appearance may have been due to the poor seeing. From a micrometer measurement, the width of the nucleus at its broadest part was 0.585 rev. = 9″. The curvature of the nucleus was not noticeable.

TAIL.—α Hydræ was just beyond the northern corner of the tail, which was therefore 16° long.

Stars from the third to seventh magnitude were seen, with no apparent diminution of brightness, through the most dense portions of the tail.

OUTER-ENVELOPE.—The outlines of the outer-envelope and tail are given in Plate V, *October* 10.71. The envelope was brighter and more sharply defined than before.

October 14.7, 1882. Observer: Eastman. 9.6 inch Equatorial.

"Compared comet with two *preceding* and *north* stars." The *preceding* of the two was Weisse X, 282, and upon this the comet's position depends. The second star was not identified. Twenty-five comparisons in right ascension were made, and three in declination. Both ends of the nucleus were observed, the difference in right ascension between the two ends (practically the length of the nucleus) being $2^s.87 = 43'.05$.

In the table on page 36 the right ascension of the *following* end is given and the north polar distance of the center, as observed. To reduce the right ascension to the right ascension of the center a correction of $-1^s.44$ must be applied to the tabular quantity.

October 14.7, 1882. Observer: Winlock. 9.6-inch Equatorial. 4-inch Comet-Seeker.

NUCLEUS.—$16^h\ 20^m$ mean time: seeing very poor. Nucleus appeared as a woolly mass with no bright points visible. At $17^h\ 15^m$, dawn coming on, and seeing as good

as at any time during the morning, still none of the bright, stellar-like points were made out. The *following* end of the nucleus was more condensed than the *preceding*: in the comet-seeker the nucleus was quite round.

Head.—The head was a little flattened on the northern side.

Tail.—The tail was about 17° long and about 3°.5 broad at the end. The division or fork extended 3° or 4° from the northern corner, down towards the head. The dark fissure in the tail near its middle was still noticeable.

Outer-Envelope.—$17^h.5$, mean time. A number of quite bright stars, conveniently situated and subsequently identified, enabled me to plot with considerable accuracy the limits of this envelope, which now seemed almost closing in around the head. On the northern side the envelope extended as a thin streamer from a point just south of the star Weisse X, 418 (about 1′.5 beyond the head), through Weisse X, 274, which was on its outer edge, backwards till it blended into the light of the tail. On the southern side this "veil" could be traced only about half a degree beyond the head. Following it towards the tail and passing about 5′ south of Weisse X, 236, it was lost in the brighter mass of the tail. The form and position of the envelope are given in Plate V, *October* 14.71.

October 15.7 and 24.7, 1882. Observer: Sampson. 4-inch Comet-Seeker with Spectroscope.

"Examined spectra of nucleus and tail. The former consisted of three bands usually seen in spectra of comets. All three were brightest and sharpest on least refrangible side, the central band being much brighter than either of the others. The spectrum of the tail was continuous, but brightest in the green."

October 24.7, 1882. Observer: Frisby. 26-inch Equatorial.

Comet *south*, *following* star. Seventeen comparisons in right ascension were made, and four in declination. Star identified as O. Arg. S. 10429—30.

October 24.7, 1882. Observer: Winlock. 26-inch Equatorial.

Nucleus.—The nucleus was much elongated, with a decided point of condensation near the *following* end. A sketch (Plate I), made with a magnifying power of 186 diameters, shows that four and perhaps five "*heads*" could be distinguished, the second one (counting from the *following* end) being by far the most prominent.

Head.—The head was nebulous and ill-defined: a little flattened on the northern side.

Tail.—The tail was about 12° long: somewhat fainter than when last seen: brighter on southern than on northern side.

Outer-Envelope.—The outer-envelope was looked for with the 5-inch finder attached to the Great Equatorial, but was not seen. Seeing good.

November 27, 1882. Observer: Winlock. 26-inch Equatorial.

NUCLEUS.—Observations made at about 17^h, mean time. The nucleus was fainter and more elongated than on October 24. Three, and perhaps four, bright points could be made out, with an indistinct nebulous mass *preceding* and *following*. The points were, as on October 9, on a curve a little convex towards the south.

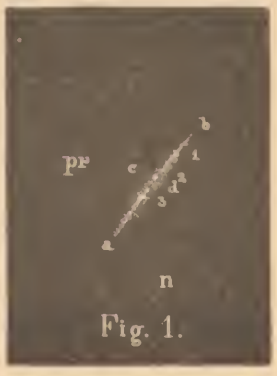


Fig. 1.

Calling these points in their order from the *following* end, or end towards the sun, 1, 2, 3, etc. (Fig. 1), the following measurements were made with the filar micrometer for determining the distances between the points 1 and 2, 1 and 3.

The value of one revolution of the micrometer screw is $9''.9479$. (See Appendix I, 1877, page 41.)

Coincidence of fixed and movable thread at $63^r.995$.

Micrometer Measures of Nucleus.—November 27, 1882.

Points	Reading of Microm. Head.	Distance in Revolutions.	Distance in Seconds of Arc
	r	r.	″
1 to 2	65.27	1.27	12.6
	65.23	1.23	12.2
	65.26	1.26	12.5
Mean			12.4
1 to 3	66.32	2.32	23.1
	66.29	2.29	22.8
	66.22	2.22	22.1
Mean			22.7

The *first* column shows the points of the nucleus upon which the threads of the micrometer were placed;

The *second* column gives the separate readings of the head of the micrometer:

The *third* column, the distance in revolutions, found by subtracting $64^r.00$ from these separate readings;

And the *fourth* column, the distances in revolutions converted into arc.

The mean result from the three observations in each case is given in the line marked "Mean."

A single setting was made to obtain the extreme length of what should be called the "nucleus"; that is, the chain of bright points with the envelope immediately surrounding them. This length was $5^r.62 = 55''.9$.

In like manner double the width of the nucleus was found to be $10''.4$; or the width of the nucleus about $5''$.

HEAD.—The head was flattened on the *north, following* side.

TAIL.—The tail was 10° or 12° long, of the same general appearance as before: a little fainter. Seeing good.

November 2.7, 1882. Observer: Sampson. 26-inch Equatorial.

A series of micrometer measures of the nucleus gave the following results. The "Points" referred to are shown in Fig. 1, page 15:

Points 1 to 2 = 10″.1 (mean of 6 observations).
Points 2 to 3 = 9″.9 (1 observation).

Length of Point 1 measured in the direction 1 to 2, from a single observation, 7″.2

November 5.7, 1882. Observer: Sampson. 26-inch Equatorial.

A series of micrometer measures of the nucleus was made with the following results (Fig. 1, page 15):

Points 1 to 2 = 16″.4 (mean of 3 observations).
Points 1 to 3 = 26″.1 (mean of 3 observations).

November 8.7, 1882. Observer: Winlock.

The comet was still quite bright.

Tail about 10° long; much brighter along the southern than along the northern side.

November 13.7, 1882. Observer: Winlock. 26-inch Equatorial.

The comet was seen through occasional breaks in the clouds.

Nucleus.—The development of the nucleus has continued. The sketch made on this date (Plate II) shows the two prominent points of condensation with a third, and perhaps fourth, out in the direction of the tail. The whole nucleus is in shape not unlike a longitudinal section of a weaver's shuttle.

The distance between the first and third bright points (Points 1 and 3, Fig 1, page 15), from three micrometer measurements, was 2ʳ.34 = 23″.3.

Tail.—The tail could be traced for about 10° from the nucleus. It was a little more "fan-shaped" and somewhat fainter.

A pencil sketch shows the cleft running down 4° or 5° from the northern corner. The southern half of tail is shown as the brighter.

November 15.7, 1882. Observer: Winlock. 26-inch Equatorial. Transit Circle.

Nucleus.—A magnifying power of 383 diameters was tried with the 26-inch equatorial, but under it the nucleus appeared as a long, narrow, nebulous mass, with a little more light towards the *following* end. Using a magnifying power of 186, better results were obtained, and the measurements in the table below were made. The sketches on this date show but two points of condensation, the *preceding* one being extended in a narrow ridge of light in the direction of the tail. The nucleus was very much elongated, narrow, hazy, and indistinct.

The *position angle* of the major axis of the nucleus, or of the line joining the points 1 and 2, was measured by bringing the nucleus between the micrometer wires set about 10″ apart; the reading of the position circle was then 12°.0, and the zero of the circle being at 321°.4, we have for the resulting position angle

309°.4.

In making the measures of distances in the table, the position circle read 99°.2; consequently these measured distances must be multiplied by cos 2°.8 to give true distances.

In the following table are the separate readings of the micrometer and the reduction to seconds of arc. Figure 2 will show the part of the nucleus indicated in the column headed "Points." The other columns are, I think, sufficiently explained by themselves.

Fig. 2.

Coincidence of fixed and movable micrometer threads at 63' 964. (One revolution of screw = 9″.95.)

Micrometer Measures of Nucleus.—November 15.7, 1882.

