I.

# Results of Double-Count Observations of the Perseids in 1921.

By **E. Öpik.**

## 1. Arrangement of Observations.

The outlines of the Double-Count method were given in *T.P.* $25_1$, together with a reduction of the results obtained by this method in 1920 at Tashkent. Thanks to the energy of Mr. P. J. Davidovitsch and to the assistance of Mr. V. M. Komarevsky and Mr. S. G. Zaosersky, and through the courtesy of Mr. V. N. Milovanoff, director of the Tashkent observatory, the Double-Count observations were organized at Tashkent in August, 1921; the observational data were forwarded to the writer, and the present paper deals with the discussion of these data.

The persons mentioned above worked as observers; for brevity's sake we shall denote them by the following letters: *D* (Mr. Davidovitsch); *A* (Mr. Komarevsky); *Z* (Mr. Zaosersky). The following persons wrote down their records: Messrs Nikolayeff, Dolgih, Savitsky and Afanasjeff. A part of the reduction was made by Messrs A. Pohla and R. Livländer, of the Tartu Observatory; to Mr. Livländer I am indebted for preparing the illustrations.

Table 1 contains the data referring to the time and conditions of observation. For the condition of the sky the scale of *T.P.* $25_1$, p. 49, was used.

The observations were not made strictly according to the instructions given in *T.P.* $25_1$, pp. 48—56; they differed in the following points:

Table 1.

| | Date and Interval. August 1921. | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | the 7th | | | the 8th | | | the 9th | | | the 10th | | | the 11th | | | the 12th | | | the 13th | | |
| | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III |
| Middle of Interval (Tashkent M. T.) | 11h 56m.1 | 13 01.1 | 14 06.1 | 12 16.2 | 13 17.1 | 14 17.1 | 12 02.1 | 13 02.1 | 14 02.1 | 12 03.2 | 13 03.1 | 14 03.1 | 12 04.1 | 13 04.1 | 14 04.1 | 12 27.0 | 13 28.0 | 14 27.1 | 12 14.0 | 13 14.1 | 14 14.1 |
| Duration (Minutes) | 50m.0 | 60.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 48.1 | 50.0 | 50.0 | 50.0 | 50.0 |
| Observers | *D, A, Z* | | | *D, A* | | | *D, A, Z* | | | *D, A, Z* | | | *D, A, Z* | | | *D, A* | | | *D, A, Z* | | |
| Mean Condition of the Sky *D* | 3.5 | | | 4.0 | | | 3.8 | | | 4.0 | | | 4.0 | | | 4.0 | | | (3.5) | | |
| Mean Condition of the Sky *A* | 3.8 | | | 4.8 | | | 3.2 | | | 4.0 | | | 3.8 | | | 3.5 | | | 3.0 | | |
| Mean Condition of the Sky *Z* | 3.5 | | | — | | | 4.5 | | | 5.0 | | | 4.0 | | | — | | | 3.5 | | |

Remarks on the Condition of the Sky:

*August 9.* $13^h12^m$ Small clouds in Perseus, Cassiopeja, Auriga; from $14^h03^m$ haze, condition of sky 2.5—3.5.

*August 12.* At beginning *Moon*, I quarter, setting at $12^h24^m$; from beginning to $12^h24^m$ clouds in *Aries, Pisces.*

*August 13.* 1st Interval the Moon, age $9^d$, $10^0$—$15^0$ above the horizon; setting during IInd Interval, at $13^h12^m$. $13^h10^m$ clouds near $\beta$ Tauri; $14^h0^m$ the Plejades hidden by clouds; $14^h10^m$ clouds in Auriga; $14^h15^m$ no clouds, but the transparency of the sky is somewhat lessened.

NB. On Aug. 8 and 12 Mr. Z. did not observe.

On Aug. 7 and 8 Mr. D. worked without assistant, writing down the records himself.

1) *D* traced all meteors he saw on a star-map, thus joining the Double-Count observations with the determination of the radiant, while the assistant recorded the time and the magnitude. Only a few meteors (about $2\,^0/_0$) recorded by *D* were not traced on the map. Notwithstanding the loss of time necessitated by the tracing of meteor paths, the number of meteors recorded by *D* was on the average $18\,^0/_0$ greater than the number by *A* and $25\,^0/_0$ greater than the number by *Z*, for the same interval of time. This must be attributed to the keener sight and greater ability of *D*. Even on August 7. and 8., when there was no assistant at his disposal, the number of meteors recorded by *D* was evidently not affected.

2) The other two observers watched the sky uninterruptedly. The record of position was made, as in 1920, by indicating the nearest star, instead of by using definitely limited sections.

3) The comparison stars used for magnitude-estimations were the same as in 1920. They are contained in table 2. The last column of this table gives the mean reduction of the adopted magnitude to the scale of the Harvard Revised Photometry [1]).

Table 2.
Comparison Stars.

| Adopted Magnitude | Stars | Mean Magn. Harv. Rev. | Reduction to H. R. |
|---|---|---|---|
| 0.0 | $\alpha$ Aurigae | 0.21 | +0.21 |
| 1.0 | ($\alpha$ Tauri) | 1.06 | +0.06 |
| 2.0 | $\alpha$, $\beta$, $\gamma$ Andromedae; $\alpha$ Arietis; $\alpha$ Persei; $\gamma$ Cassiopejae | 2.19 | +0.19 |
| 3.0 | $\delta$, $\zeta$, $\varepsilon$, $\gamma$ Persei; $\beta$ Arietis; $\delta$ Cassiopejae; $\beta$ Trianguli | 2.95 | — 0.05 |
| 4.0 | $\nu$, $\varphi$, $\vartheta$, $\tau$ Persei; $\mu$ Andromedae; $\eta$ Piscium; $\gamma$ Arietis | 4.01 | +0.01 |
| 5.0 | $\pi$, $k$, $l$ Persei; $\nu$, $\xi$, $\chi$ Andromedae; $\xi$, $\pi$ Cassiopejae | 4.85 | — 0.15 |
| 6.0 | $\varrho$, o, $\mu$ Arietis. | 5.70 | — 0.30 |

4) Observations for the determination of atmospheric absorption were not made (as they were not made in 1920).

The region of observation was the same as in 1920. For purposes of reduction the region was subdivided into sections that were not identical with the sections used in 1920. Fig. 1 represents the scheme of the region and its sections in gnomonic projection, with the network of coordinates for the equinox 1855.0. The coordinates of the centra and the area of each section in square degrees were read from a similar chart made on a larger scale. Table 3 contains the data for the sections. The 4th column ($\varrho$) gives the distance of the centre from the point $\alpha = 40^0$, $\delta = 57^0$ (Mean Radiant for 1921, according to the observations of *D*).

The direction was reckoned by the method explained on

1) *Harvard Annals* 50.

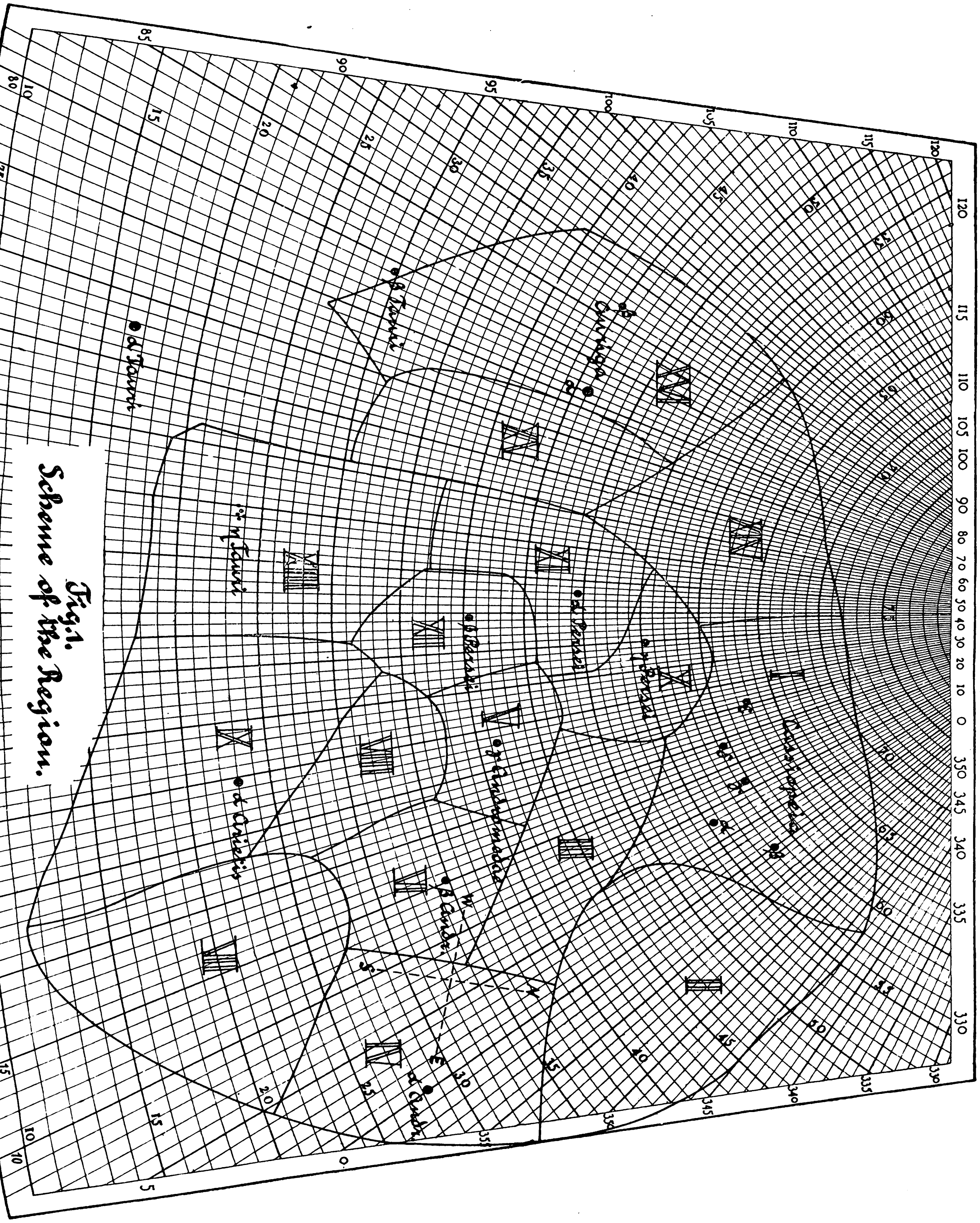



*Fig. 1. Scheme of the Region.*

p. 51 of *T.P.* $25_1$; the line $\gamma$—$\alpha$ Andromedae was taken as the direction *W*—*E*.

The observational data are given in table 29 in a collected form. Instead of the rough material this table represents the result of a first discussion: the identification of meteors recorded by different observers is indicated in this table; every line of the table corresponds to one individual meteor. The first column gives the number; the 2nd — the letters of the observers who recorded the meteor; the 3d — the hour and minute, the 4th — the seconds of time as recorded by each observer; the 5th, 7th and 9th columns contain the magnitude, the position and the direction as given by each observer separately, in the order of the letters of column 2. The position according to *D* is indicated by the number of the section, directly found from the star-map; for the constellations the three-letter abbreviations adopted by the International Astron. Union are used; N. And. means „Andromeda Nebula"; Plej. = Plejades ($\eta$ Tauri). To save space coordinates of the meteors traced by *D* are omitted from the table. Columns 6, 8 and 10 of the table will be explained later on.

Table 3.

| Section | Coord. of Centre $\alpha$ 1921 | $\delta$ | $\varrho$ | Area Sq. Degr. |
|---|---|---|---|---|
| | | + | | |
| I | 16° | 63° | 13° | 388 |
| II | 355 | 46 | 30 | 275 |
| III | 16 | 45 | 19 | 167 |
| IV | 4 | 29 | 39 | 167 |
| V | 29.5 | 42 | 17 | 118 |
| VI | 17 | 34 | 28 | 127 |
| VII | 17 | 20 | 41 | 188 |
| VIII | 29.5 | 32 | 26 | 115 |
| IX | 33 | 22 | 36 | 264 |
| X | 33.5 | 55 | 4 | 131 |
| XI | 52 | 48 | 11 | 186 |
| XII | 44 | 39 | 18 | 129 |
| XIII | 53 | 27 | 31 | 284 |
| XIV | 62 | 63 | 12 | 279 |
| XV | 67.5 | 42 | 23 | 194 |
| XVI | 82.5 | 45 | 28 | 347 |

Taking into account the high cost of printing, the publication of the numerous observations of meteors must be regarded as a luxury; but here we thought an exception should be made, because the new method of observation and reduction must be illustrated by the observational material on which it is based; without the concrete data of observation at his disposal it would be difficult for the reader to exercise full criticism on the work.

The total number of the records was 1135, referring to

756 different meteors. The numbers recorded by each observer were:

| Date Aug. 1921 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Total |
|---|---|---|---|---|---|---|---|---|---|
| Observer | *D* | 30 | 49 | 55 | 38 | 190 | 69 | 39 | 470 |
| | *A* | 20 | 44 | 30 | 38 | 192 | 46 | 29 | 399 |
| | *Z* | 37 | — | 21 | 28 | 150 | — | 30 | 266 |
| | | | | | | | | | 1135 |

The number of *different* meteors recorded by all observers on each day was:

| Aug. 1921 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Total |
|---|---|---|---|---|---|---|---|---|
| Number | 59 | 71 | 73 | 72 | 327 | 87 | 67 | 756 |

## 2. Discussion of Observational Records.

a) *Magnitudes.* Observers *A* and *Z* wrote their magnitudes to $0^{mg}.5$; observer *D*, instead of decimals, wrote sometimes the letters *a*, *b*, *c*, which should represent something like the fractions $^1/_4$, $^1/_2$, $^3/_4$. The meaning of these letters was, however, determined directly by comparison with the magnitudes of *A*, who was known from his work of 1920 to be a careful observer. The systematic difference of magnitude, determined from meteors common to *D* and *A*, was:

| Magnitudes of *D* | Without letter | With *a* | With *b* | With *c* |
|---|---|---|---|---|
| *D—A* | +0.68 | +0.56 | +0.12 | +0.46 |
| *n* | 105 | 24 | 45 | 12 |

Hence the letters must correspond to the following decimals:

$$a = 0.12\,;\ b = 0.56\,;\ c = 0.22.$$

These values differ sensibly from the values assigned to the letters à priori; however, for *a* and *c* the discrepancy is not surprising, owing to the small number of comparisons. Finally the following values of the decimals of $D$ were adopted;

$$a = 0{,}2\,;\; b = c = 0{,}5.$$

With these values the systematic differences of the magnitude-estimations of the observers were found from the common meteors; they were:

| Observer | $D-A$ | $D-Z$ | $A-Z$ |
|---|---|---|---|
| Difference, St. Mg., and P. E. | $+0.69 \pm 0.03$ | $+0.27 \pm 0.04$ | $-0.42 \pm 0.04$ |
| Number | 200 | 121 | 122 |

In finding the mean only those meteors of observer $Z$ were included, which were recorded by him as fainter than $0^{mg},0$. Meteors recorded by $Z$ as brighter than magnitude zero showed a curious deviation in the sense that $Z$ *overestimated* their brightness by about 2 magnitudes; for these meteors the systematic differences were:

| | $D-Z$ | $A-Z$ |
|---|---|---|
| Difference | $+1.9 \pm 0.2$ | $+1.8 \pm 0.2$ |
| $n$ | 9 | 9 |

From all these data the following corrections were adopted to translate the magnitudes recorded to the system of $D$:

| Observer | $D$ | $A$ | $Z$ (m $>$ 0.0) | $Z$ (m $\leqslant$ 0.0) |
|---|---|---|---|---|
| Syst. Correction St. Mg. | 0.00 | $+0.70$ | $+0.30$ | $+2.30$ |

Column 6 of table 29, under the heading "adopted", contains the magnitude reduced to the system of $D$ by the application of these corrections and after forming the mean for the common meteors.

The probable errors of the magnitude-estimations were:

| Observer | $D$ | $A$ | $Z$ |
|---|---|---|---|
| P. E. 1921 | $\pm 0.35$ | $\pm 0.37$ | $\pm 0.31$ |
| P. E. 1920 | $\pm 0.29$ | $\pm 0.39$ | — |

For comparison the p. e. found in 1920 for *D* and *A* are given. Whereas the accuracy of the magnitude-estimations of *A* was sensibly the same in both cases, the probable error of *D* comes out somewhat greater in 1921 than in 1920. Mr. Davidovitsch expresses the opinion that this is due to the different circumstances of observation: in 1920 his chief purpose was to trace accurately the meteors on the map, without attempting completeness; the total number recorded by *D* in 1920 was only 170. On the contrary, in 1921 the task was to trace and record *all* meteors; the number recorded was $2^1/_2$ times greater than in the previous year, and it is only natural that the accuracy was somewhat affected. Mr. Davidovitsch thinks that a probable error of $\pm 0,3$ st. mg. must be regarded as the best that can be expected from magnitude-estimations of meteors.

Owing to the small difference in the p. e. the magnitudes of each observer received equal weight in calculating the mean. The p. e. of the magnitude of a meteor, observed by a single person, may be assumed equal to $\pm 0^{mg},35$; if observed by 2 persons — to $\pm 0^{mg},25$; and if recorded by 3 — to $\pm 0^{mg},20$.

The *decimal equation* of the records of magnitude was determined as in *T.P.* $25_1$, pp. 10—11. Table 4 shows the distribution of the different records of magnitude for each observer.

Table 4.
Number of Meteors.

| Recorded Magnitude | | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *D* | Recorded | 9 | 13 | 13 | 58 | 76 | 176 | 89 | 15 | 11 | 0 | 460 |
| | Smoothed | 10 | 12 | 15 | 54 | 83 | 166 | 95 | 14 | 11 | 0 | |
| *A* | Recorded | 16 | 34 | 121 | 54 | 80 | 33 | 31 | 6 | 9 | 0 | 384 |
| | Smoothed | 13 | 48 | 97 | 74 | 64 | 44 | 25 | 10 | 7 | 1 | |
| *Z* | Recorded | 11 | 10 | 39 | 31 | 69 | 31 | 40 | 8 | 8 | 1 | 248 |
| | Smoothed | 8 | 17 | 29 | 44 | 52 | 45 | 30 | 14 | 6 | 2 | |

For Observer *D* the decimals were rounded off to $0^{mg}.5$ in forming this table.

The smoothed numbers of table 4 were computed on the assumption of a constant decimal equation, represented by the following table. It was assumed that one meteor recorded with the decimal .0 was equivalent to the following effective numbers:

| With decimal | 0,5 (brighter) | 0.0 | 0.5 (fainter) |
|---|---|---|---|
| | Number | | |
| Observer *A* | 0.10 | 0.80 | 0.10 |
| „ *Z* | 0.125 | 0.75 | 0.125 |

For *D* the decimal equation had the opposite sign; for him one meteor recorded with the decimal 0.5 was equivalent to

0.03 meteors (brighter) } with the decimal .0
0.03 „ (fainter) }
0.94 „ with the decimal .5.

These effective quantities were obtained by plotting the observed numbers of table 4 and by drawing preliminary smooth curves by hand.

b) The *record of position* by *A* and *Z* through the indication of the nearest star produced the same inconvenience as in 1920. The meteor observed by *A* or *Z* could be referred to a section with a certain degree of probability; only for the meteors observed by *D* and traced on the chart the position could be indicated with certainty. From the meteors recorded simultaneously by *A* and *D* or *Z* and *D* the following effective quantities, used to transform the records of position into sections, were deduced:

Table 5.
Records of Position.

| Observer *A* | | Observer *Z* | |
|---|---|---|---|
| Record | Adopted Probability of Sections. | Record | Adopted Probability of Sections |
| Cas | 0.9 I; (0.1 out). | Cas | 0.8 I; 0.1 X; (0.1 out) |
| λ And | 1.0 II | λ And | 0.6 II; 0.4 III |
| Cas-And | 1.0 III | α And | 1.0 IV |
| N. And.[1]) | 0.8 III; 0.2 II | γ „ | 0.7 V; 0.3 X |
| α And. | 1.0 IV | β „ | 0.5 VI; 0.5 III |
| γ And. | 0.8 V; 0.2 III | Psc | 0.6 VII; 0.3 VIII; 0.1 IV |
| β And. | 0.7 VI; 0.3 III | Tri | 1.0 VIII |

1) Andromeda Nebula.

Table 5. Continued.

| Observer *A* | | Observer *Z* | |
|---|---|---|---|
| Record | Adopted Probability of Sections | Record | Adopted Probability of Sections |
| Psc | 0.7 VII; 0.2 IV; (0.1 out) | Ari | 1.0 IX |
| Tri | 0.5 VIII; 0.25 VI; 0.25 V | $\chi$ Per | 1.0 X |
| Ari<br>Ari-Plej. | 1.0 IX | $\alpha$ Per | 0.9 XI; 0.1 X |
| | | $\beta$ Per | 0.7 XII; 0.3 XIII |
| $\chi$ Per<br>$\gamma$ And-$\chi$ Per | 1.0 X | Plej. | 0.7 XIII; 0.2 XV; (0.1 out) |
| | | Cam | 0.9 XIV; (0.1 out) |
| $\alpha$ Per | 0.8 XI; 0.2 XIV | $\iota$ Aur | 1.0 XV |
| $\alpha$ Per-Cam | 1.0 XIV | $\alpha$ Aur | 0.7 XVI; 0.3 XIV |
| $\gamma$, $\delta$ Per<br>$\alpha$ Per-And | 1.0 XI | $\beta$ Aur | 1.0 XVI |
| $\beta$ Per | 0.5 XII; 0.5 XI | | |
| $\zeta$ Per<br>Plej.<br>Plej.-$\iota$ Aur | 1.0 XIII | | |
| Cam | 0.9 XIV; (0.1 out) | | |
| $\varepsilon$ Per<br>$\iota$ Aur<br>Per-Aur | 1.0 XV | | |
| $\alpha$ Aur | 0.6 XVI; 0.4 XV | | |
| $\beta$ Aur | 1.0 XVI | | |

„Out“ means: without the boundary of the region.

The coefficients before the number of the section in table 5 represent the *effective probability* that the meteor belongs to the section; these coefficients, being not identical with the *true* probability, are chosen so that the total number of meteors obtained for any section with the aid of these coefficients will be equal to the *probable number* of meteors within this section.

Column 8 of table 29 contains the section adopted for each meteor; in the case of meteors observed by *D* there is no doubt as to the section; for the remaining meteors the data of column 8 in table 29 were adopted according to table 5.

c) The *direction of the path* was determined in 1921 better than in 1920; this was due partly to the circumstance that more than $^1/_2$ of all meteors were traced on the chart, and partly by the better quality of records of the other two observers. In table 29, column 9, the direction attributed to observer *D* was found by estimating the direction upon the star-map; from comparison with *D* the following table for the frequency of errors in direction committed by the other two observers was found

| Error in Direction | Number of Errors *A* | *Z* |
|---|---|---|
| $\pm 0^0$ | 105 | 66 |
| $22^1/_2$ | 57 | 35 |
| 45 | 33 | 24 |
| $> 45^0$ | 5 | 9 |
| Total | 200 | 134 |
| *e* | 0.025 | 0.07 |
| Probable Error | $\pm 17^0$ | $\pm 21^0$ |

In this table *e* means the frequency of errors in direction greater than $45^0$; this quantity was used in formula (11), p. 19 of *T.P.* $25_1$, for the computation of the *true* frequency of Perseids (*P*) from the *apparent* frequency (*P'*). Owing to the smallness of *e* this formula was not used in the reduction of the observations of 1921, so that it was assumed $P = P'$; owing to the fact that only a small fraction of all meteors were observed by a single observer, *A* or *Z*, it must be admitted that the error in the number of Perseids due to this assumption can be, at the worst, only a few per cent.

The data in the $10^{th}$ column of table 29, under the heading "Radiant Adopted", mean: *P* — that the meteor was counted as a Perseid, and *N* — that it was counted as a Non-Perseid.

## 3. The Coefficient of Perception.

The method of determining the Magnitude Function and the Coefficients of Attention was explained in *T.P.* $25_1$, pp. 13—19. For the observations of 1921 the region was subdivided into the following 3 parts: *K*, containing sections I, II, III, IV, VII; *L*, containing V, VI, VIII, IX; and *M*, containing X, XI, XII, XIII, XIV, XV. Section XVI, being highly influenced by atmospheric absorption, was not included. Tables 6 and 7 give the number of meteors observed by different combinations of the observers and classified according to the magnitude (system of *D*, from column 6 of table 29). The numbers of meteors recorded by a single observer (*D*, *A* or *Z*) were corrected for the *decimal equation*. The moonlit hours, namely a part of the $I^{st}$ interval, August 12, and the $I^{st}$ and a part of the $II^{nd}$ interval of August 13, during which the Moon was above the horizon, were not included in these tables; the data for the moonlit hours are given separately in Table 8.

Table 6.

Number of Meteors.