Points.	Reading of Microm. Head.	Distance in Revolutions.	Distance in Seconds of Arc.	Dist. in Secs. of Arc × cos 2° 8.
	r.	r.	″	″
1 to 2	65. 731	1. 767	17. 6	17. 6
	65. 700	1. 796	17. 9	17. 9
	65. 765	1. 801	17. 9	17. 9
	65. 790	1. 826	18. 2	18. 2
	65. 830	1. 866	18. 6	18. 6
Mean				18. 0
1 to 1	71. 303	7. 399	73. 6	73. 5
	70. 752	6. 788	67. 5	67. 4
	71. 804	7. 840	78. 1	78. 0
	71. 042	7. 078	70. 4	70. 3
	70. 832	6. 868	68. 3	68. 2
Mean				71. 5
2 to 1	67. 112	3. 148	31. 3	31. 3
	67. 736	3. 772	37. 5	37. 5
	68. 698	4. 734	47. 1	47. 0
Mean				38. 6
1 to 2	64. 894	0. 930	9. 3	9. 3
	65. 069	1. 105	11. 0	11. 0
	64. 920	0. 956	9. 5	9. 5
Mean				9. 9

In measuring from such indefinite things as the nebulous ends *a* and *b*, discrepancies in the readings, such as the table shows, are to be expected.

The distance *a* to *b*, the total length of the nuclear mass, is evidently—

$$71''.5 + (38''.6 - 18''.0) = 92''.1.$$

The TAIL was about 10° long, with a dark channel running down to about the middle.

A *transit circle* observation of position, the first it has been possible to obtain

since September 20.96, was made this morning. I picked up the nucleus readily by sweeping; it was very much elongated, woolly, and a difficult object to observe. I observed what, from previous examination with the 26-inch, I judged to be the position of the main point of condensation near the *following* end. This is shown in Plate IV, "November 15.74, 1882."

November 17.7. Observer: Sampson. 26-inch Equatorial.

The extreme length of the nucleus, *a* to *b*, Fig. 2, page 17, from the mean of two measures was 80″.6.

November 18.7, 1882. Observer: Winlock. 26 inch Equatorial. Transit Circle.

NUCLEUS.—I noticed that the light was more "bunched" about the "*sunward*" end of the nucleus than ever before. (26-inch Equatorial, $17^h\ 10^m$, mean time.)

For the position angle of the major axis of the nucleus, the following settings were made:

		°
Circle Readings	- -	10.0
		13.2
Mean	- - - -	11.6

Resulting position angle

309°.8.

But two points of condensation in the nucleus were seen. Several measurements of the distance between these points were made under a magnifying power of 186 diameters, and are given in detail. The micrometer threads being inclined at an angle of 83°.7 to the line joining the points in question, the measured distances are to be multiplied by the sine of that angle to reduce them to true distances.

The coincidence of fixed and movable threads was assumed at 63r.996 (Value of 1 rev. = 9″.95.)

Micrometer Measures of Nucleus.—November 18.7, 1882.

Points.	Reading of Microm. Head.	Distance in Revolutions.	Distance in Seconds of Arc.	Dist. in Secs. of Arc × cos 6°.3.
	r.	r.	″	″
1 to 2	61.982	2.014	20.0	19.9
	61.958	2.038	20.2	20.1
	61.870	2.126	21.1	21.0
	62.000	1.996	19.9	19.8
	61.946	2.050	20.4	20.3
Mean				20.2

HEAD.—The head was indistinct and ill-defined.

TAIL.—The tail was about the same length as on November 15, and seemed of about the same width as a month ago. It was less curved.

For the transit circle observation the seeing was better than on November 15. Dark field was used, and the main point of condensation near the *following* end of the nucleus observed. (Plate IV, "November 18.73, 1882.")

November 18.7, 1882. Observer: Sampson. 26-inch Equatorial.

Micrometer measures of nucleus: (Fig. 2, page 17.)

Points 1 to 2 = 20″.3 (mean of 3 observations).
Points 1 to 3 = 33″.0 (1 observation).

November 20.7, 1882. Observer: Winlock. Transit Circle.

With the 26-inch I made no observations. The following notes were made in connection with the transit circle observation of position. (Aperture, 8.5 inches; magnifying power, 186.)

Nucleus.—No sharp point of condensation could be seen, though the nucleus was decidedly brighter near the *following* end. It was this brighter part that I observed. (Plate IV, "November 20.72, 1882.") A star of about 8.5 magnitude was immediately *south, following* the nucleus, and is given in its estimated position in Plate IV. Seeing, fair.

Head.—The head, as it entered the field, was quite well defined, especially on the northern side.

Tail.—The tail I could make out in the transit circle, crossing the field about 3 minutes before the nucleus. To the naked eye it was about 15° long, and at its extremity its width was about equal to the distance between the stars δ Orionis and ζ Orionis, or about 3°. The split in the tail, extending more than half its length, was still noticeable.

November 21.7, 1882. Observer: Winlock. 26-inch Equatorial. Transit Circle.

Nucleus.—Examined the nucleus carefully with the 26-inch Equatorial; power, 186. It was more extended and was narrower than on previous dates, presenting a thin line of light with two bright points of condensation. (A drawing of the head and nucleus is given in Plate II.) In size and brightness I could detect but little difference between these points. If there is any difference, the preceding is a little the smaller

For the position angle of the nucleus the following settings were made:

Circle Readings - -	$\left\{\begin{matrix}8.15\\7.13\end{matrix}\right.$	°
Mean - - - -	7.64	

giving for the position angle

313°.8.

Head.—The *north, following* side was quite sharp and clearly defined, but on the *south* side there was no distinct outline.

Tail, 11° in length.

In making the transit circle observation I tried to observe the brightest part of the nucleus, near the following end. Observation quite satisfactory.

November 22.7, 1882. Observer: Winlock. Transit Circle.

Nucleus presented a blurred and ill-defined appearance; not quite as long as on November 18. A 10th-magnitude star was just *preceding* the northern end. (Plate IV.)

The following note was entered in the observing-book: "Seeing, pretty good. Moon does not seriously interfere. Can see no trace of comet when field is at all illuminated. Point observed, perhaps a little *preceding* that observed on previous mornings."

Head.—The apparent lower or northern side of the head was seen sharply defined before the nucleus entered the field; but, as before, the southern side fades out gradually without any definite limit. Excepting a slight decrease in brightness but very little change has taken place in the head during the past month.

Tail.—In the moonlight the tail was faint and only about 7° long. After the moon had disappeared the tail could be followed about 12°.

November 24.7, 1882. Observer: Winlock. Transit Circle.

Obtained a meridian observation of position. Owing to the moonlight the comet was barely visible. Two stars, 11th and 9.5 magnitude, respectively, slightly preceded the nucleus, and are given in their relative positions in Plate IV.

December 2.7, 1882. Observer: Winlock.

$15^h.5$ Washington mean time: comet faint.

Tail between 6° and 7° long.

December 3.7, 1882. Observer: Sampson. 26-inch Equatorial.

Micrometer measures of nucleus (Fig. 2, page 17):

Points 1 to 2 = 23″.1 (mean of 4 observations).
Points *a* to *b* = 102″.1 (1 observation).

December 3.7, 1882. Observer: Winlock. 26-inch Equatorial. Transit Circle.

Nucleus in the transit circle was but little changed since the last observations It was more sharply defined on the *following* than on the *preceding* side.

With the 26-inch the following measurements were made:

For position angle—

	°
Circle Readings - -	346.2
	348.8
	349.4
Mean - - - - -	348.1

Resulting position angle,

333°.3.

Three points of condensation were seen: numbering them 1, 2, 3 (Fig. 2, page 17) as before, in their order from the *following* or *southern* end of the nucleus, 2 and 3 were close together (about ⅓ as far apart as 1 and 2). The distance 1 to 2, and the length of the nucleus, "over all," were measured with the filar micrometer.

Coincidence of fixed and movable threads $93^{r}.774$ (1 rev. = $9''.95$).

Micrometer Measures of Nucleus.—December 3.7, 1882.

Distance	Reading of Microm. Head.	Distance in Revolutions.	Distance in Seconds of Arc
	r.	r.	″
1 to 2	90. 278	3. 496	34. 8
	90. 365	3. 409	33. 9
Mean	. . .	. . .	34. 4
a to *b*	82. 980	10. 704	107. 4
	83. 340	10. 434	103. 8
Mean	. .	. .	105. 6

Tail.—The tail was shorter, straighter, and considerably fainter than in the early part of November; more light on southern than on northern side; end ragged.

In making the Transit Circle observation, the chronograph pen failed to mark, so that the right ascension was lost. The value of the zenith-point correction ($55^{s}.76$), used in reducing the observation in north-polar distance, is the mean of the values for December 3.2 and December 3.9, 1882.

December 4.6, 1882. Observer: Winlock. Transit Circle.

Nucleus ill-defined, and observation difficult. I aimed, as before, at observing the more condensed part toward the *following* end.

December 5.6, 1882. Observer: Sampson. 26-inch Equatorial.

Micrometer measures of nucleus (Fig. 2, page 17):

Points 1 to 2 = $29''.6$ (mean of 2 observations.)

December 7.6, 1882. Observer: Winlock. Transit Circle.

Nucleus woolly; no marked condensation; quite eccentric with regard to the axis of the head. The same part was observed as on previous dates.

Head.—The outline of the head was distinct and even sharp on the *north, following* side, and on this side the head was decidedly flattened.

Tail still quite bright; about 8° long.

December 11.6, 1882. Observer: Winlock. Transit Circle.

Nucleus very faint. In the observation of position the same part was observed as before, viz, the more condensed part near the *following* end.

Tail followed distinctly to ι Argus, 8°, but it extends farther.

METEOR.—At about $14^h.5$, mean time, a meteor as bright as Sirius passed from near the zenith, downward across Orion's belt.

December 28.5, 1882. Observer: Winlock. Transit Circle.

The comet was invisible to the naked eye on account of moonlight.

NUCLEUS very faint and difficult to observe. A faint 10.5 magnitude star was just below the middle of the nucleus, and a star a little brighter followed 4 or 5 seconds at about the same declination. The approximate relative positions of the nucleus and these two stars are shown in Plate IV. The nucleus was terminated by a nearly straight and vertical line on the following side, and was rounded and somewhat more indistinct and nebulous on the preceding side.

The part of the nucleus observed was about 5″ *south* of the 10.5 magnitude star. It seemed to me the center of light, and was, perhaps, a little farther from the "sunward" end of the nucleus than the point observed on previous occasions.

December 30.5, 1882. Observer: Winlock. Transit Circle.

Observation for position is only approximate: two threads in right ascension:—one bisection in declination. Comet too faint to observe well.

February 1.4, 1883. Observer: Winlock. 26-inch Equatorial. Transit Circle.

The comet was readily seen in the finder.

NUCLEUS.—Examined the nucleus carefully with the 26-inch and power of 186. There has been very little change since the last observations I made with the equatorial, December 3. The three points of condensation visible were sharp and nearly equidistant, lying along a straight line in the general direction of the axis of the head (Plate III). I think the two *preceding* points (as the comet now culminates before midnight, what was formerly the *following* end is now the *preceding*) are a little nearer together than the middle and *following* points; only two of these were seen at first, but a close inspection showed the third, *following;* the middle point was the brightest. The line of light connecting these points, and with them forming the extended and complex nucleus of the comet, was fainter than on December 3.

By noting the time it took the nucleus to pass out of the field, I formed a rough estimate of its length and the distances apart of the bright points, as follows:

The points are designated as before, except that they are now numbered from the *preceding* end of the nucleus (Fig. 3, page 23).

Points 1 to 2 = 35″
Points 2 to 3 = 42″
Points *a* to *b* = 80″

HEAD.—The outline of the head is somewhat difficult to trace, though, on the

southern side it is comparatively well defined; on the northern side the nebulosity extends farther out than on the southern

The transit circle observation of position was not very satisfactory. The nebulous mass, presenting something like a condensed center when it entered the field, was almost entirely lost when it reached the illuminated threads. Tried to observe the center of illumination.

February 23.3, 1883. Observer: Frisby. 26-inch Equatorial.

"Looked at comet *b*, 1882; very faint; 3 condensations of light, middle one the brightest: *preceding* one, probably, a little brighter than the other."

February 23.3. 1883. Observer: Winlock. 26-inch Equatorial.

NUCLEUS.—$8^h.2$, mean time. The nucleus appears very much as it did February 1. It is fainter on account of poor seeing and moonlight. Three bright points are visible (Plate III); the middle point brightest and about equal to a star of the 12th magnitude, which follows; the *preceding* point is next in brightness, and the *following* point very faint. For the position angle of the line joining the *preceding* with the *following* point, we have

		°
Circle readings,	- -	65.1
		60.8
		62.0
Mean	- - -	62.6

Resulting position angle

$76^\circ.5$

February 26.3. 1883. Observer: Hall. 26 inch Equatorial.

Magnifying power 186 The comet is an easy object in the finder.

NUCLEUS.—In the telescope the comet shows three points of condensation: 1, 2, 3, Fig. 3; 2 and 3 are nearly of the same brightness, but 3 may be a little the brighter of the two: 1 is very faint. The spaces between 1, 2, 3, and 4 are filled with faint nebulous matter. The brightest part of this matter seems to be around 3.

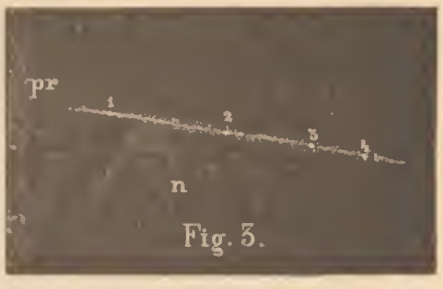


Fig. 3.

The following measures were made with the filar micrometer:

For position angle,

		°
Circle Readings, $7^h.9$, m. t.	- -	64.2
		61.6
		60.4
		61.6
Mean	- - - - - - -	61.9

Resulting position angle

$77^\circ.2$

Micrometer Measures of Nucleus.—February 26.3, 1883.

	Points 1 to 2 ($7^h.9$, m. t.)		Points 2 to 3 ($8^h.2$, m. t.)	
	r.	r.	r.	r.
Micrometer Readings	68.812	59.240	60.405	67.497
	68.450	59.040	60.782	67.736
	68.417	58.965	60.675	67.532
Mean	68.560	59.082	60.651	67.588
Double Distance	$9^r.478$		$6^r.937$	
Distance in Revolutions	$4^r.739$		$3^r.468$	
Distance in Seconds of Arc	$47''.14$		$34''.50$	

These measures were made by first setting the fixed thread on one point and the movable thread on the other, and then reversing. The table requires no further explanation than that the "Points" referred to are shown in Fig. 3, page 23.

February 27.3, 1883. Observer: Hall. 26-inch Equatorial.

Nucleus.—Magnifying power, 383. Point 3 (Fig. 3, page 23) is the brightest point to-night; 1 is very faint, and 4 is brighter than last night. The nebulous matter is condensed on the *following* side, beyond 4.

The following micrometer measures were made:

For position angle of the line joining 1 and 3

	°
Circle Readings, $7^h.4$, m. t.	60.4
	58.8
	61.5
	60.3
Mean	60.3

Resulting position angle,

$78°.8$.

Micrometer Measures of Nucleus.—February 27.3, 1883.

	Points 1 to 2 ($7^h.5$, m. t.)		Points 2 to 3 ($7^h.4$, m. t.)		Points 3 to 4 ($7^h.7$, m. t.)	
	r.	r.	r.	r.	r.	r.
Micrometer Readings	68.980	59.226	60.364	67.478	61.709	66.202
	69.015	59.074	60.591	67.382	61.780	66.242
Mean	68.998	59.150	60.478	64.430	61.744	66.222
Double Distance	$9^r.848$		$6^r.952$		$4^r.478$	
Distance in Revolutions	$4^r.924$		$3^r.476$		$2^r.239$	
Dist. in Seconds of Arc	$48''.99$		$34''.58$		$22''.27$	

February 27.4, 1883. Observer: Winlock. 26 inch Equatorial.

NUCLEUS.—Seeing, remarkably fine. Examined nucleus with powers of 186 and 383: very much extended, but not much fainter than on February 1. Plate III, "February 27.36, 1883," shows the appearance of the comet on this date.

Four bright points (Fig. 3, page 23) were distinctly seen, and a fifth suspected, about 50" *following* 4.

February 28.3, 1883. Observer Eastman. Transit Circle.

The following note accompanies the observation of position:

"Observed the middle point, between second and third points in the nucleus. Could not see anything fainter."

March 3.3, 1883. Observer: Winlock. 26 inch Equatorial. Transit Circle.

NUCLEUS.—$8^h.5$, mean time, 26-inch Equatorial: Points 1, 2, and 3 (Fig. 3, page 23) are about equal in brightness, and of about twelfth magnitude. 4 is somewhat fainter. The whole nuclear system is inclosed in a nebulous envelope, broad in the middle and tapering off at the extremities. A drawing of the nucleus, as it appeared at this time, is given in Plate III.

In the transit circle the nucleus appeared as merely a faint streak, with two very difficult points of condensation. I observed the following point, which was apparently the brighter. Two stars, of about eighth magnitude, were *south*, *preceding* the point observed. The twelfth magnitude, seen in the 26-inch, I did not see here.

April 4.3, 1883. Observer: Winlock. 26-inch Equatorial.

At 8^h, mean time, I could make out but one point of condensation in the nucleus with certainty, though the existence of another was suspected. The point seen was near the middle of an extremely faint, nebulous streak of light, some 20" to 30" long, extending very nearly in the direction of a parallel of declination. At this time a light haze covered the part of the sky towards which the telescope was directed, and it would be impossible to represent in a sketch the little wisp of light which indicated the presence of the comet.

April 4.3, 1883. Observer: Frisby. 26-inch Equatorial.

Comet *precedes*, *south* of star. Twelve comparisons of right ascension were made, and four of declination: star identified as Weisse V, 1497. ($8^h\ 22^m$, mean time.)

Three points of light were seen at times, the *following* one being the brightest and the *preceding* the faintest: the *following* point was observed.