Aug. 7, 9, 10, 11, 13.

| Observer \ Magn. | ⩽2.7 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | Total |
|---|---|---|---|---|---|---|---|---|
| | | | | *Part. K* | | | | |
| *D* | 3.0 | 2.4 | 14.1 | 11.5 | 0.0 | 1.0 | 0.0 | 32.0 |
| *A* | 8.5 | 8.9 | 8.2 | 5.7 | 3.0 | 2.7 | 1.6 | 38.6 |
| *Z* | 5.0 | 3.6 | 3.6 | 4.3 | 4.6 | 3.8 | 2.2 | 27.1 |
| *DA* | 4.0 | 3.0 | 7.0 | 1.0 | 0 | 0 | 0 | 15.0 |
| *DZ* | 5.0 | 0 | 3.0 | 2.0 | 0 | 0 | 0 | 10.0 |
| *AZ* | 0.9 | 5.0 | 1.9 | 2.0 | 1.0 | 0 | 0 | 10.8 |
| *DAZ* | 15.0 | 10.0 | 4.0 | 1.0 | 0 | 0 | 0 | 30.0 |
| | | | | *Part. L* | | | | |
| *D* | 0.0 | 2.5 | 15.0 | 14.5 | 3.8 | 1.2 | 0 | 37.0 |
| *A* | 3.8 | 3.7 | 3.8 | 5.0 | 4.5 | 2.3 | 3.6 | 26.7 |
| *Z* | 2.4 | 2.1 | 3.2 | 2.7 | 1.7 | 1.0 | 0.5 | 13.6 |
| *DA* | 1.0 | 2.0 | 6.0 | 4.0 | 0 | 0 | 0 | 13.0 |
| *DZ* | 2.0 | 4.0 | 4.0 | 2.0 | 0 | 1.0 | 0 | 13.0 |
| *AZ* | 2.0 | 2.0 | 8.0 | 1.0 | 0 | 0 | 0 | 13.0 |
| *DAZ* | 10.0 | 12.0 | 3.0 | 1.0 | 0 | 0 | 0 | 26.0 |
| | | | | *Part. M* | | | | |
| *D* | 7.7 | 12.0 | 22.6 | 14.7 | 2.0 | 4.0 | 0 | 63.0 |
| *A* | 12.9 | 10.2 | 6.0 | 3.4 | 2.1 | 1.3 | 0.4 | 36.3 |
| *Z* | 7.7 | 4.2 | 7.6 | 7.5 | 4.5 | 2.3 | 0.6 | 34.4 |
| *DA* | 2.0 | 10.0 | 5.0 | 4.0 | 1.0 | 0 | 0 | 22.0 |
| *DZ* | 2.0 | 2.0 | 1.0 | 2.0 | 3.0 | 0 | 0 | 10.0 |
| *AZ* | 7.0 | 2.9 | 4.0 | 0 | 0 | 0 | 0 | 13.9 |
| *DAZ* | 15.0 | 13.0 | 2.0 | 3.0 | 0 | 0 | 0 | 33.0 |

From tables 6 and 7 equations analogous to the equations (*P*) represented by table 6 of *T.P.* $25_1$ were formed. We shall give here only the results of the final solution of these equations; this solution differed from the solution given for 1920 in this respect, that for each observer the Magnitude Function was found separately.

Table 9 gives the values of the Magnitude Function ($\chi$), found from the equations. The „average $\chi$" is not the mean of the preceding individual values, but is determined directly from

## Table 7.
### Number of Meteors.
Aug. 8, 12

| Observer \ Magn. | ≤2.7 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | Total |
|---|---|---|---|---|---|---|---|---|
| | | | | *Part. K* | | | | |
| *D* | 3.0 | 2.2 | 6.6 | 9.2 | 1.0 | 1.0 | 0 | 23.0 |
| *A* | 0.7 | 1.5 | 1.6 | 1.0 | 2.0 | 1.5 | 0.4 | 8.7 |
| *DA* | 8.0 | 1.0 | 3.0 | 3.0 | 0 | 0 | 0 | 15.0 |
| | | | | *Part. L* | | | | |
| *D* | 0.0 | 2.2 | 4.7 | 3.1 | 2.0 | 1.0 | 0.0 | 13.0 |
| *A* | 0.7 | 0.4 | 1.1 | 2.5 | 1.3 | 0.2 | 2.5 | 8.7 |
| *DA* | 5.0 | 5.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 12.0 |
| | | | | *Part. M* | | | | |
| *D* | 1.0 | 1.3 | 8.5 | 7.2 | 0.0 | 1.0 | 0 | 19.0 |
| *A* | 2.1 | 2.4 | 2.7 | 2.1 | 1.4 | 1.4 | 1.5 | 13.6 |
| *DA* | 5.0 | 1.0 | 5.0 | 4.0 | 1.0 | 0 | 0 | 16.0 |

## Table 8.
### Number of Meteors.
*Moonlit Hours.*

| Observer \ Magn. | ≤2.7 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | Total |
|---|---|---|---|---|---|---|---|---|
| | | | | Aug. 13, I Interval | | | | |
| *D* | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 6 |
| *A* | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 6 |
| *Z* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *DA* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *DZ* | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| *DAZ, AZ* | | | | 0 | | | | |
| | | | | Aug. 13, II Interval | | | | |
| *D* | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 3 |
| *A* | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| *Z* | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 4 |
| *DA* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| *DZ* | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| *AZ* | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| *DAZ* | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 3 |
| | | | | Aug. 12, II Interval | | | | |
| *D* | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 4 |
| *A* | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 6 |
| *DA* | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 5 |

Table 9.

| m (Syst. $D$) | | $\leqslant 2.7$ | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
|---|---|---|---|---|---|---|---|
| $\chi$ | $D$ | 1.000 | 0.954 | 0.674 | 0.688 | 0.231 | 0.087 |
| | $A$ | 1.000 | 0.976 | 0.509 | 0.339 | 0.143 | 0.000 |
| | $Z$ | 1.000 | 0.864 | 0.437 | 0.331 | 0.296 | 0.127 |
| Average $\chi$ | | 1.000 | 0.931 | 0.533 | 0.426 | 0.216 | 0.061 |
| p. e. | | — | $\pm 0.012$ | $\pm 0.017$ | $\pm 0.022$ | $\pm 0.028$ | $\pm 0.033$ |

the equations of condition on the assumption of an identical Magnitude Function for all observers.

The values of $\chi$ in table 9 show some irregularities in their variation with the magnitude; they were thus smoothed a little; finally the values of $\chi$ contained in table 10 were adopted; the way of deriving the Magnitude Function for the separate groups of days will be explained later on.

Table 10.
Magnitude Function ($\chi$) *adopted.*

| | Magn. | $\leqslant 2.7$ | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
|---|---|---|---|---|---|---|---|
| Aug. 11 and Mean of All Days | $D$ | 1.00 | 0.95 | 0.79 | 0.57 | 0.23 | 0.09 |
| | $A$ | 1.00 | 0.98 | 0.51 | 0.34 | 0.14 | 0.03 |
| | $Z$ | 1.00 | 0.86 | 0.49 | 0.36 | 0.25 | 0.10 |
| Aug. 8 and 10 | $D$ | 1.00 | 1.00 | 0.85 | 0.66 | 0.37 | 0.15 |
| | $A$ | 1.00 | 1.00 | 0.70 | 0.41 | 0.22 | 0.07 |
| | $Z$ | 1.00 | 0.92 | 0.64 | 0.41 | 0.29 | 0.16 |
| Aug. 7, 9, 12, 13 | $D$ | 1.00 | 0.90 | 0.72 | 0.47 | 0.19 | 0.05 |
| | $A$ | 1.00 | 0.84 | 0.46 | 0.28 | 0.11 | 0.00 |
| | $Z$ | 1.00 | 0.75 | 0.43 | 0.33 | 0.20 | 0.05 |

The Coefficients of Attention for the separate sections were computed with the *mean* values of $\chi$ from Table 10; they are contained in table 11.

The *average* Coefficient of Attention represents not the mean of the separate values for the sections, but was found directly from the equations of condition on the assumption of a constant $\pi$ throughout the whole region; this value may be called, too, the

Table 11.

Coefficients of Attention ($\pi$).

| Section / Observer | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | XIII | XIV | XV | XVI | Average $\pi$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *D* | 0.69 | 0.73 | 0.78 | 0.58 | 0.76 | 0.82 | 0.46 | 0.69 | 0.63 | 0.68 | 0.65 | 0.62 | 0.63 | 0.57 | 0.55 | 0.73 | 0.657 |
| *A* | 0.69 | 0.65 | 0.84 | 0.64 | 0.72 | 0.79 | 0.87 | 0.62 | 0.85 | 0.67 | 0.73 | 0.62 | 0.69 | 0.73 | 0.68 | 0.60 | 0.712 |
| *Z* | 0.52 | 0.61 | 0.91 | 0.74 | 0.72 | 1.00 | 0.53 | 0.63 | 0.76 | 0.67 | 0.42 | 0.73 | 0.54 | 0.56 | 0.49 | 0.33 | 0.632 |

*effective* $\pi$. In computing this *average* $\pi$ the unsmoothed values of $\chi$ from table 9 were used, instead of the smoothed values of table 10.

Variations of the Magnitude Function, depending upon the conditions of the sky, and variations of the Coefficient of Attention from day to day can be expected *à priori*. A very detailed investigation of these variations is, however, impossible; reliable results can be obtained only for periods of observation with a sufficient number of observations. Instead of individual values, *effective quantities* for different groups of observations must be determined.

The influence of the varying transparency of the atmosphere was investigated as in *T.P.* $25_1$ by determining the shift of the Magnitude Function. The variations of "atmospheric absorption", found by this method, are sometimes very great; probably not only the absorption is responsible, but, also, the illumination of the background of the sky due to the terrestrial atmosphere. Of course, the knowledge of the true cause of the variation of the Coefficient of Perception of faint meteors is of no real importance for our purposes; what is needed is a working hypothesis which can furnish us with a reliable formula of interpolation; and it is only natural to take the constants of this formula from the meteor numbers themselves.

As may by judged from the remarks on the condition of the sky (see table 1), the days of observation can be subdivided into three groups according to the transparency of the atmosphere:

1) days of high transparency — August 8 and 10; magnitude of faintest stars . . . . . . . . . . 5.6
2) average conditions — August 11; magnitude of faintest stars . . . . . . . . . . . . . . . 5.4
3) days of low transparency — August 7, 9, 12, 13; magnitude of faintest stars . . . . . . . . . . 5.3.

The magnitude of the faintest stars visible is obtained by converting the average estimates of the condition of the sky, made by *D* and *A* (*Z* not used), into stellar magnitudes with the aid of the scale given in *T.P.* $25_1$, p. 49.

For the three groups of days the *effective* Magnitude Function (average for all observers) was determined and from comparison with the average values of $\chi$ from table 9 the *shift in stellar magnitudes* for the interval $m = 3.0$ to 4.5 was found. The results were:

| | Magn. | $\leqslant 2.7$ | 3.0 | 3.5 | 4.0 | 4.5 | Mean |
|---|---|---|---|---|---|---|---|
| Aug. 8, 10 | $\chi$ eff. | 1.000 | 1.000 | 0.577 | 0.579 | 0.248 | — |
| | Shift St. Mg. | — | — 0.22 | — 0.09 | — 0.46 | — 0.06 | — $0.^{mg}21$ |
| Aug. 11 | $\chi$ eff. | 1.000 | 0.909 | 0.558 | 0.390 | 0.244 | — |
| | Shift St. Mg. | — | + 0.04 | — 0.04 | + 0.10 | — 0.06 | + $0.^{mg}01$ |
| Aug. 7, 9, 12, 13 | $\chi$ eff. | 1.000 | 0.930 | 0.456 | 0.361 | 0.164 | — |
| | Shift St. Mg. | — | 0.00 | + 0.32 | + 0.14 | + 0.12 | + $0.^{mg}15$ |

The mean shifts are in unexpectedly close agreement with the estimated magnitude of the faintest stars visible. Taking the mean secant of the zenith distance of the region = 1,4 and the coefficient of absorption on August 8 and 10 equal to 0.23 st. magnitudes, we obtain for the other days the following hypothetical coefficients of absorption:

| | |
|---|---|
| Aug. 8 and 10 . . . . . . . . . . . . . | 0.23 st. mg. |
| Aug. 11 . . . . . . . . . . . . . . . | 0.38 " |
| Aug. 7, 9, 12, 13 . . . . . . . . . . . | 0.48 " |
| Mean of all days . . . . . . . . . . . . . | 0.38 st. mg. |

(the number of meteors being taken as the weight).

With the shifts found above the Magnitude Function for the different groups of days, given in table 10, was determined from the mean values for all days, given in the same table; the values of $\chi$ for August 11 are identical with the mean values for all days.

Variations in the Coefficient of Attention can be found by determining the effective value of $\pi$; let $\overline{\pi_0}$ be the effective Coefficient of Attention for *all* days (this value is contained in the last column of table 11), $\overline{\pi}$ — the effective value of $\pi$ for a certain period of observation, and let $f$ be the "day factor of attention", by which the mean Coefficients of Attention of the observer must be multiplied to obtain the coefficients for the period under question; then we may put

$$f = \frac{\overline{\pi}}{\overline{\pi}_0}.$$

The determination of $f$ for days with a small number of meteors cannot be made with certainty; such days were therefore joined into groups. Comparing the day of the maximum, the 11th August, with all other days, we found for $A$:

August 11 . . . . . . . . . . . . $f = 1.01 \pm 0.04$
All other days . . . . . . . . . . $f = 0.98 \pm 0.05$.

The difference is within the limits of the probable error; the same we found to be true for $Z$; thus for $A$ and $Z$ the factor $f$ was taken equal to 1 for all days of observation.

Table 12.
Values of the Extrapolation Factor. 1921.

Aug. 7, 9, 13.

| Section | Magnitude | | | | | |
|---|---|---|---|---|---|---|
| | ⩽2.7 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
| I | 1.04 | 1.09 | 1.33 | 1.78 | 3.47 | 14 |
| II | 1.03 | 1.08 | 1.30 | 1.71 | 3.28 | 14 |
| III | 1.00 | 1.02 | 1.17 | 1.48 | 2.68 | 11 |
| IV | 1.04 | 1.10 | 1.36 | 1.80 | 3.29 | 14 |
| V | 1.02 | 1.05 | 1.24 | 1.60 | 3.07 | 12 |
| VI | 1.00 | 1.02 | 1.16 | 1.45 | 2.53 | 11 |
| VII | 1.03 | 1.10 | 1.43 | 1.94 | 3.70 | 20 |
| VIII | 1.04 | 1.09 | 1.31 | 1.75 | 3.29 | 14 |
| IX | 1.01 | 1.05 | 1.27 | 1.65 | 3.07 | 14 |
| X | 1.03 | 1.08 | 1.30 | 1.72 | 3.29 | 14 |
| XI | 1.05 | 1.11 | 1.37 | 1.85 | 3.79 | 17 |
| XII | 1.04 | 1.10 | 1.34 | 1.78 | 3.21 | 14 |
| XIII | 1.05 | 1.11 | 1.37 | 1.84 | 3.47 | 17 |
| XIV | 1.05 | 1.11 | 1.39 | 1.87 | 3.58 | 17 |
| XV | 1.07 | 1.16 | 1.46 | 1.96 | 3.93 | 20 |
| XVI | 1.06 | 1.13 | 1.38 | 1.87 | 3.78 | 17 |

Aug. 8

| Section | Magnitude | | | | | |
|---|---|---|---|---|---|---|
| | ⩽2.7 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
| I | 1.09 | 1.09 | 1.24 | 1.58 | 2.63 | 6.7 |
| II | 1.08 | 1.08 | 1.23 | 1.56 | 2.56 | 5.9 |
| III | 1.03 | 1.03 | 1.14 | 1.42 | 2.30 | 5.6 |
| IV | 1.16 | 1.16 | 1.35 | 1.78 | 2.96 | 7.7 |
| V | 1.05 | 1.05 | 1.18 | 1.49 | 2.43 | 6.3 |
| VI | 1.03 | 1.03 | 1.13 | 1.40 | 2.25 | 5.6 |
| VII | 1.07 | 1.07 | 1.29 | 1.78 | 2.97 | 7.7 |
| VIII | 1.11 | 1.11 | 1.27 | 1.62 | 2.69 | 6.7 |
| IX | 1.05 | 1.05 | 1.21 | 1.57 | 2.55 | 7.1 |
| X | 1.10 | 1.10 | 1.25 | 1.61 | 2.63 | 6.3 |
| XI | 1.09 | 1.09 | 1.24 | 1.60 | 2.21 | 6.7 |
| XII | 1.15 | 1.15 | 1.34 | 1.73 | 2.89 | 6.7 |
| XIII | 1.11 | 1.11 | 1.29 | 1.68 | 2.76 | 6.7 |
| XIV | 1.12 | 1.12 | 1.31 | 1.73 | 2.83 | 7.1 |
| XV | 1.15 | 1.15 | 1.35 | 1.79 | 2.96 | 7.1 |
| XVI | 1.10 | 1.10 | 1.25 | 1.58 | 2.62 | 6.3 |

Table 12. Continued.

Aug. 10

| Section | Magnitude $\leqslant 2.7$ | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
|---|---|---|---|---|---|---|
| I | 1.04 | 1.04 | 1.15 | 1.41 | 2.11 | 4.6 |
| II | 1.03 | 1.03 | 1.13 | 1.37 | 2.00 | 4.0 |
| III | 1.00 | 1.00 | 1.05 | 1.23 | 1.73 | 3.3 |
| IV | 1.04 | 1.05 | 1.16 | 1.44 | 2.09 | 7.1 |
| V | 1.02 | 1.02 | 1.09 | 1.30 | 1.87 | 3.7 |
| VI | 1.00 | 1.00 | 1.04 | 1.20 | 1.66 | 3.2 |
| VII | 1.03 | 1.03 | 1.17 | 1.51 | 2.30 | 5.0 |
| VIII | 1.04 | 1.04 | 1.15 | 1.40 | 2.06 | 4.4 |
| IX | 1.01 | 1.02 | 1.10 | 1.34 | 1.90 | 4.0 |
| X | 1.03 | 1.03 | 1.13 | 1.38 | 2.01 | 3.8 |
| XI | 1.05 | 1.05 | 1.16 | 1.46 | 1.93 | 4.8 |
| XII | 1.04 | 1.04 | 1.15 | 1.42 | 2.06 | 3.8 |
| XIII | 1.05 | 1.05 | 1.17 | 1.46 | 2.15 | 4.4 |
| XIV | 1.05 | 1.05 | 1.18 | 1.47 | 2.18 | 4.4 |
| XV | 1.07 | 1.07 | 1.22 | 1.54 | 2.32 | 4.8 |
| XVI | 1.06 | 1.06 | 1.18 | 1.46 | 2.25 | 5.0 |

Aug. 11

| Section | Magnitude $\leqslant 2.7$ | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
|---|---|---|---|---|---|---|
| I | 1.05 | 1.07 | 1.31 | 1.65 | 2.99 | 7.7 |
| II | 1.04 | 1.06 | 1.27 | 1.59 | 2.86 | 7.1 |
| III | 1.00 | 1.01 | 1.15 | 1.38 | 2.28 | 5.6 |
| IV | 1.04 | 1.06 | 1.33 | 1.65 | 2.85 | 7.1 |
| V | 1.02 | 1.04 | 1.22 | 1.49 | 2.59 | 6.7 |
| VI | 1.00 | 1.01 | 1.13 | 1.36 | 2.20 | 5.6 |
| VII | 1.03 | 1.05 | 1.37 | 1.75 | 3.22 | 8.3 |
| VIII | 1.05 | 1.07 | 1.29 | 1.60 | 2.86 | 7.1 |
| IX | 1.01 | 1.03 | 1.23 | 1.52 | 2.59 | 6.3 |
| X | 1.04 | 1.06 | 1.27 | 1.58 | 2.80 | 6.7 |
| XI | 1.06 | 1.08 | 1.34 | 1.71 | 3.30 | 8.3 |
| XII | 1.04 | 1.07 | 1.30 | 1.63 | 2.80 | 7.1 |
| XIII | 1.06 | 1.08 | 1.34 | 1.71 | 2.99 | 8.3 |
| XIV | 1.06 | 1.07 | 1.36 | 1.71 | 3.14 | 7.7 |
| XV | 1.09 | 1.11 | 1.41 | 1.80 | 3.30 | 8.3 |
| XVI | 1.09 | 1.11 | 1.35 | 1.76 | 3.46 | 9.1 |

Aug. 12

| Section | Magnitude $\leqslant 2.7$ | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
|---|---|---|---|---|---|---|
| I | 1.09 | 1.16 | 1.47 | 2.11 | 4.8 | 25 |
| II | 1.08 | 1.16 | 1.45 | 2.07 | 4.8 | 25 |
| III | 1.03 | 1.08 | 1.33 | 1.86 | 4.2 | 25 |
| IV | 1.16 | 1.25 | 1.64 | 2.39 | 5.6 | 33 |
| V | 1.05 | 1.12 | 1.39 | 1.98 | 4.6 | 25 |
| VI | 1.03 | 1.07 | 1.31 | 1.85 | 4.2 | 25 |
| VII | 1.07 | 1.18 | 1.64 | 2.41 | 5.6 | 50 |
| VIII | 1.11 | 1.19 | 1.50 | 2.17 | 5.0 | 25 |
| IX | 1.05 | 1.13 | 1.46 | 2.10 | 4.8 | 33 |
| X | 1.10 | 1.18 | 1.48 | 2.15 | 5.0 | 25 |
| XI | 1.09 | 1.17 | 1.49 | 2.15 | 5.0 | 25 |
| XII | 1.15 | 1.25 | 1.58 | 2.34 | 5.3 | 33 |
| XIII | 1.11 | 1.17 | 1.54 | 2.27 | 5.0 | 33 |
| XIV | 1.12 | 1.18 | 1.58 | 2.31 | 5.3 | 33 |
| XV | 1.15 | 1.25 | 1.67 | 2.40 | 5.9 | 33 |
| XVI | 1.10 | 1.18 | 1.46 | 2.09 | 4.8 | 25 |

As to *D*, there were reasons for expecting *à priori* a variation of $\pi$ for different days of observation; on August 7 and 8 he made all his records alone, without an assistant; and on August 11 the great number of meteors to be traced on the map should reduce the net time of watching the sky. For these groups of days we found the following values:

Observer *D*.

August 7, 8 . . $f = 1.05 \pm 0.08$
„ 11 . . . $f = 0.95 \pm 0.04$
„ 9, 10, 12, 13 $f = 1.08 \pm 0.06$.

Only on Aug. 11 a sensible decrease of $f$ takes place; thus we adopted finally for *D*:

On Aug. 11 . . . . . . . . . . . . . $f = 0.95$
„ the other days . . . . . . . . . . $f = 1.07$.

This difference in $f$ would correspond to an effective loss of time of $D$ in tracing a meteor's path of about 6 seconds, on the day of the maximum, August 11.

A variation of the Coefficient of Attention for the three consecutive hours of observation was not indicated.

The Coefficient of Perception was computed for each day from the formula

$$p = f \pi \chi,$$

where $\chi$ is given by table 10, $\pi$ — by table 11 and where the factor $f$ was taken equal to 1 except for observer $D$.

Table 12 contains the values of the Extrapolation Factor

$$Z = \frac{1}{1 - (1 - p_1)(1 - p_2)(1 - p_3)},$$

where $p_1$, $p_2$ and $p_3$ are the Coefficients of Perception of the observers[1]). The table is arranged according to the magnitude (system $D$) and the sections.

The Extrapolation Factor represents the probable *true* number of meteors that correspond to one *observed* meteor.

The *moonlit hours* were treated separately; from the data of table 8 the mean day factor of attention for all observers was found as

$f = 0.23 \pm 0.04$ for August 13, $I^{st}$ interval (intense moonlight), and
$f = 1.36 \pm 0.20$ for combined Aug. 12, $I^{st}$ and Aug. 13, $II^{nd}$ interval (Moon near the horizon).

Hence we may infer that the disturbing influence of the Moon revealed itself only on Aug. 13, $I^{st}$ interval; in this interval a shift of the magnitude by 1.5 st. mg. was assumed, so that the Coefficient of Perception of a $3^d$ — magnitude meteor would be the same as for a meteor of magnitude 4.5 at normal conditions; the data for this interval cannot, however, be greatly relied on.

The high value of $f$ for Aug. 12, $I^{st}$ and Aug. 13, $II^{nd}$ interval indicates, that these intervals can be treated as were the observations of the other days; the values of $Z$ given in table 12 were therefore applied to them directly.

---

1) On August 8 and 12 it was assumed $p_3 = 0$.