SUMMARY OF OBSERVATIONS.

NUCLEUS.

The nucleus, on the afternoon of September 19, 1882, "presented very much the appearance of a bird with wings extended." The coma forming these "wings" was lost about October 3, and on October 4 a small central condensation was noted. The length of the nucleus was then 15″ or 20″, and width 4″. On October 6, the weather having been unfavorable for several days previous, the breaking up of the nucleus was first seen: there were three points of condensation, connected and surrounded by nebulous matter, the light being nowhere discontinuous. From this date forward the development, or disintegration, continued as long as the comet was observed, the points gradually separating and the nebulous matter surrounding them becoming fainter, till the outer points seemed almost isolated from the rest of the nucleus. The greatest number of points, five, was recorded on October 24, 1882, and also (the fifth being a little doubtful) on February 27, 1883. When last measured, February 27, 1883, the distance between the extreme points visible was 106″.

Sketches of the nucleus were made on October 6, 9, 10, 24, November 2, 13, 15, 18, 21, and December 3, 1882, and February 1, 23, 27, March 3, 1883. The sketches of October 9, 24, November 13, 21, February 1, 23, 28, March 3, are reproduced in Plates I, II, and III, showing the changes which took place. Plate IV, giving the appearance of the nucleus in the transit circle, will furnish in itself a *résumé* of the various aspects of the comet while under observation with that instrument.

Table I, on the following page, contains a summary of the micrometer measures and the estimates made of the nucleus, with descriptive notes. The 9.6-inch Equatorial was used until October 24.7; on that and following dates the 26-inch.

In the column "Observer", H is for Prof. A. Hall; Sn, Commander W. T. Sampson; E, Prof. J. R. Eastman; F, Prof. E. Frisby; W, Assistant Astronomer W. C. Winlock. In "Points of Nucleus", reference is made to Fig. 1, page 15, Fig. 2, page 17, and Fig. 3, page 23.

The numbers printed in full sized brevier type indicate actual measurements or estimates. The small figures are distances which, it will be seen, are directly deducible from these measurements.

TABLE I.—*Summary of Observations of Nucleus.*

[Large figures are actual measurements or estimates; small figures are derived from them.]

DATE.	Obs'r.	Position Angle.	Points of Nucleus.								NOTES.
			1 to 2.	1 to 3.	2 to 3.	3 to 4.	*a* to *b*.	*c* to *d*.	*a* to 1.	2 to *b*.	
1882.			″	″	″	″	″	″	″	″	
Sept. 19. 1	W.										Nucleus looked like a bird with wings extended.
29. 7	F.						15	3			Distances estimated. Irregular.
Oct. 2. 8	W.										Woolly. Almost circular, with a slight indication of wings. No elongation or division noted.
4. 7	F.										Small central condensation in nucleus ¾ of its length from end nearest tail.
6. 7	F.										2, possibly 3 condensations.
	W.						27	4			3 bright points; middle one largest and brightest, and about 4″ wide and 12″ long (micrometer meas.). Total length estimated.
8. 7	F.										At least 3 condensations.
9. 7	E.						31. 8				From diff. of R. A. between the ends.
	W.										4 distinct points and "tail" lying on a curve slighly convex to the south.
10. 7	W.							9			3 bright points, middle largest; width from micrometer measures.
14. 7	E.						43. 0				From diff. of R. A. between the ends.
	W.										No bright points seen.
24. 7	W.										Much elongated. 4 or 5 "beads" seen; second the most prominent.
Nov. 2. 7	W.		12. 4	22. 7			55. 0	5			3 or 4 bright points; nucleus more elongated; nebulous. Micrometer measures.
	Sn.		10. 1	20. 0	9. 9						Length of point 1 7″. 2. Filar micrometer measures.
5. 7	Sn.		16. 4	26. 1	9. 7						Filar micrometer.
13. 7	W.			23. 3							2 prominent points and a 3d and perhaps 4th. Filar micrometer.
15. 7	W.	309. 4	18. 0				92. 1	9. 9	71. 5	38. 6	Elongated, narrow, indistinct. 2 points visible. Filar micrometer.
17. 7	Sn.						80. 6				Filar micrometer.
18. 7	W.	309. 8	20. 2								Filar micrometer.
	Sn.		20. 3	33. 0	12. 7						Filar micrometer.
21. 7	W.	313. 8									Thin line of light with 2 points nearly equal in brightness. Filar micrometer.
Dec. 3. 7	Sn.		23. 1				102. 1				Filar micrometer.
	W.	333. 3	34. 4		11		105. 6				3 points seen; dist. 2 to 3, estimated as ⅓, dist. 1 to 2. Filar microm.
5. 0	Sn.		29. 6								Filar micrometer.

TABLE I.—*Summary of Observations of Nucleus*—Continued.

DATE.	OBS'R	Position Angle	Points of Nucleus.								NOTES
			1 to 2	1 to 3.	2 to 3.	3 to 4.	*a* to *b*.	*c* to *d*	*a* to 1.	2 to *b*.	
1883.			″	″	″	″	″	″	″	″	
Feb. 1.4	W.		35		42		80				3 pts. of condensation, sharp, nearly equidistant; middle one brightest. Distances estimated.
23.3	W.	70.5									3 pts. condensation, middle brightest, as on February 1. Filar microm.
26.3	H.	77.2	47.1	[illegible]	34.5						4 bright points. 3d brighest; though nearly equal to 2d. Filar microm.
27.3	H.	78.8	49.0	[illegible]	34.6	22.3	195.9				4 bright points. 3d brightest; 4th brighter than last night. Filar mic.
27.4	W.										4 bright points and a 5th suspected, *following*. Seeing very good.
Mar. 3.3	W.										4 bright points. 1, 2, 3 about equal in brightness; 4 fainter.
	W.										Only 1 point made out with certainty, though another suspected. Seeing poor.
April 4.3											
	E.										3 points seen at times, *following* brightest and *preceding* faintest.

HEAD.

The few notes relating to the head are of a generally descriptive character, no accurate measures having been obtained.

On October 6.7 "the head was not symmetrically disposed about the nucleus, but extended farther out on the southern than on the northern side." The axis about which it was most symmetrical was, also, slightly inclined to the axis of the nucleus.

The *flattened* appearance of the head on the *north, following* side, one of its principal peculiarities, was noticed on October 6, 14, 24, November 2, and December 7. It was shown in nearly all of the sketches made in 1882.

TAIL.

But little attention was given to the tail, except to note occasionally its more important features. On September 28 its length was 15°, and on December 11, 8°. The maximum length, 19°, was recorded on October 2; but all estimates of the length were necessarily affected by the hazy state of the atmosphere generally prevailing at this time of year.

The points to be noticed were as follows:

The tail was curved: concavity and greater curvature on northern side. The southern side was sharp, well-defined, and, at its middle, very bright, while the northern side was broken and indistinct. The end was ragged, and from October 8 to November 20 there was a split extending down beyond the middle.

Outlines of the tail with the Outer-Envelope, on October 6, 7, 9, 10, and 14, are given in Plate V.

Table II contains a summary of all observations of the tail, the figures relating to the length and width being naked eye estimates. The observers are (F) Prof. E. Frisby; (S) Assistant Astronomer A. N. Skinner, and (W) Assistant Astronomer William C. Winlock.

Table II.—*Summary of Observations of the Tail.*

DATE.	Observer.	Length.	Width at Extremity.	NOTES.
1882.		°	°	
Sept. 28.7	S.	15	1.5	Slightly curved, with concavity on N. side. A dark streak extends down the tail.
29.7	F.	15	. .	Well-defined and sharp, terminating suddenly.
Oct. 2.8	W.	19	. .	Remarkably narrow.
4.7	F.	17–18	. .	
6.7	W.	17	3	Slightly concave on N.; brightest part 8° from the head; fissure 4° or 5° long near middle; N. edge broken and ragged.
7.7	W.	17	5	2° wide at 3° from head; S. side sharp and near the middle bright; black fissure visible; N. side broken.
8.7	F.	. .	. .	There appeared to be a "fan-shaped" division.
9.7	W.	14	. .	Fork, near *a* Hydræ, has become more conspicuous.
10.7	W.	16	. .	*a* Hydræ just beyond the N. corner.
14.7	W.	17	3.5	Fork extends 3° or 4° down from N. corner. Dark fissure near middle still noticeable.
24.7	W.	12	. .	Brighter on S. than on N. side.
Nov. 2.7	W.	10–12	. .	Has become a little fainter.
8.7	W.	10	. .	Brighter on S. than on N. side.
13.7	W.	10	. .	Little more fan-shaped; somewhat fainter.
15.7	W.	10	. .	Dark channel running down to about the middle.
18.7	W.	10	. .	Less curved than a month ago. About the same width.
20.7	W.	15	3	The "split" extended more than half the length of the tail.
21.7	W.	11	. .	
22.7	W.	12	. .	Before the moon set tail could be followed only 7°.
Dec. 2.7	W.	6–7	. .	
3.7	W.	. .	. .	Tail fainter, shorter, and straighter than in November; more light on S. than on N. side; end ragged.
7.6	W.	8	. .	Still quite bright.
11.6	W.	8	. .	Followed distinctly to *z* Argus (8°), but it extends farther.

"OUTER-ENVELOPE."

This faint "veil," or "outer-envelope," projecting beyond the head, was first seen on October 6.7, 1882. It was noticed again October 7, 9, 10, and 14, gradually increasing in brightness, but on October 24 it was not found. Full descriptions are given under October 6 and 14, and no marked change took place in the envelope while under observation. It was followed farther on the north side of the head than on the south (possibly due to the fact that on this side there was less light) and was brighter on the outer edge than close in to the head.

Where it was possible, the limits of the envelope, with reference to any neighboring stars, were plotted at the telescope. In most cases the stars were identified, and I was thus enabled to give the outline of the envelope with considerable accuracy. In the figures of Plate V, α Hydræ served to fix the direction and extent of the tail, the position of the head being known from observation.

The stars which are charted on Plate V are given in Table III, arranged, with the comet, in the order of right ascension.

TABLE III.—*Stars Plotted with the "Outlines of 'Outer-Envelope' and Tail," Plate V.*

DATE.		Stars.	Mag.	Approx. R.A.		Approx Dec.	
1882.				h.	m.	°	′
Oct. 6.71	α	Hydræ	2	9	21.8	− 8	9
		Weisse X, 515	7	10	30.5	− 9	58
		Weisse X, 526	9	10	30.9	− 9	13
		Nucleus		10	31.3	− 9	48
Oct. 7.71	α	Hydræ	2	9	21.8	− 8	9
		Nucleus		10	29.6	− 10	14
Oct. 9.71	α	Hydræ	2	9	21.8	− 8	9
		Weisse X, 435	7	10	26.2	− 10	49
		Weisse X, 437	9	10	26.3	− 11	8
		Nucleus		10	26.7	− 11	6
		Weisse X, 450	9	10	27.4	− 11	11
		Anon. (?)	9?	10	29.0	− 11	2
		Anon. (?)	9?	10	29.9	− 10	50
Oct. 10.71	α	Hydræ	2	9	21.8	− 8	9
		Nucleus		10	25.3	− 11	32
Oct. 14.71	α	Hydræ	2	9	21.8	− 8	9
	θ^1	Hydræ	5	9	45.8	− 14	18
	λ	Hydræ	4.5	10	4.9	− 11	46
		Weisse X, 236	7	10	15.5	− 13	12
		Weisse X, 251	7	10	16.4	− 12	49
		Weisse X, 274	7	10	17.6	− 12	47
		Weisse X, 282	9	10	18.3	− 13	4
		Nucleus		10	19.9	− 13	11
		Weisse X, 418	6.7	10	25.2	− 12	59

OBSERVATIONS OF POSITION.

TRANSIT CIRCLE OBSERVATIONS.

Seventeen transit circle observations were obtained, the first on September 19.97, 1882, and the last, March 3.30, 1883.

A brief description of the instrument may be found on page 8; a more complete description, with the manner of reducing observations, is given in the published annual volumes.

As the final results of these observations of the comet will not appear till the volumes for 1882 and 1883 are published (at least two years), a preliminary reduction has been made, and positions obtained, which, except for the correction "$\Delta\varphi + \Delta z$," are essentially the same as the final positions.

The north-polar distances have been corrected for refraction, and for flexure of the circle and telescope. The corrections $\Delta\varphi$ and Δz to the assumed latitude and zenith-point correction can only be deduced from a discussion of the whole year's work with the instrument, and they, therefore, have not been applied. The sum of these outstanding corrections was

		$''$
In	1876	$= +$ 0.97
	1877	$= +$ 0.45
	1878	$= +$ 1.39
	1879	$= -$ 0.75
	1880	$= +$ 4.06

As these corrections appear to follow no law, but are very irregular in amount, we can only say, for the present, that the north-polar distances given, require a certain constant correction for the observations made in 1882, and a different constant for the observations in 1883. The value of this constant is (from inspecting the values given above) probably in the neighborhood of $+ 1''.2$, though it may be as great as $+ 4''$. It might be remarked that this, in most of the observations, is merely equivalent to introducing a little more uncertainty as to the part of the nucleus which was observed.

In Table IV, on the following page,

The *first* column contains the mean solar date to hundredths of a day;

The *second* column gives the observer's initial: E. standing for Prof. J. R. Eastman; S., Assistant Astronomer A. N. Skinner, and W., Assistant Astronomer William C. Winlock;

The *third* column gives the number of threads observed in right ascension;

The *fourth* and *fifth* columns, respectively, the apparent right ascension and north-polar distance;

The *sixth* column, the number of bisections made with the zenith-distance micrometer;

The *seventh* column, the logarithm of the product of the comet's distance from the earth times the parallax.

The column "Remarks" is intended, principally, to indicate the part of the nucleus which was observed on each occasion, but, for a more complete description, reference must be made to the detailed observations, and to Plate IV, which is especially designed to accompany this table.

TABLE IV.—*Results of Transit Circle Observations.*

DATE.	Observer.	No. of Threads R. A.	Apparent Right Ascension.			Apparent N. P. Distance.			No. of Bisections N. P. D.	log Δp.	REMARKS.
1882.			h.	m.	s.	°	′	″			
Sept. 19.97	W.	9	11	14	18.95	90	34	29.4	4	0.7478*n*	*Following*, or main part of nucleus. Observation very satisfactory.
20.96	S.	9	11	9	10.93	91	19	21.9	4	0.7547*n*	Region of greatest condensation.
Nov. 15.74	W.	11	9	27	50.72	114	49	19.9	2	0.8982*n*	Main condensation near *following* end.
18.73	W.	11	9	21	4.44	115	43	19.6	2	0.9015*n*	Do.
20.72	W.	11	9	16	18.88	116	17	36.2	4	0.9036*n*	Do.
21.71	W.	11	9	13	51.33	116	34	6.6	2	0.9045*n*	Do.
22.71	W.	11	9	11	21.67	116	50	12.0	4	0.9055*n*	Point observed a little *preceding* that of previous dates.
24.70	W.	11	9	6	16.21	117	21	26.4	2	0.9072*n*	Brightest part towards *following* end.
Dec. 3.65	W.	.	8	42	. .	119	16	17.4	2	0.9134*n*	Main condensation near *following* end.
4.65	W.	11	8	38	5.15	119	26	9.6	2	0.9139*n*	Main condensation near *following* end. Observation difficult.
7.64	W.	11	8	28	55.34	119	51	58.1	2	0.9152*n*	Main condensation near *following* end.
11.62	W.	11	8	16	21.69	120	16	28.9	2	0.9166*n*	Do.
28.54	W.	11	7	22	50.81	119	53	11.3	2	0.9153*n*	Center of light. A little *north* of point previously observed.
30.53	W.	2	7	16	55.29	119	37	23.6	1	0.9145*n*	Observation poor. Comet too faint.
1883.											
Feb. 1.39	W.	9	6	9	4.98	111	55	14.6	4	0.8865*n*	Center of light. Observation not very satisfactory.
28.30	E.	9	5	51	45.20	105	16	8.7	2	0.8542*n*	Observed middle part, between 2d and 3d points of nucleus.
Mar. 3.30	W.	6	5	51	17.49	104	38	6.0	2	0.8505*n*	Observed *following* and brighter of two points.

It will be seen that all of the observations are quite satisfactory, except that of December 3.65, when the right ascension was lost owing to the failure of the chronograph pen, and that of December 30.53, when the comet was too diffused and faint to admit of very accurate observation.

EQUATORIAL OBSERVATIONS.

The 9.6-inch and 26-inch equatorials were both used in determining the position of the comet. Necessary data respecting these instruments are given in the Introduction.

Up to October 4.7, no stars bright enough for comparison were found in the immediate vicinity of the nucleus. These observations are, therefore, dependent upon the circles, the corrections to which were found by pointing on the sun, or some first or second magnitude star in the same part of the sky. A single determination of position consisted, generally, of observing the transit over three or five threads, and bisecting on two threads.

After October 4, the comet was compared with a star by the usual method of differences of right ascension and declination.

In Table V are the results of the equatorial observations of position.

The *first* column contains the mean solar date to hundredths of a day;

The *second* column gives the observer's initial: E. standing for Prof. J. R. Eastman; F., Prof. E. Frisby; and S., Assistant Astronomer A. N. Skinner;

The *third* column gives the equatorial used;

The *fourth* column, Washington mean time of observation;

The *fifth* and *seventh* columns, differences in right ascension and declination, respectively, between the star and comet;

The *sixth* and *eighth* columns, the number of comparisons in right ascension and declination, respectively;

The *ninth* and *eleventh* columns, apparent right ascension and north-polar distance;

The *tenth* and *twelfth* columns, the logarithms of the product of the parallax times the distance from the earth;

The *thirteenth* column, a letter for reference.