## Table 13.

## Effective Areas ($S$) and Zenithal Reductions of the Magnitudes ($\triangle m$).

| XVI | XV | XIV | XIII | XII | XI | X | IX | VIII | VII | VI | V | IV | III | II | I | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44900 | 10700 | 2220 | 20000 | 1500 | 2160 | 518 | 3820 | 767 | 1060 | 434 | 562 | 387 | 430 | 411 | 893 | $S$ | I | Aug. 7 |
| 3.7(5.4) | 3.9 | 1.5 | 4.2 | 1.8 | 1.8 | 1.0 | 2.0 | 1.4 | 1.3 | 0.9 | 1.1 | 0.6 | 0.7 | 0.2 | 0.6 | $\triangle m$ | | |
| 12700 | 3360 | 1370 | 4200 | 618 | 984 | 321 | 1360 | 346 | 510 | 244 | 292 | 252 | 277 | 321 | 673 | $S$ | II | |
| 2.7(3.6) | 2.5 | 1.2 | 2.3 | 1.1 | 1.2 | 0.6 | 1.2 | 0.8 | 0.7 | 0.5 | 0.7 | 0.3 | 0.4 | 0.0 | 0.4 | $\triangle m$ | | |
| 4040 | 1180 | 867 | 1460 | 317 | 512 | 221 | 659 | 205 | 313 | 166 | 187 | 196 | 209 | 282 | 548 | $S$ | III | |
| 1.8(2.2) | 1.5 | 0.8 | 1.4 | 0.7 | 0.7 | 0.4 | 0.7 | 0.4 | 0.4 | 0.2 | 0.3 | 0.1 | 0.1 | 0.0 | 0.3 | $\triangle m$ | | |
| 28000 | 6530 | 1850 | 10400 | 1040 | 1590 | 426 | 2510 | 558 | 773 | 339 | 434 | 325 | 356 | 367 | 792 | $S$ | I | Aug. 8 |
| 3.3(3.9) | 2.9 | 1.4 | 3.0 | 1.5 | 1.6 | 0.9 | 1.6 | 1.1 | 1.0 | 0.7 | 0.9 | 0.5 | 0.6 | 0.1 | 0.5 | $\triangle m$ | | |
| 8810 | 2260 | 1180 | 2960 | 496 | 805 | 284 | 1050 | 293 | 423 | 214 | 253 | 232 | 247 | 302 | 630 | $S$ | II | |
| 2.4(2.7) | 1.9 | 1.0 | 1.9 | 1.0 | 1.1 | 0.6 | 1.0 | 0.7 | 0.6 | 0.4 | 0.6 | 0.2 | 0.3 | 0.1 | 0.4 | $\triangle m$ | | |
| 3430 | 1010 | 805 | 1250 | 284 | 478 | 208 | 592 | 188 | 292 | 160 | 174 | 190 | 197 | 277 | 533 | $S$ | III | |
| 1.7(1.9) | 1.3 | 0.8 | 1.2 | 0.6 | 0.7 | 0.3 | 0.6 | 0.4 | 0.3 | 0.2 | 0.3 | 0.1 | 0.1 | 0.0 | 0.2 | $\triangle m$ | | |
| 33500 | 8050 | 2000 | 13000 | 1230 | 1750 | 462 | 2980 | 649 | 859 | 376 | 476 | 354 | 387 | 386 | 836 | $S$ | I | Aug. 9 |
| 3.4(4.9) | 3.7 | 1.4 | 3.7 | 1.6 | 1.6 | 0.9 | 1.8 | 1.3 | 1.1 | 0.8 | 1.0 | 0.5 | 0.6 | 0.1 | 0.6 | $\triangle m$ | | |
| 10700 | 2620 | 1260 | 3400 | 566 | 881 | 303 | 1200 | 326 | 461 | 231 | 274 | 240 | 262 | 311 | 649 | $S$ | II | |
| 2.5(3.5) | 2.3 | 1.1 | 2.1 | 1.1 | 1.1 | 0.6 | 1.1 | 0.8 | 0.6 | 0.4 | 0.6 | 0.3 | 0.3 | 0.0 | 0.4 | $\triangle m$ | | |
| 3890 | 1120 | 843 | 1390 | 313 | 504 | 220 | 640 | 203 | 305 | 164 | 184 | 196 | 204 | 281 | 546 | $S$ | III | |
| 1.8(2.2) | 1.3 | 0.8 | 1.4 | 0.6 | 0.7 | 0.4 | 0.6 | 0.4 | 0.4 | 0.2 | 0.3 | 0.1 | 0.1 | 0.0 | 0.2 | $\triangle m$ | | |
| 30900 | 7330 | 1930 | 11500 | 1120 | 1680 | 440 | 2700 | 593 | 818 | 358 | 455 | 339 | 372 | 378 | 818 | $S$ | I | Aug. 10 |
| 3.4(4.0) | 3.0 | 1.4 | 3.0 | 1.6 | 1.6 | 0.9 | 1.7 | 1.2 | 1.1 | 0.7 | 1.0 | 0.5 | 0.6 | 0.1 | 0.5 | $\triangle m$ | | |
| 9290 | 2460 | 1230 | 3080 | 524 | 828 | 293 | 1120 | 307 | 445 | 223 | 263 | 236 | 255 | 308 | 635 | $S$ | II | |
| 2.4(2.7) | 2.0 | 1.1 | 1.8 | 1.0 | 1.1 | 0.6 | 1.0 | 0.7 | 0.6 | 0.4 | 0.6 | 0.3 | 0.3 | 0.1 | 0.4 | $\triangle m$ | | |
| 3670 | 1070 | 824 | 1290 | 295 | 486 | 212 | 611 | 192 | 301 | 161 | 177 | 192 | 200 | 278 | 542 | $S$ | III | |
| 1.7(1.9) | 1.3 | 0.8 | 1.2 | 0.6 | 0.7 | 0.4 | 0.6 | 0.4 | 0.3 | 0.2 | 0.3 | 0.1 | 0.1 | 0.0 | 0.2 | $\triangle m$ | | |
| 28000 | 6530 | 1850 | 10400 | 1040 | 1590 | 426 | 2510 | 558 | 773 | 339 | 434 | 325 | 356 | 367 | 792 | $S$ | I | Aug. 11 |
| 3.3(4.4) | 3.2 | 1.4 | 3.2 | 1.5 | 1.6 | 0.9 | 1.6 | 1.1 | 1.0 | 0.7 | 0.9 | 0.5 | 0.6 | 0.0 | 0.5 | $\triangle m$ | | |
| 8810 | 2260 | 1180 | 2960 | 496 | 805 | 284 | 1050 | 293 | 423 | 214 | 253 | 232 | 247 | 302 | 630 | $S$ | II | |
| 2.4(2.9) | 2.0 | 1.0 | 1.9 | 1.0 | 1.1 | 0.6 | 1.0 | 0.7 | 0.6 | 0.4 | 0.6 | 0.2 | 0.3 | 0.0 | 0.4 | $\triangle m$ | | |
| 3430 | 1010 | 805 | 1250 | 284 | 478 | 208 | 592 | 188 | 292 | 160 | 174 | 190 | 197 | 277 | 533 | $S$ | III | |
| 1.7(2.0) | 1.3 | 0.8 | 1.3 | 0.6 | 0.7 | 0.3 | 0.6 | 0.4 | 0.3 | 0.2 | 0.3 | 0.1 | 0.1 | 0.0 | 0.2 | $\triangle m$ | | |
| 15700 | 3900 | 1500 | 5430 | 743 | 1130 | 356 | 1650 | 408 | 565 | 268 | 334 | 274 | 299 | 323 | 714 | $S$ | I | Aug. 12 |
| 2.8(3.9) | 2.7 | 1.2 | 2.6 | 1.3 | 1.3 | 0.7 | 1.3 | 0.9 | 0.8 | 0.5 | 0.8 | 0.4 | 0.4 | 0.0 | 0.4 | $\triangle m$ | | |
| 5550 | 1510 | 970 | 1850 | 382 | 605 | 246 | 782 | 235 | 345 | 181 | 210 | 208 | 221 | 288 | 575 | $S$ | II | |
| 2.0(2.6) | 1.8 | 0.9 | 1.6 | 0.8 | 0.9 | 0.5 | 0.8 | 0.5 | 0.4 | 0.3 | 0.4 | 0.2 | 0.2 | -0.1 | 0.3 | $\triangle m$ | | |
| 2370 | 745 | 687 | 887 | 238 | 387 | 185 | 491 | 163 | 264 | 144 | 154 | 182 | 183 | 276 | 505 | $S$ | III | |
| 1.4(1.7) | 1·2 | 0.7 | 0.9 | 0.4 | 0.5 | 0.3 | 0.5 | 0.3 | 0.2 | 0.1 | 0.2 | 0.1 | 0.1 | 0.0 | 0.2 | $\triangle m$ | | |
| 19400 | 4550 | 1610 | 6620 | 818 | 1260 | 370 | 1850 | 446 | 631 | 292 | 356 | 290 | 316 | 342 | 736 | $S$ | I | Aug. 13 |
| 3.0(4.1) | 2.8 | 1.3 | 2.7 | 1.3 | 1.4 | 0.8 | 1.4 | 1.0 | 0.9 | 0.6 | 0.8 | 0.4 | 0.5 | 0.1 | 0.5 | $\triangle m$ | | |
| 6550 | 1750 | 1050 | 2140 | 410 | 664 | 255 | 865 | 250 | 375 | 195 | 223 | 215 | 230 | 292 | 596 | $S$ | II | |
| 2.2(2.8) | 1.9 | 1.0 | 1.7 | 0.8 | 0.9 | 0.5 | 0.9 | 0.6 | 0.5 | 0.3 | 0.5 | 0.2 | 0.2 | -0.1 | 0.3 | $\triangle m$ | | |
| 2690 | 822 | 721 | 975 | 251 | 416 | 191 | 514 | 169 | 272 | 149 | 161 | 187 | 188 | 276 | 514 | $S$ | III | |
| 1.5(1.8) | 1.2 | 0.7 | 1.0 | 0.5 | 0.6 | 0.3 | 0.5 | 0.3 | 0.3 | 0.1 | 0.2 | 0.1 | 0.1 | 0.0 | 0.2 | $\triangle m$ | | |

The Effective Areas are expressed in Zenithal Square Degrees; for $H = 100$ km. one $Z^0\square$ is about 3 km$^2$.

To Obtain the Zenithal Magnitude the value of $\triangle m$ must be subtracted from the apparent magnitnde given in the 6th column of table 29.

## 4. Determination of Standard Horary Numbers.

Table 13 contains the *effective horizontal area* of the sections ($S$), in *zenithal square degrees*, aud the *reduction of the magnitudes to the zenith* ($\triangle m$). The method of computation of these quantities was explained on pp. 23 and 27 of *T.P.* $25_1$. The atmospherical absorption was taken into account for the following sections, where no comparison stars were available:

| Section | II | XIII | XVI ($m \geqslant 2.5$) | XV |
|---|---|---|---|---|
| Section of Comp. Stars | V, VI | IX, XII | XI, XII | XI, XII. |

For these sections the *differential* absorption between them and the section of the comparison stars was applied. In section XVI the differential absorption was applied only for meteors fainter than magnitude 2.5, the brighter meteors being directly compared with $\alpha$ Aurigae; in table 13 the reduction for the fainter meteors of section XVI is given in parentheses. The coefficients of atmospherical absorption used were the hypothetical coefficients found in the preceding section of this paper. The *decimal equation* of the magnitudes was not taken into account in the derivation of the Horary Numbers.

As in 1920, the limiting Zenithal Magnitude for which the Horary Numbers were computed, was 4.0 (3.8—4.2). Meteors with apparent magnitude not fainter than 4.8 mg. stars at the zenith were included in the derivation of the results. For each section a certain inferior limit of the Zenithal Magnitude existed, for which reliable results could be obtained: the smaller the zenithal distance of the section, the fainter the limiting zenithal brightness of the meteors counted. Table 14 gives the *limiting Zenithal Magnitude* actually included in the counts, for each section and hour of observation.

The method of computation of the Standard Horary Numbers was described in *T.P.* $25_1$, pp. 37—38. The only difference in the present investigation was that the numbers were counted from a card catalogue of meteors, and the Zen. Magn. were rounded off to $0^{mg}.5$. The results are given in table 15 (Perseids) and 16 (Non-Perseids). In these tables $n_h$ denotes the Standard Horizontal Number, given for each $\frac{1}{2}$ - magnitude class of the Zenithal Magnitude; $n$ — the number of actually obser-

## Table 14.
## Limiting Zenithal Magnitude.

| Section | Date and Interval: Aug. 7 | | | Aug. 8 | | | Aug. 9 | | | Aug. 10 | | | Aug. 11 | | | Aug. 12 | | | Aug. 13 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | I*) | II | III |
| I | 3.7 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 3.7 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 2.7 | 4.2 | 4.2 |
| II | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 2.7 | 4.2 | 4.2 |
| III | 3.7 | 4.2 | 4.2 | 3.7 | 4.2 | 4.2 | 3.7 | 4.2 | 4.2 | 3.7 | 4.2 | 4.2 | 3.7 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 2.7 | 4.2 | 4.2 |
| IV | 3.7 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 2.7 | 4.2 | 4.2 |
| V | 3.2 | 3.7 | 4.2 | 3.7 | 4.2 | 4.2 | 3.2 | 3.7 | 4.2 | 3.7 | 4.2 | 4.2 | 3.7 | 3.7 | 4.2 | 3.7 | 4.2 | 4.2 | 2.2 | 4.2 | 4.2 |
| VI | 3.7 | 4.2 | 4.2 | 3.7 | 4.2 | 4.2 | 3.7 | 4.2 | 4.2 | 3.7 | 4.2 | 4.2 | 3.7 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 2.2 | 4.2 | 4.2 |
| VII | 3.2 | 3.7 | 4.2 | 3.7 | 4.2 | 4.2 | 3.2 | 3.7 | 4.2 | 3.2 | 4.2 | 4.2 | 3.2 | 3.7 | 4.2 | 3.7 | 4.2 | 4.2 | 2.2 | 4.2 | 4.2 |
| VIII | 3.2 | 3.7 | 4.2 | 3.2 | 3.7 | 4.2 | 3.7 | 3.7 | 4.2 | 3.2 | 3.7 | 4.2 | 3.2 | 3.7 | 4.2 | 3.7 | 4.2 | 4.2 | 1.7 | 3.7 | 4.2 |
| IX | 2.7 | 3.2 | 3.7 | 2.7 | 3.7 | 3.7 | 2.2 | 3.2 | 3.7 | 2.7 | 3.7 | 4.2 | 2.7 | 3.2 | 3.7 | 2.7 | 3.7 | 4.2 | 1.2 | 3.7 | 4.2 |
| X | 3.2 | 3.7 | 4.2 | 3.7 | 4.2 | 4.2 | 3.7 | 3.7 | 4.2 | 3.7 | 4.2 | 4.2 | 3.7 | 3.7 | 4.2 | 3.7 | 4.2 | 4.2 | 2.2 | 4.2 | 4.2 |
| XI | 2.7 | 3.2 | 3.7 | 2.7 | 3.2 | 3.7 | 2.2 | 3.2 | 3.7 | 2.7 | 3.2 | 3.7 | 2.7 | 3.2 | 3.7 | 2.7 | 3.7 | 4.2 | 1.2 | 3.7 | 3.7 |
| XII | 2.7 | 3.2 | 3.7 | 2.7 | 3.7 | 3.7 | 2.2 | 3.2 | 3.7 | 2.7 | 3.7 | 4.2 | 2.7 | 3.2 | 3.7 | 2.7 | 3.7 | 4.2 | 1.2 | 3.7 | 4.2 |
| XIII | -0.3 | 1.7 | 3.2 | 1.2 | 2.7 | 3.2 | 0.2 | 2.2 | 3.2 | 1.2 | 2.7 | 3.2 | 0.7 | 2.2 | 3.2 | 1.7 | 2.7 | 3.7 | 0.2 | 2.7 | 3.7 |
| XIV | 3.2 | 3.2 | 3.7 | 3.2 | 3.2 | 3.7 | 2.7 | 3.2 | 3.7 | 3.2 | 3.2 | 3.7 | 2.7 | 3.2 | 3.7 | 3.2 | 3.7 | 3.7 | 1.2 | 3.2 | 3.7 |
| XV | 0.2 | 1.7 | 2.7 | 1.2 | 2.7 | 3.2 | 0.2 | 2.2 | 3.2 | 1.2 | 2.2 | 3.2 | 1.2 | 2.2 | 3.2 | 1.7 | 2.7 | 3.2 | -0.7 | 2.7 | 3.2 |
| XVI | -1.3 | 0.7 | 2.2 | 0.2 | 1.7 | 2.7 | -0.8 | 0.7 | 2.2 | 0.2 | 1.7 | 2.7 | -0.3 | 1.2 | 2.2 | 0.2 | 1.7 | 2.7 | -1.7 | 1.7 | 2.7 |

ved meteors from which $n_h$ was deduced; $N_h = \Sigma n_h$ is the Horizontal Intensity, $I_h$ — the Horizontal Horary Luminosity. In table 15 $N_0$ and $I_0$ denote the Normal Intensity and Normal Horary Luminosity (for 10 000 $Z^0\square$ or about 30 000 km² of the cross-section of the Perseid shower); $\lambda_\odot$ — the apparent geocentric longitude of the sun, $Z_r$ — the zenith distance of the mean radiant of the Perseids for the middle of the interval; the mean coordinates of the radiant for the period 7—13. VIII 1921 were assumed, according to the observations of Mr. Davidovitsch, as

$$\alpha = 40^0; \ \delta = 57^0 \ (1921);$$

the radiant showed during the period of observation no systematic displacement.

On August 13, I interval, it was assumed that the effect of the illumination by the Moon corresponded to a diminution of the apparent brightness by 1.5 magnitudes, and the Extrapolation Factors were read from table 12 on this assumption. To take into account the fact that the meteors of Zen. Mg. 3.0

*) Aug. 13, I Interval: effect of the moonlight taken into account.

# Table 15.

## Horary Numbers for Perseids. 1921. Reduced to 10 000 $Z^0\square$.

| Date. | Interval | $\lambda\odot$ | Cos $Z_r$ | | Zenithal Magnitude 4.0 | 3.5 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | 0.5 | 0.0 | −0.5 | −1.0 | −1.5 | −2.0 | Sum ($N_h$) | $I_h$ | $N_0$ | $I_0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug. 7 | I | 134°42′14″ | 0.586 | $n_h$ | 0 | 0 | 10.5 | 5.4 | 0 | 2.8 | 1.6 | 1.6 | 0 | 0 | 0 | 0 | 0 | 21.9 | 22.4 | 37.3 | 38.2 |
| | | | | $n$ | 0 | 0 | 2 | 2 | 0 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 11 | | | |
| | II | 44 50 | .701 | $n_h$ | 16.7 | 4.0 | 3.2 | 0 | 2.7 | 0.69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27.3 | 8.8 | 39.1 | 12.6 |
| | | | | $n$ | 1 | 1 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | | | |
| | III | 47 26 | .799 | $n_h$ | 6.4 | 9.2 | 0 | 1.8 | 0 | 0 | 0 | 1.1 | 0 | 0 | 0 | 0 | 0 | 18.5 | 8.8 | 23.1 | 11.0 |
| | | | | $n$ | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | | | |
| Aug. 8 | I | 135 40 35 | .628 | $n_h$ | 0 | 0 | 3.0 | 2.4 | 2.3 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8.8 | 6.7 | 14.0 | 10.7 |
| | | | | $n$ | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | | | |
| | II | 43 01 | .732 | $n_h$ | 12.5 | 4.3 | 6.6 | 0 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24.5 | 6.8 | 33.4 | 9.3 |
| | | | | $n$ | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | | | |
| | III | 45 25 | .820 | $n_h$ | 8.8 | 4.4 | 6.7 | 8.0 | 0 | 4.0 | 1.3 | 0 | 0 | 0 | 0 | 0 | 0 | 33.2 | 19.7 | 40.5 | 24.0 |
| | | | | $n$ | 1 | 1 | 3 | 6 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | | | |
| Aug. 9 | I | 136 37 34 | .612 | $n_h$ | 0 | 7.9 | 21.3 | 0 | 1.2 | 2.2 | 0 | 0 | 0 | 0 | 0 | 0.17 | 0 | 32.8 | 19.4 | 53.6 | 31.7 |
| | | | | $n$ | 0 | 1 | 5 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 10 | | | |
| | II | 39 58 | .714 | $n_h$ | 0 | 0 | 2.0 | 2.4 | 0.95 | 1.0 | 0.95 | 0.52 | 0 | 0 | 0 | 0 | 0 | 7.9 | 9.2 | 11.1 | 12.8 |
| | | | | $n$ | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | | | |
| | III | 42 22 | .802 | $n_h$ | 7.7 | 3.5 | 3.2 | 3.4 | 2.0 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20.9 | 9.2 | 26.0 | 11.5 |
| | | | | $n$ | 1 | 1 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | | | |

## Table 15. Continued.

| Date, | Interval | $\lambda\odot$ | Cos $Z_r$ | | Zenithal Magnitude 4.0 | 3.5 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | 0.5 | 0.0 | −0.5 | −1.0 | −1.5 | −2.0 | Sum ($N_h$) | $I_h$ | $N_0$ | $I_0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug. 10 | I | 137°35′10″ | 0.622 | $n_h$ | 8.7 | 0 | 5.9 | 0 | 1.2 | 2.0 | 0.40 | 0.41 | 0 | 0 | 0 | 0 | 0 | 18.6 | 10.8 | 29.9 | 17.3 |
| | | | | $n$ | 1 | 0 | 2 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 8 | | | |
| | II | 37 34 | .720 | $n_h$ | 0 | 5.9 | 6.3 | 5.0 | 0.7 | 0.66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18.6 | 8.9 | 25.9 | 12.3 |
| | | | | $n$ | 0 | 2 | 3 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | | | |
| | III | 39 58 | .811 | $n_h$ | 15.0 | 7.9 | 5.6 | 1.2 | 1.3 | 4.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35.8 | 16.3 | 44.3 | 20.1 |
| | | | | $n$ | 2 | 2 | 3 | 1 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | | | |
| Aug. 11 | I | 138 32 48 | .628 | $n_h$ | 0 | 5.4 | 30.0 | 24.2 | 28.3 | 12.0 | 5.6 | 4.0 | 0.90 | 0.22 | 0.45 | 0.23 | 0.20 | 111.4 | 134.8 | 177.4 | 214.6 |
| | | | | $n$ | 0 | 1 | 9 | 19 | 24 | 11 | 8 | 8 | 2 | 1 | 2 | 1 | 1 | 87 | | | |
| | II | 35 12 | .730 | $n_h$ | 29.6 | 39.4 | 45.4 | 41.0 | 19.7 | 27.2 | 7.4 | 3.6 | 0.62 | 0.64 | 0 | 0 | 0 | 214.6 | 164.6 | 294.0 | 225.5 |
| | | | | $n$ | 2 | 6 | 18 | 19 | 18 | 24 | 12 | 6 | 1 | 1 | 0 | 0 | 0 | 107 | | | |
| | III | 37 36 | .817 | $n_h$ | 32.0 | 49.0 | 60.9 | 40.4 | 18.1 | 15.1 | 2.6 | 3.8 | 0 | 1.3 | 1.3 | 0 | 0 | 224.5 | 164.2 | 274.6 | 201.0 |
| | | | | $n$ | 3 | 13 | 24 | 19 | 13 | 12 | 2 | 3 | 0 | 1 | 1 | 0 | 0 | 91 | | | |
| Aug. 12 | I | 139 31 18 | .675 | $n_h$ | 21.3 | 17.7 | 19.4 | 5.5 | 9.3 | 0.76 | 1.2 | 0 | 0.38 | 0 | 0 | 0 | 0 | 75.6 | 34.9 | 112.0 | 51.7 |
| | | | | $n$ | 2 | 3 | 5 | 2 | 5 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 20 | | | |
| | II | 33 44 | .763 | $n_h$ | 0 | 27.9 | 17.1 | 4.0 | 7.8 | 2.8 | 0.97 | 0 | 0 | 0 | 1.01 | 0 | 0 | 61.6 | 46.9 | 80.7 | 61.4 |
| | | | | $n$ | 0 | 5 | 4 | 2 | 5 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 20 | | | |
| | III | 36 06 | .852 | $n_h$ | 34.0 | 19.7 | 6.0 | 3.2 | 5.7 | 3.4 | 1.9 | 0 | 0 | 0 | 0 | 0 | 0 | 73.9 | 30.6 | 86.7 | 35.9 |
| | | | | $n$ | 3 | 5 | 2 | 1 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | | | |

Table 15. Continued.

| Date, Interval | | λ☉ | Cos Zr | | Zenithal Magnitude 4.0 | 3.5 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | 0.5 | 0.0 | −0.5 | −1.0 | −1.5 | −2.0 | Sum | $I_h$ | $N_0$ | $I_0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug. 13 | I | 140°28′24″ | 0.660 | $n_h$ | — | — | — | 25.0 | 0 | 0 | 0 | 2.9 | 0 | 0.59 | 0 | 0 | 0 | 28.5 | * 33.3+6.0=39.3 | * — — | *60.0 |
| | | | | $n$ | — | — | — | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 5 | | | |
| | II | 30 48 | .756 | $n_h$ | 0 | 11.1 | 5.4 | 3.5 | 4.0 | 0 | 3.1 | 0 | 0.80 | 0 | 0 | 0 | 0 | 27.9 | 24.0 | 37.0 | 31.8 |
| | | | | $n$ | 0 | 3 | 2 | 2 | 3 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 14 | | | |
| | III | 33 12 | .840 | $n_h$ | 4.2 | 15.0 | 11.9 | 3.4 | 2.7 | 3.1 | 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 41.8 | 22.8 | 49.7 | 27.1 |
| | | | | $n$ | 1 | 4 | 4 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | | | |

and fainter were cut off, the Horary Luminosity for this interval was corrected by adding the average fraction of $I_h$ (or $I_0$) between Zen. Magn. 3.0 and 4.0, found for the other two intervals of this day; the result is marked with an asterisk. Owing to the small number of meteors actually observed and the small weight of the method of reduction the results for the I^st interval, Aug. 13, were not used in the following discussion. To take into account the small clouds which appeared in the region on August 9, 12 and 13 (see table 1), the numbers were multiplied by the following factors: on Aug. 9, II interval — by 1.03; on Aug. 12, I interval — by 1.05; on Aug. 13, II interval — by 1.01 and III interval — by 1.04.

The probable errors of the $n_h$ in tables 15 and 16 can be computed from the formula

$$\text{p. e.} = \pm 0.674 \frac{n_h}{\sqrt{n}},$$

this formula being true only for great values of $n$; for convenience's sake the same formula can be adopted for small values of $n$, except when $n = 0$.

Table 17 contains the mean Horary Numbers of the 3 intervals of each day.