Table VI, Comparison Stars: Equatorial observations,

The *first* column gives a reference letter;

The *second* column, for *a*, *b*, *c*, *d*, and *e*, the object by which the circle corrections were found; for *f*, *g*, *h*, *i*, *j*, *k*, and *l* the names of the comparison star;

The *third* and *fifth* columns, the right ascension and declination, brought down to the beginning of the year from the Catalogues;

The *fourth* and *sixth* columns, reduction to the date of observation;

The *seventh* column, "Remarks" applied to the observation of the comet or to the reduction of the star place.

TABLE V.—*Results of Equatorial Observations.*

DATE.	Observer.	Equatorial.	Washington Mean Time.	$\Delta\alpha$	No. of Comps.	$\Delta\delta$	No. of Comps.	Apparent Right Ascension.	log $\cdot p$	Apparent North Polar Distance.	log $\cdot p$	Ref. letter.
1882.			h. m. s.	m. s.		′ ″		h. m. s.		° ′ ″		
Sept. 19.1	F.	9.6	2 45 22	. .	.	. .	.	11 19 38.2	9.5471*p*	89 52 25	0.7418*n*	***a***
19.8	F.	9.6	18 43 2	. .	.	. .	.	11 15 25.7	9.6321*n*	90 25 19	0.7438*n*	***b***
23.8	S.	9.6	18 3 45	. .	.	. .	.	10 58 16.0	9.6413*n*	93 10 30	0.7517*n*	***c***
29.7	F.	9.6	17 22 25	. .	.	. .	.	10 43 4.2	9.6413*n*	96 29 15	0.7596*n*	***d***
Oct. 1.7	F.	9.6	17 31 8	. .	.	. .	.	10 39 14.6	9.6269*n*	97 29 10	0.7674*n*	***e***
4.7	F.	9.6	17 16 53	+ 3 16.57	8	+ 7 8.2	4	10 34 53.9	9.6266*n*	98 48 21.1	0.7708*n*	***f***
6.7	F.	9.6	17 27 6	+ 0 34.05	31	+ 10 34.3	7	10 31 1.6	9.6064*n*	99 47 51.4	0.7804*n*	***g***
8.7	F.	9.6	17 17 26	− 0 15.68	22	− 21.4	7	10 28 6.5	9.6064*n*	100 40 21.9	0.7835*n*	***h***
9.7	E.	9.6	17 25 56	+ 0 23.80	6	+ 1 27.9	4	10 26 41.7	9.5905*n*	101 6 24.8	0.7896*n*	***i***
14.7	E.	9.6	17 1 47	+ 1 37.92	25	− 6 47.6	3	10 19 54.5	9.5911*n*	103 11 13.4	0.7971*n*	***j***
24.7	F.	26	17 44 50	+ 0 11.68	17	− 1 36.0	4	10 5 52.3	9.4006*n*	107 5 6.8	0.8456*n*	***k***
1883.												
Apr. 4.3	F.	26	8 21 35	+ 2 17.59	12	− 1 17.6	4	5 57 20.6	9.5521*p*	99 18 27.8	0.7904*n*	***l***

TABLE VI.—*Comparison Stars:—Equatorial Observations.*

Ref. letter.	Comparison Star.	α 1882.0	Red. to App. Place.	δ 1882.0	Red. to App. Place.	REMARKS.
		h. m. s.	s.	° ′ ″	″	
a	Sun and circles . .	. . . .	. .	. . .	. .	2 determinations of comet's place. N. S. *preceding* and *following* limbs of sun observed.
b	α Leonis and circles .	. . . .	. .	. . .	. .	2 determinations of comet's place and 2 of α Leonis.
c	α Hydræ and circles .	. . . .	. .	. . .	. .	2 determinations of place of α Hydræ; 2 determinations of comet in N. P. D. and 3 in R. A.
d	α Hydræ and circles .	. . . .	. .	. . .	. .	3 determinations of place of α Hydræ and 5 of comet.
e	α Hydræ and circles .	. . . .	. .	. . .	. .	1 determination of place of α Hydræ and 5 of comet.
f	(Weisse X, 539 . .	10 31 35.33	− 2.10	− 8 55 20.9	11.5)	Weisse place, $\frac{1}{2}$ weight. Central condensation, $\frac{3}{4}$ distance from *preceding* end of nucleus observed.
	(Schjellerup 3883 . .	35.20	− 2.10	16.3	−11.5)	
g	(Lamont 753 . . .	10 30 25.49	− 2.14	− 9 58 13.2	11.3)	Part of nucleus observed, not noted.
	(Weisse X, 515 . .	25.23	−2.14	15.6	−11.3)	
h	(Lamont 742 . . .	10 28 20.00	− 2.17	10 39 47.8	11.1)	Part of nucleus observed, not noted.
	(Weisse X, 472 . .	20.07	− 2.17	51.0	−11.1)	
i	Weisse X, 437 . .	10 26 15.71	− 2.19	− 11 7 41.8	10.9	Both ends of nucleus were observed in α; center in δ. α of *following* end is given here. Length of nucleus in α $2^s.12$.
j	Weisse X, 282 . .	10 18 14.32	− 2.29	13 4 15.3	10.5	Observation similar to one above (*i*.) Length of nucleus in α $2^s.87$
k	O. Arg. S. 10429–30 .	10 5 38.07	−2.54	−17 3 21.2	9.6	Part of nucleus observed, not noted.
		α 1883.0		δ 1883.0		
l	Weisse V, 1497 . .	5 59 37.14	− 1.03	− 9 16 53.4	−16.8	*Following* and brightest of 3 points, observed.

ERRATA.

Page 37. For October 13. 71, 1882, read November 13. 71, 1882.
For October 21. 70, 1882, read November 21. 70, 1882.

EXPLANATION OF PLATES.

The data upon which the plates depend were obtained from rough sketches and notes made at the telescope. The drawings, with the exception of those in Plate V, represent the comet as it appeared in an inverting telescope, the lower side being the *north* (N.), and the left hand, the *preceding* (Pr.). The figures in Plates I, II, and III are all on the same scale, so that the extension of the nucleus is represented as it was observed. In Plates I and II the approximate shape of the head is shown, and a little of this shape is still seen on February 1.34, 1883 (Plate III), but the nebulous matter forming the head gradually faded out, till the nucleus was left a hazy streak of light, studded with three or four bright points. Further details than those given below will be found under the dates of observation.

PLATE I.—*Drawings of the Nucleus and Head.*

October 9.72, 1882:—9.6-inch equatorial, magnifying power 132; the four bright points, with the little elongated tail of the nucleus, are inclosed in a nebulous envelope, and around this lies the head, a little flattened on the *north*, *following* side; rather hazy on the *south*. The points are on a curve, slightly convex to the south.

October 24.71, 1882:—26-inch equatorial, magnifying power 186. "Four, and perhaps five, 'beads' could be distinguished, the second one being by far the most prominent," surrounded by the nebulous head.

PLATE II.—*Drawings of the Nucleus and Head.*

October 13.71, 1882:—26-inch equatorial, magnifying power 186. "Two prominent points, with a third, and perhaps fourth, out in the direction of the tail."

October 21.70, 1882:—26-inch equatorial, magnifying power 186. The nucleus is a narrow line of light with two points of condensation, nearly equal in brightness.

PLATE III.—*Drawings of the Nucleus and Head.*

February 1.34, 1883:—26-inch equatorial, magnifying power 186. A fine, straight, nebulous line of light, with three points of condensation. The outline of the head sharper on the *south* than on the *north* side is to be noted.

February 23.34, 1883:—26-inch equatorial, magnifying power 186. Three bright points along a nebulous ridge; middle point brightest, *following* point faintest.

February 27.36, 1883:—26-inch equatorial, magnifying power 186. Four bright points seen, and a fifth, *following*, suspected; less light surrounding the nucleus than before.

March 3.35, 1883:—26-inch equatorial, magnifying power 186. Four bright points are inclosed in a nebulous envelope, broad in the middle and tapering off at the extremities.