The data of this table are plotted on fig. 2. From an inspection of this figure and from table 17 the following conclusions may be drawn:

# Table 16.
## Horary Numbers for Non-Perseids.
### Reduced to 10 000 $Z^0\square$.

| Date | Interval | | 4.0 | 3.5 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | 0.5 | 0.0 | −0.5 | −1.0 | Sum ($N_h$) | $I_h$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug. 7 | I | $n_h$ | 200.0 | 8.0 | 1.9 | 1.6 | 1.0 | 0 | 0 | 0 | 0 | 0.37 | 0 | 212.9 | 40.5 |
| | | $n$ | 4. | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 10 | |
| | II | $n_h$ | 0.0 | 5.6 | 2.3 | 3.2 | 0 | 0 | 0.91 | 0.38 | 0 | 0 | 0 | 12.4 | 8.1 |
| | | $n$ | 0 | 1 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 6 | |
| | III | $n_h$ | 0 | 9.7 | 2.6 | 1.7 | 1.1 | 1.1 | 0 | 0 | 0 | 0 | 0 | 16.2 | 7.3 |
| | | $n$ | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | |
| Aug. 8 | I | $n_h$ | 60.0 | 3.9 | 13.4 | 4.9 | 0 | 1.1 | 0 | 0.57 | 0 | 0 | 0 | 83.9 | 23.0 |
| | | $n$ | 3 | 1 | 5 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 14 | |
| | II | $n_h$ | 11.3 | 9.2 | 9.2 | 1.2 | 1.4 | 2.9 | 0 | 0 | 0 | 0 | 0 | 35.2 | 14.5 |
| | | $n$ | 1 | 2 | 4 | 1 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 13 | |
| | III | $n_h$ | 25.2 | 4.4 | 2.3 | 0 | 0 | 1.3 | 1.3 | 0 | 0 | 0 | 0 | 34.5 | 11.3 |
| | | $n$ | 3 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 7 | |
| Aug. 9 | I | $n_h$ | 0 | 39.1 | 9.7 | 3.1 | 1.0 | 0 | 0 | 0 | 0.52 | 0 | 0.33 | 53.7 | 25.3 |
| | | $n$ | 0 | 6 | 3 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 13 | |
| | II | $n_h$ | 0 | 24.4 | 6.3 | 4.0 | 3.1 | 0 | 1.3 | 0 | 0.55 | 0 | 0.55 | 40.2 | 29.5 |
| | | $n$ | 0 | 4 | 2 | 2 | 3 | 0 | 1 | 0 | 1 | 0 | 1 | 14 | |
| | III | $n_h$ | 26.2 | 4.3 | 2.2 | 1.8 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 | 35.6 | 8.3 |
| | | $n$ | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | |
| Aug. 10 | I | $n_h$ | 16.7 | 14.0 | 2.6 | 2.9 | 1.2 | 0 | 0 | 0 | 0 | 0 | 0 | 37.4 | 10.2 |
| | | $n$ | 1 | 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | |
| | II | $n_h$ | 9.0 | 12.2 | 2.4 | 0 | 0 | 0.58 | 0.66 | 0 | 0 | 0.58 | 0 | 25.4 | 13.8 |
| | | $n$ | 1 | 3 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 8 | |
| | III | $n_h$ | 5.2 | 0 | 0 | 4.8 | 2.6 | 0 | 0 | 1.2 | 0 | 0 | 0 | 13.8 | 11.2 |
| | | $n$ | 1 | 0 | 0 | 4 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 8 | |
| Aug. 11 | I | $n_h$ | 0 | 28.5 | 17.9 | 1.1 | 1.1 | 0 | 0 | 0 | 0.47 | 0.23 | 0 | 49.3 | 21.4 |
| | | $n$ | 0 | 4 | 5 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 13 | |
| | II | $n_h$ | 16.6 | 4.9 | 12.2 | 2.3 | 2.5 | 1.4 | 0 | 0 | 0 | 0 | 0 | 39.9 | 14.9 |
| | | $n$ | 1 | 1 | 5 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | |
| | III | $n_h$ | 16.7 | 3.2 | 2.2 | 0 | 1.2 | 0 | 0 | 0 | 0 | 1.3 | 0 | 24.6 | 18.6 |
| | | $n$ | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | |
| Aug. 12 | I | $n_h$ | 0 | 27.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27.0 | 6.8 |
| | | $n$ | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | |
| | II | $n_h$ | 0 | 5.1 | 9.3 | 3.9 | 0 | 0 | 0 | 0.93 | 0 | 0 | 0 | 19.2 | 11.2 |
| | | $n$ | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 6 | |
| | III | $n_h$ | 9.0 | 0 | 12.8 | 5.1 | 0 | 0 | 1.6 | 0 | 0 | 0 | 0 | 28.5 | 13.7 |
| | | $n$ | 1 | 0 | 3 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | |
| Aug. 13 | I | $n_h$ | — | — | — | 12.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.8 | *8.1+10.4= |
| | | $n$ | — | — | — | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | =18.5 |
| | II | $n_h$ | 46.0 | 7.1 | 5.8 | 0 | 3.1 | 0 | 0 | 0 | 0 | 0 | 0 | 62.0 | 14.5 |
| | | $n$ | 4 | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | |
| | III | $n_h$ | 6.2 | 29.6 | 2.6 | 1.5 | 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 41.4 | 11.8 |
| | | $n$ | 1 | 5 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | |

### Table 17.
### Mean Horary Numbers. Limiting Zenithal Magnitude 4,2.

| | Date. August 1921 | | | | | | |
|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 (II and III Interval) |
| | | | Perseids. | | | | |
| Mean $N_0$ | 33.2 | 29.3 | 30.2 | 33.4 | 248.7 | 93.1 | 43.4 |
| Mean $I_0$ | 20.6 | 14.7 | 18.7 | 16.6 | 213.7 | 49.7 | 29.5 |
| Observed Number | 23 | 26 | 23 | 32 | 285 | 57 | 29 |
| | | | Non-Perseids | | | | |
| Mean $N_h$ | 80.5 | 51.2 | 43.2 | 25.5 | 37.9 | 24.9 | 51.7 |
| Mean $I_h$ | 18.6 | 16.3 | 21.0 | 11.7 | 18.3 | 10.6 | 13.2 |
| Observed Number | 21 | 34 | 34 | 24 | 30 | 18 | 19 |

1) in 1921, on August 7—10, the intensity of the Perseid shower was relatively low and remained almost constant till

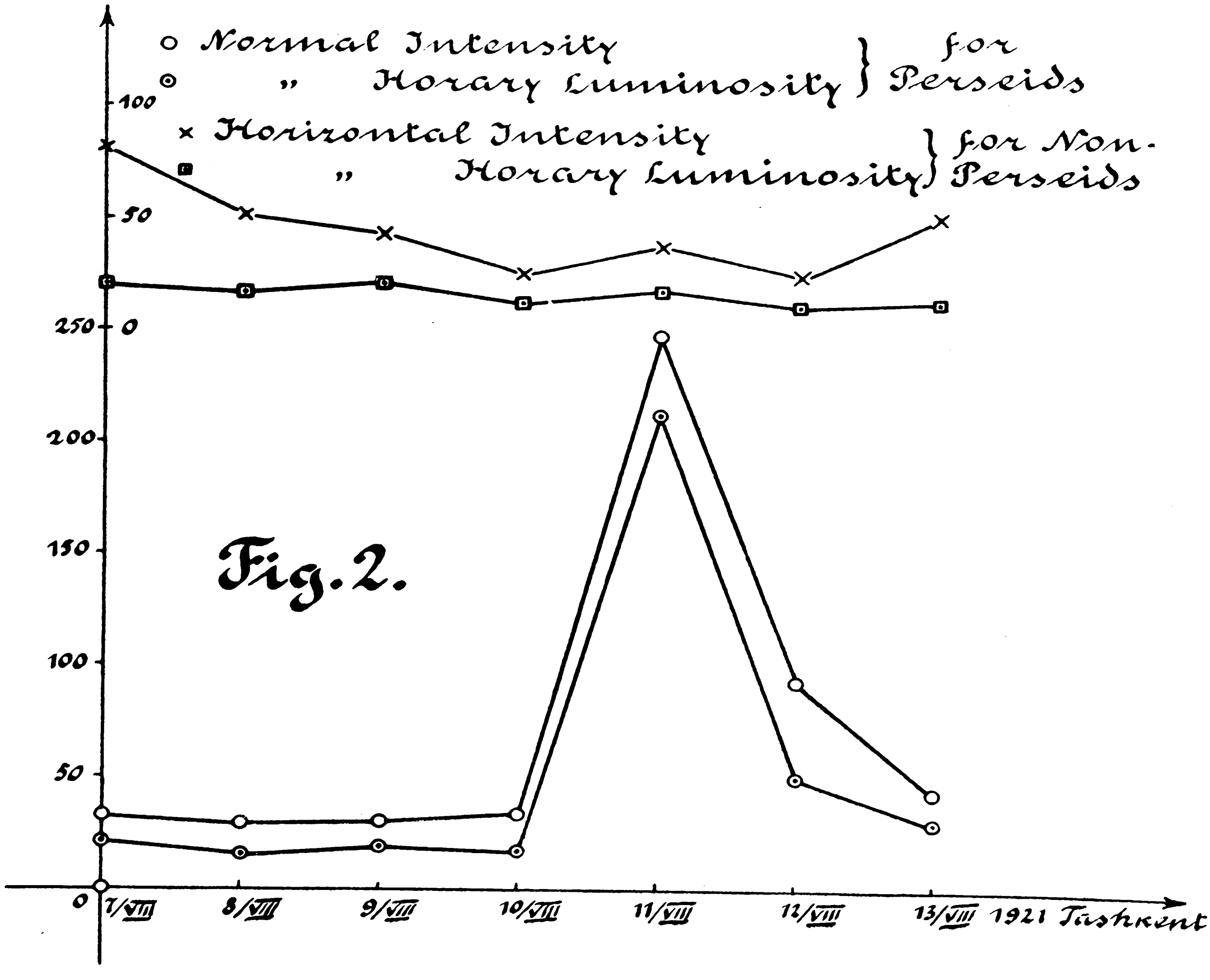



Fig.2.

the very maximum; on Aug. 11 the increase of intensity was very steep. The cross-section of the shower had thus quite a different character from that of 1920 (compare fig. 5 in *T.P.* $25_1$);

2) from a comparison of the Horary Numbers of the Perseids and Non-Perseids for 1921, as well as for 1920, it may be inferred that the separation of the Perseids from meteors not belonging to this radiant can be made quite satisfactorily from the rough records of the observers; were it not so, the numbers of Non-Perseids should exhibit a maximum on August 11, due to Perseids with faulty records of direction; but the numbers of Non-Perseids show no sensible trace of such a behaviour on the day of maximum of the Perseids.

If we sum up the $n_h$ of tables 15 and 16 separately for each Zenithal Magnitude, we obtain the frequency of the magnitudes of meteors; table 18 gives the frequency, for convenience's sake converted into percentages, for 1920, 1921 and the mean of these years. The mean was computed, attributing equal weight to both series in the case of the Perseids, and attributing the weight 1 to the percentages of 1920, and the weight 1,7 — to those of 1921 for the Non-Perseids; the weights were taken in accordance with the number of actually observed meteors. As in the preceding tables, $n$ means the number of meteors actually observed.

Table 18.

Percentage Frequency of Zenithal Magnitudes (Luminosity-Curve).

| Zen. Magn. | 4.0 | 3.5 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | 0 5 | 0.0 | −0.5 | −1.0 | −1.5 | −2.0 | −2.5 | −3.0 | −3.5 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Perseids | | | | | | | | | | |
| Percent. 1921 | 17.9 | 21.1 | 24.6 | 14.1 | 9.9 | 7.7 | 2.60 | 1.36 | 0.25 | 0.20 | 0.25 | 0.04 | 0.02 | 0 | 0 | 0 | 100.0 |
| $n$ | 19 | 51 | 93 | 85 | 83 | 73 | 34 | 22 | 5 | 3 | 4 | 2 | 1 | 0 | 0 | 0 | 475 |
| Percent. 1920 | 25.4 | 20.7 | 18.4 | 13.2 | 10.9 | 5.2 | 3.74 | 1.34 | 0.64 | 0.17 | 0.08 | 0.09 | 0.05 | 0 | 0 | 0.04 | 100.0 |
| $n$ | 30 | 60 | 85 | 85 | 75 | 50 | 35 | 14 | 8 | 3 | 2 | 2 | 1 | 0 | 0 | 1 | 451 |
| Mean Percent. | 21.6 | 20.9 | 21.5 | 13.6 | 10.4 | 6.4 | 3.17 | 1.35 | 0.44 | 0.18 | 0.16 | 0.06 | 0.04 | 0 | 0 | 0.02 | 99.9 |
| $n$ | 49 | 111 | 178 | 170 | 158 | 123 | 69 | 36 | 13 | 6 | 6 | 4 | 2 | 0 | 0 | 1 | 926 |
| | | | | | | | Non-Perseids | | | | | | | | | | |
| Percent. 1921 | 50.2 | 26.9 | 13.2 | 4.8 | 2.4 | 0.94 | 0.65 | 0.35 | 0.17 | 0.28 | 0.10 | 0 | 0 | 0 | 0 | 0 | 100.0 |
| $n$ | 26 | 42 | 40 | 27 | 18 | 9 | 5 | 4 | 3 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 180 |
| Percent. 1920 | 49.1 | 20.5 | 12.1 | 6.9 | 5.4 | 2.40 | 1.03 | 1.15 | 0.67 | 0.73 | 0.06 | 0 | 0 | 0 | 0 | 0 | 100.0 |
| $n$ | 20 | 21 | 19 | 13 | 12 | 7 | 4 | 5 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 106 |
| Mean Percent. | 49.8 | 24.5 | 12.8 | 5.6 | 3.5 | 1.50 | 0.79 | 0.65 | 0.35 | 0.45 | 0.09 | 0 | 0 | 0 | 0 | 0 | 100.0 |
| $n$ | 46 | 63 | 59 | 40 | 30 | 16 | 9 | 9 | 6 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 286 |

It is interesting that the frequency distribution — for both Perseids and Non-Perseids, was perceptibly the same in 1920 and 1921.

No calculation of the Horary Mass was made; in this respect no improvement of the results of *T.P.* $25_1$ can be yet obtained, and as an expression of the intensity of a shower the Horary Mass gives practically the same as the Horary Luminosity.

## 5. Comparison of Results of Different Epochs or Observers.

The Double-Count method leads to results which, theoretically, must be free from external influences and from many personal factors. The condition of the sky, especially the illumination by the Moon, determines the inferior limit of the magnitude to which the data can be regarded as complete; but a variation of this limit cannot be a serious obstacle to the comparison of results obtained under different conditions: the ratio of the numbers for the common parts of the Luminosity-Curve can be regarded as a substitute for the ratio of the true intensities; the only disadvantage of bad observational conditions will be the comparatively small number of recorded objects.