PLATE IV.—*Transit Circle Observations.*

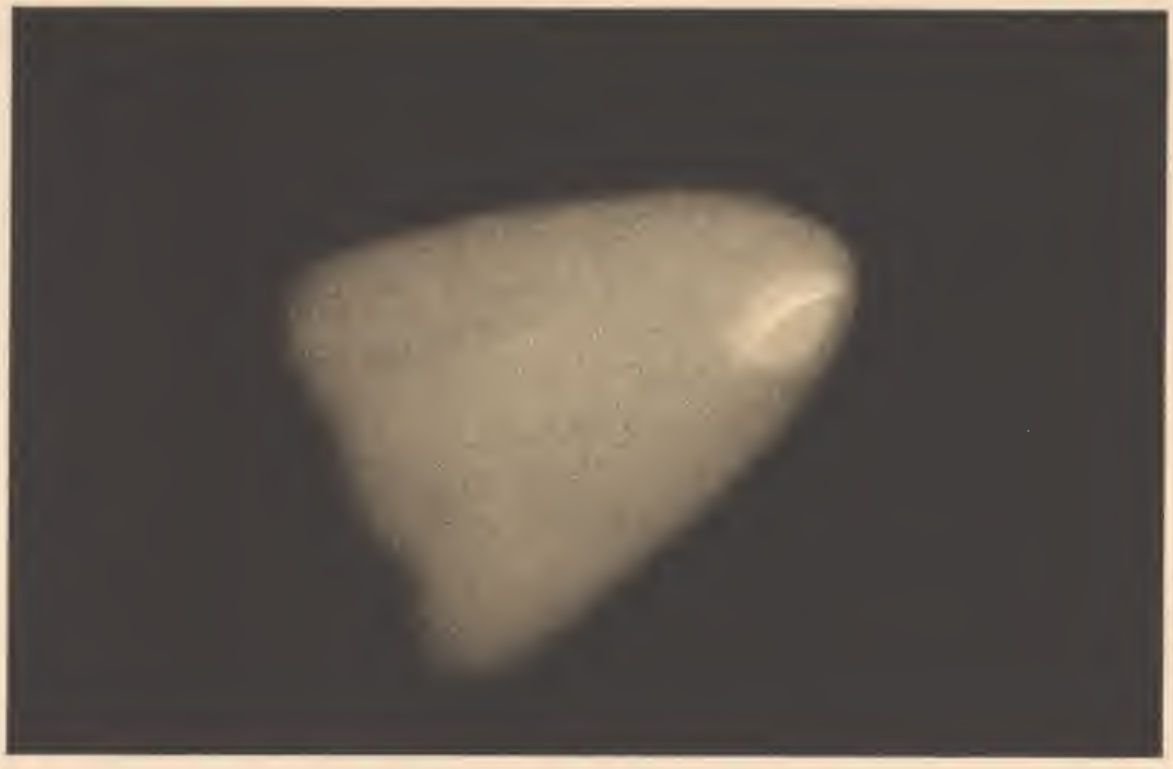
Plate IV is intended to show the part of the nucleus which was observed on different dates with the Transit Circle, in order that it may be possible to compare these observations with observations made elsewhere, and thus obviate, as far as possible, the difficulties necessarily attending any discussion of the comet's motion on account of the extended nucleus

The sketch on September 19.97 is partly from memory; on September 20.96 no sketch was available, the observer reporting "the region of greatest condensation" observed; the other sketches are from notes and diagrams made by the observer.

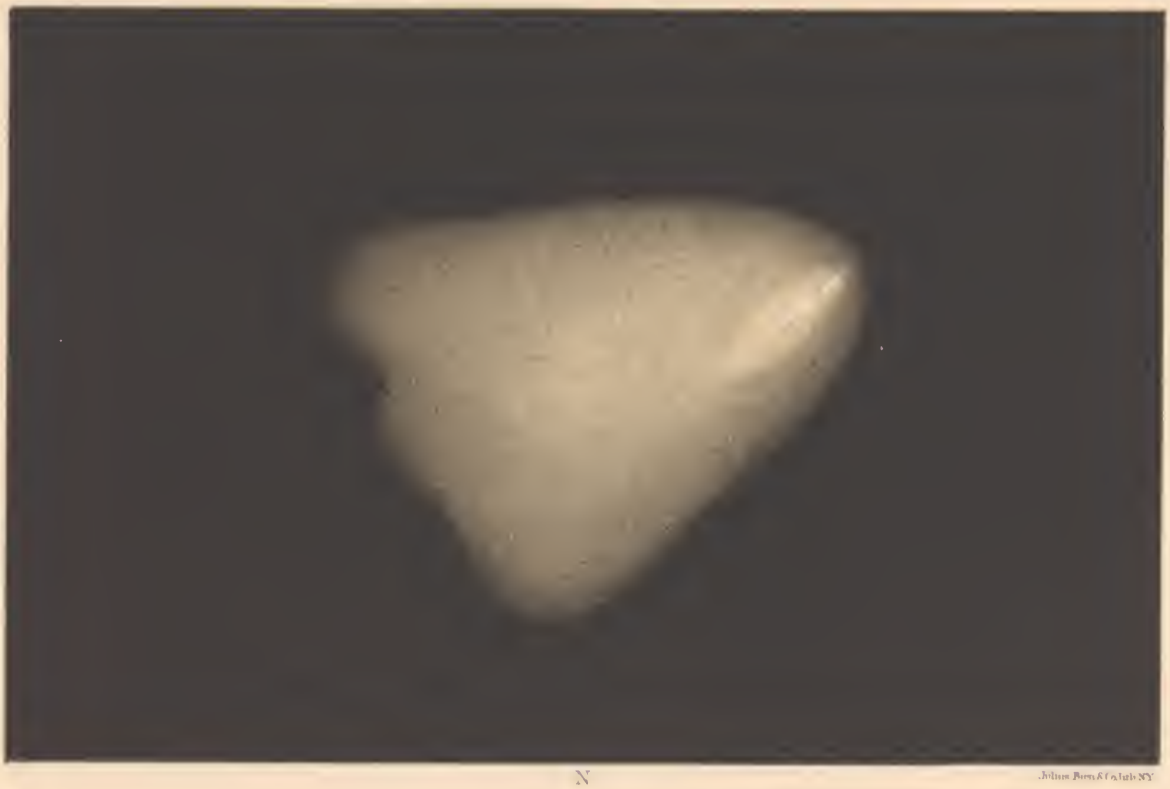
The close horizontal lines are the "double threads" of the declination system with which the bisections are made; the vertical line, a thread of the right ascension system, so that the intersection of this vertical line with the middle of the space between the horizontal lines is the part of the nucleus which was observed. The little sketches, showing how the nucleus appeared in the Transit Circle, will give an idea of the difficulties encountered in trying to make an accurate observation of this comet. Where any small stars were seen near the nucleus, they have been put down in their approximate positions; most of these stars have been entered upon the Transit Circle observing list, and will, in due time, be observed.

PLATE V.—*Outline of the Outer-Envelope and Tail.*

A sufficient explanation of this plate, with a list of the stars plotted on each date, will be found in the summary of observations of the outer-envelope, page 31, and on pages 11 and 14.



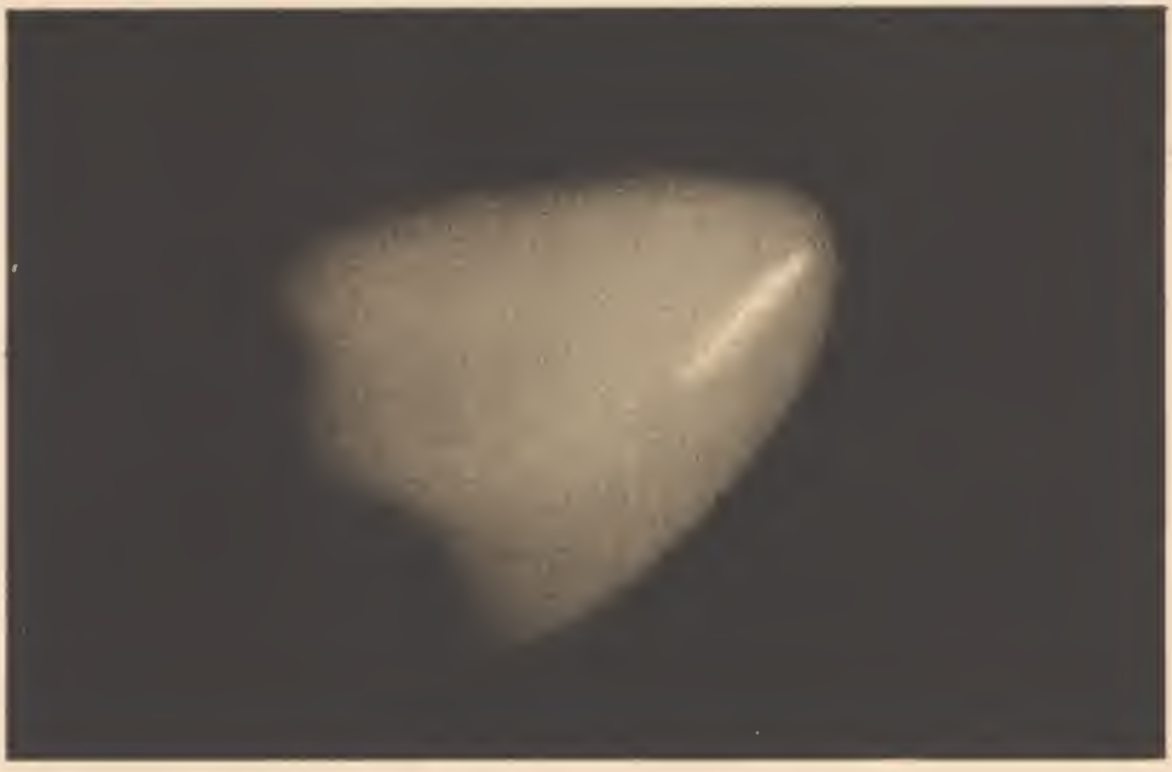
Pr. OCT 9 72, 1882, 96-IN. EQUATORIAL



N

OCT. 24.71, 1882, 26-IN. EQUATORIAL.

THE GREAT COMET OF 1882.



Pr NOV. 13.71, 1882, 26-IN. EQUATORIAL.

N

NOV. 21 70. 1882, 26-IN. EQUATORIAL.

THE GREAT COMET OF 1882.

Pr. FEB. 1.34, 1883, 26-IN. EQUATORIAL.

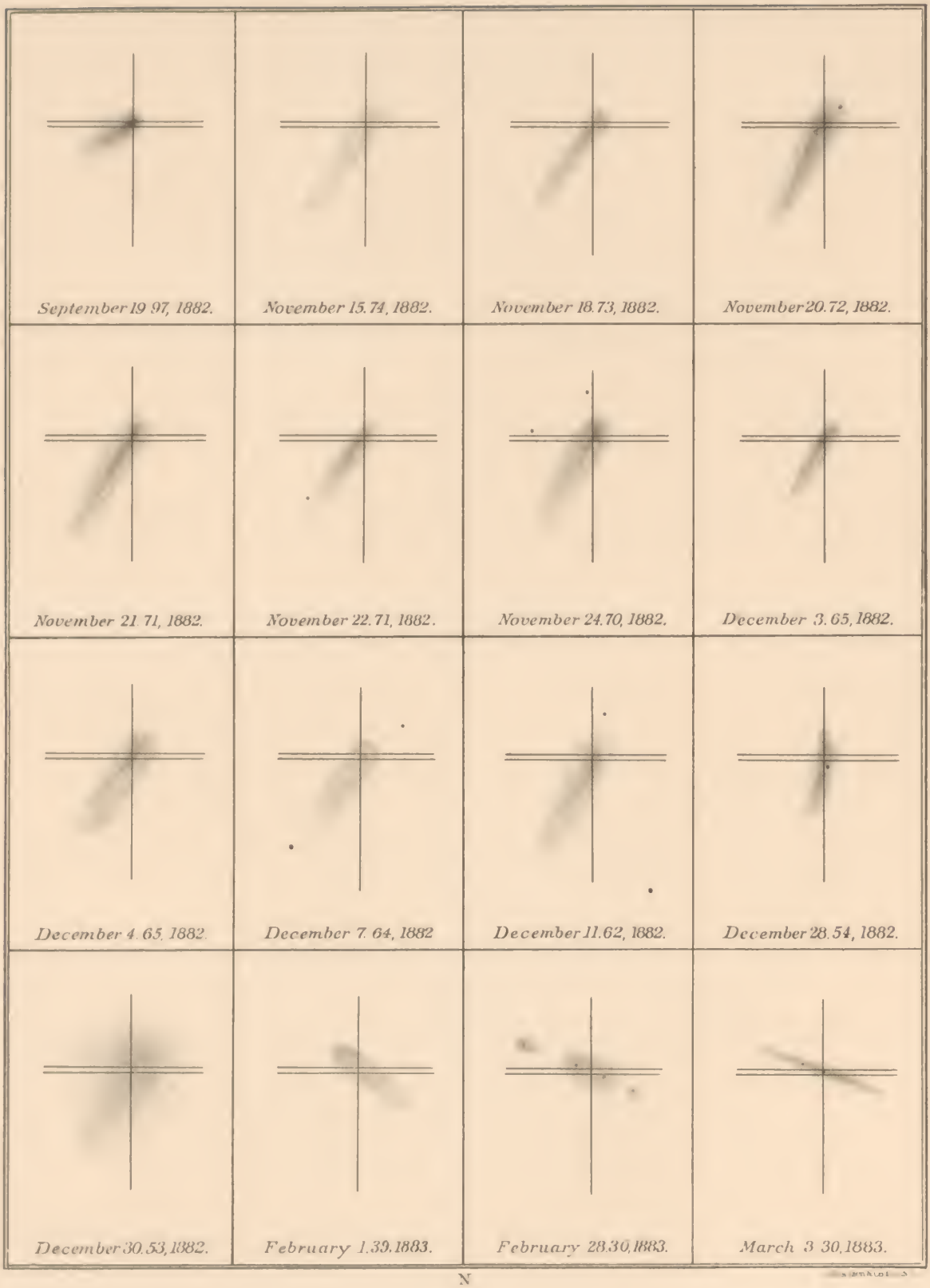
FEB. 23.34, 1883, 26-IN. EQUATORIAL.

FEB. 27.36, 1883, 26-IN. EQUATORIAL.

N

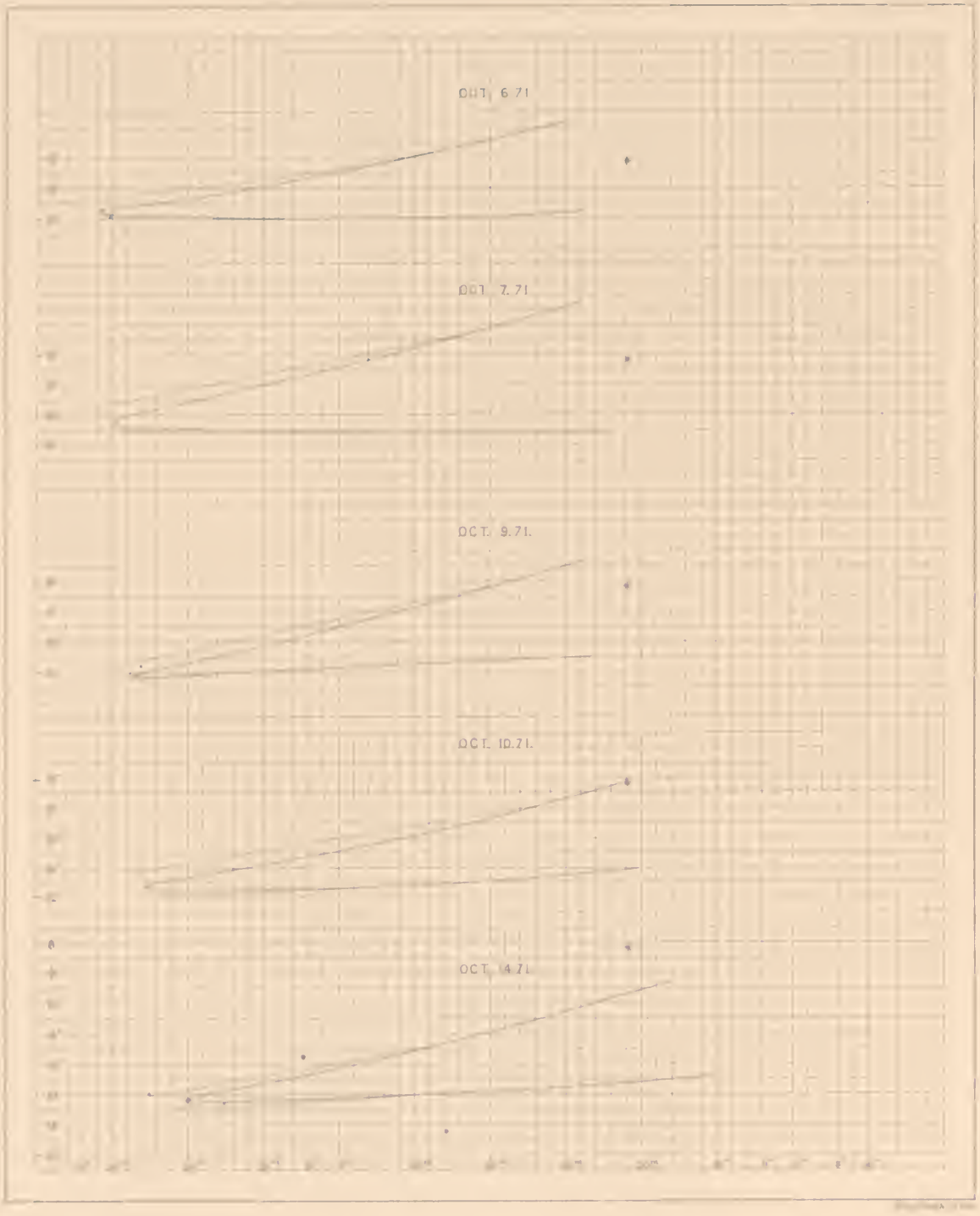
MARCH 3.35, 1883, 26-IN. EQUATORIAL.

THE GREAT COMET OF 1882.



THE GREAT COMET OF 1882.

TRANSIT CIRCLE OBSERVATIONS.



OUTLINE OF THE OUTER ENVELOPE AND TAIL

THE GREAT COMET OF 1882.

RECEIPT.

(To be detached, signed, and returned.)

(Place,) _____

(Institution,) _____

Received, _____, 188 ,

from the United States Naval Observatory, one copy of ~~Reports on the Total Solar Eclipses of July 29, 1878, and of January 11~~, 1880. a/sp/

(Signature,) _____

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United States Naval Observatory,

Washington, Dec 7, 1883.

Sir:

I have the honor to send to you a copy of ~~Reports on the Total Solar Eclipses of July 29, 1878, and of January 11~~, 1880. a/sp/

Will you be pleased to sign and return by post the accompanying receipt? A failure to return the receipt will be considered an intimation from you that our publications are not desired.

Very respectfully,

Your obedient servant,

~~JOHN RODGERS,~~

Rear Admiral, U. S. N., Superintendent.