There exists, however, a subjective source of error, which enters with full weight into the results of the Double-Count method: the observer's scale of stellar magnitudes. An idea of the variety of the subjective scales of different observers can be obtained if the percentages of different apparent magnitudes recorded by them are compared. The distribution of the apparent magnitudes depends upon the Magnitude Function, the error dispersion of the magnitudes and the personal scale of the observers; of these three factors the last is, probably, the most subject to variation, so that the number of the different magnitudes recorded may be regarded as a general characteristic of the magnitude-scale. In this way C. P. Olivier estimates the probable shift of the magnitude-scales of several observers of the American Meteor Society [1]); he finds differences of 1 magnitude above or below the "normal" scale. In spite of this variety of scales it is interesting to observe that there exists a majority of "normal" observers with a certain common

1) Publications of the Leander Mc Cormick Observatory, Vol. II Part 7, p. 220.

frequency-distribution of the magnitudes; the inspection of the tables collected by A. G. Cooke and W. F. Denning[1]) and C. P. Olivier[2]) may give us an idea of this phenomenon.

The use of certain comparison stars must, without doubt, help to standardize the scales of different observers, especially in what concerns the uniformity of the scales. But personal differences cannot be excluded, and, as may be inferred from the experience with the 5 observers in 1920 and 1921 at Tashkent, the average difference of the personal equation of two observers must be of the order of $\pm 0.5$ magnitudes. Even for the same observer small fluctuations of the magnitude scale from one year to another can be expected; thus, to make use of the full precision of the Double-Count method, a means of comparing the magnitude scales of different sets of observation must be invented.

Before the comparison all objective factors influencing the magnitude scale of the observer must be excluded; such factors are: 1) the effect of the error-dispersion of the estimated magnitudes and 2) the irregularities of the *adopted* scale of the comparison stars.

The observed numbers of meteors have a maximum at a magnitude somewhat about 3; on both sides of this median value the meteor numbers decrease rapidly; the effect of the error-dispersion will be to spread a greater number of meteors in the direction from the crowded magnitudes towards those represented by smaller meteor numbers, than in the opposite direction; thus the recorded magnitudes on both sides of the median magnitude will contain a great percentage of meteors whose true magnitudes are nearer to the median value. If $m_0$ is the median magnitude, $m$ — the true, $m'$ — the recorded magnitude and $\overline{m}$ — the *average true* magnitude of the meteors classified as having the magnitude $m'$, then we shall have

$$m_0 > \overline{m} > m' \text{ or}$$
$$m_0 < \overline{m} < m'.$$

The correction for accidental errors can be made by adding to $m'$ the difference $\triangle m' = \overline{m} - m'$; this correction depends

1) Observatory, **38**, pp. 138, 139.
2) Loc. Cit. p. 263.

upon the error-dispersion and upon the form of the frequency-distribution of the magnitudes.

Let $\varphi(m)$ and $f(m')$ denote the frequency-functions of $m$ and $m'$ respectively, and let $\psi(m-m')$ be the error-function; then the following integral equation can be written:

$$f(m') = \int_{-\infty}^{a} \varphi(m)\, \psi(m-m')\, dm \quad \ldots\ldots \quad (1);$$

the upper limit $a$ denotes the faintest magnitude occurring in the observations. The average true magnitude which corresponds to the category observed as $m'$, is

$$\overline{m} = \frac{\int_{-\infty}^{a} m\, \varphi(m)\, \psi(m-m')\, dm}{\int_{-\infty}^{a} \varphi(m)\, \psi(m-m')\, dm} \quad \ldots\ldots \quad (2).$$

The error-function may be assumed to be a Gaussian; the value of the error-dispersion and the form of the function $f(m')$ are known from observation; thus at first the true frequency-function $\varphi(m)$ must be determined from the integral equation (1). In practice all functions are numerical and the integral must be regarded as the symbol of the sum taken for finite intervals of the magnitude.

In this case the best method to determine the unknown function $\varphi$ is the method of consecutive approximations, giving good results if the error-dispersion $\psi$ is smaller than the effective dispersion of the magnitudes corresponding to the frequency-function $\varphi$. As the first approximation we take $\varphi_1(m) = f(m)$ substituting into (1), we obtain

$$f_1(m') = \int_{-\infty}^{a} f(m)\, \psi(m-m')\, dm \quad (1');$$

by analogy with (1) and (1′) we can put

$$\varphi(m) - f(m) = f(m) - f_1(m),$$

whence follows the second approximation

$$\varphi(m) = \varphi_1(m) - [f_1(m) - f(m)] = \varphi_2(m) \quad \ldots\ldots \quad (3);$$

the process must be repeated till the observed distribution $f(m')$ is obtained.

The true distribution $\varphi(m)$ being found, the correction $\triangle m = \overline{m} - m'$ is determined, taking $\overline{m}$ from (2).

Since the distribution of the apparent and of the Zenithal magnitudes is not identical, the correction for accidental errors must be made separately for both systems.

In accordance with the probable errors given in *T.P.* $25_1$, p. 9 and in section 2 of this paper, and taking into account the higher accuracy of the common meteors, the following *average* probable errors for the magnitudes (apparent or zenithal) were found:

in 1920 p. e. = ± 0.40 st. mg.
„ 1921 „ „ ± 0.30 „ „

Table 19 gives the probability $\Theta(h)$ of a meteor having the magnitude $m$ to be classified as having the magnitude $m + h$.

Table 19.

| | *h* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | —1.5 | —1.0 | —0.5 | 0.0 | +0.5 | +1.0 | +1.5 | Total |
| $\Theta(h)$ (1920) | 0.02 | 0.08 | 0.23 | 0.34 | 0.23 | 0.08 | 0.02 | 1.00 |
| $\Theta(h)$ (1921) | 0.00 | 0.05 | 0.24 | 0.42 | 0.24 | 0.05 | 0.00 | 1.00 |

The distribution of the *actually observed* meteors according to the apparent and Zenithal magnitudes and the adopted approximation to the true distribution freed from the effect of the error-dispersion and somewhat smoothed is given in table 20. To determine the correction for error-dispersion the actually observed numbers, not the Standard Horary numbers, must evidently be used.

Taking as the function $\varphi(m)$ the "true adopted" distribution from table 20, the correction for the error-dispersion, $\overline{m} - m'$, was computed according to formula (2)[1]) with the aid of the data of table 19.

1) The integral being substituted by numerical sums.

## Table 20.

### a) Distribution of Apparent Magnitudes. (All Meteors).

| m | ⩽—0.5 | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1920 | | | | | | | |
| Observed | 2 | 2 | 3 | 12 | 28 | 48 | 68 | 115 | 131 | 110 | 72 | 38 | 0 |
| True Adopted (2nd Approx.) | 2 | 0 | 1 | 9 | 25 | 43 | 56 | 129 | 152 | 122 | 65 | 25 | 0 |
| | | | | | | 1921 (Moonlit Hours, Section XVI and Meteors out of the Region excluded). | | | | | | | |
| Observed | 4 | 3 | 7 | 8 | 17 | 30 | 87 | 117 | 180 | 113 | 48 | 20 | 15 |
| True Adopted (2nd Approx.). | 4 | 3 | 5 | 7 | 13 | 20 | 87 | 115 | 221 | 116 | 37 | 16 | 5 |

### b) Distribution of Actually Observed Zenithal Magnitudes. Meteors used in the Derivation of the Horary Numbers.

| m | ⩽—2.0 | —1.5 | —1.0 | —0.5 | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1920. Perseids | | | | | | | |
| Observed | 2 | 2 | 2 | 3 | 8 | 14 | 35 | 50 | 75 | 85 | 85 | 60 | 30 | (15) |
| True Adopted (2nd Approx.) | 2 | 2 | 2 | 2 | 5 | 8 | 35 | 48 | 81 | 93 | 98 | 63 | 21 | (6) |
| | | | | | | | 1921. Perseids | | | | | | | |
| Observed | 1 | 2 | 4 | 3 | 5 | 22 | 34 | 73 | 83 | 85 | 93 | 51 | 19 | (10) |
| True Adopted (2nd Approx.) | 1 | 2 | 4 | 2 | 3 | 15 | 38 | 66 | 95 | 84 | 110 | 49 | 11 | (5) |
| | | | | | | | 1920. Non-Perseids | | | | | | | |
| Observed and Adopted (1st Approx.) | 0 | 0 | 0 | 2 | 3 | 5 | 4 | 7 | 12 | 13 | 19 | 21 | 20 | (10) |
| | | | | | | | 1921. Non-Perseids | | | | | | | |
| Observed and Adopted (1st Approx.) | 0 | 0 | 2 | 4 | 3 | 4 | 5 | 9 | 18 | 27 | 40 | 42 | 26 | (15) |

The second correction, depending upon the adopted scale of the comparison stars, was taken directly (or interpolated) from the last column of table 2, called the "Reduction to H. R." (the scale of the Harvard Revised Photometry).

The "Reduction to the Normal Scale" of the observer is the sum of the correction for error-dispersion and the reduction to the H.R.

## Table 21.
### Reduction of Apparent Magnitudes to the Normal Scale. (All Meteors).

| | Magnitude | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $\leqslant$0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 |
| Reduction to H. R. | +0.20 | +0.15 | +0.06 | +0.13 | +0.19 | +0.07 | −0.05 | −0.02 | +0.01 | −0.07 |
| Correction for Error-Dispersion 1920 | (+0.80) | +0.75 | +0.58 | +0.37 | +0.33 | +0.29 | +0.18 | +0.02 | −0.17 | −0.38 |
| Correction for Error-Dispersion 1921 | (+0.00) | +0.25 | +0.25 | +0.34 | +0.39 | +0.26 | +0.16 | −0.01 | −0.23 | −0.39 |
| Red. to Norm. Scale 1920 | (+1.00) | +0.90 | +0.64 | +0.50 | +0.52 | +0.36 | +0.13 | 0.00 | −0.16 | −0.45 |
| Red. to Norm. Scale 1921 | (+0.20) | +0.40 | +0.31 | +0.47 | +0.58 | +0.33 | +0.11 | −0.03 | −0.22 | −0.46 |

## Table 22.
### Reduction of Zenithal Magnitudes to the Normal Scale.

| | Magnitude. | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | −2.0 | −1.5 | −1.0 | −0.5 | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 |
| | Perseids. 1920 | | | | | | | | | | | | | |
| Red. to H. R. | +0.20 | +0.20 | +0.14 | +0.08 | +0.14 | +0.16 | +0.04 | −0.04 | −0.02 | −0.03 | −0.02 | +0.01 | −0.01 | −0.06 |
| Corr. for Error-Disp. | 0.00 | 0.00 | 0.00 | +0.50 | +0.56 | +0.58 | +0.41 | +0.27 | +0.16 | +0.02 | −0.12 | −0.31 | −0.50 | −0.66 |
| Red. to Norm. Scale | +0.20 | +0.20 | +0.14 | +0.58 | +0.70 | +0.74 | +0.45 | +0.23 | +0.14 | −0.01 | −0.14 | −0.30 | −0.51 | −0.72 |
| | Perseids. 1921 | | | | | | | | | | | | | |
| Red. to H. R. | +0.20 | +0.20 | +0.20 | +0.15 | +0.07 | +0.11 | −0.03 | 0.00 | −0.03 | −0.04 | −0.01 | +0.01 | −0.03 | −0.07 |
| Corr. for Error-Disp. | 0.00 | +0.25 | 0.00 | +0.35 | +0.58 | +0.37 | +0.27 | +0.15 | +0.06 | +0.01 | −0.10 | −0.29 | −0.46 | −0.39 |
| Red. to Norm. Scale | +0.20 | +0.45 | +0.20 | +0.50 | +0.65 | +0.48 | +0.24 | +0.15 | +0.03 | −0.03 | −0.11 | −0.28 | −0.49 | −0.46 |
| | Non-Perseids. 1920 | | | | | | | | | | | | | |
| Corr. for Error-Disp. | — | — | — | 0.00 | 0.00 | +0.20 | +0.30 | +0.25 | +0.23 | +0.11 | +0.11 | +0.03 | −0.19 | −0.31 |
| Red. to Norm. Scale | — | — | — | +0.08 | +0.14 | +0.36 | +0.34 | +0.21 | +0.21 | +0.08 | +0.09 | +0.04 | −0.20 | −0.37 |
| | Non-Perseids. 1921 | | | | | | | | | | | | | |
| Corr. for Error-Disp. | — | — | +0.25 | +0.17 | 0.00 | 0.00 | +0.25 | +0.25 | +0.24 | +0.19 | +0.04 | −0.06 | −0.18 | −0.26 |
| Red. to Norm. Scale | — | — | +0.45 | +0.32 | +0.07 | +0.11 | +0.22 | +0.25 | +0.21 | +0.15 | +0.03 | −0.05 | −0.21 | −0.33 |

Tables 21 and 22 contain the adopted reductions to the normal scale of observer *D*; after applying these corrections it can be taken for granted that the magnitude-scale will be affected only by purely subjective factors.

The "Reductions to H. R." adopted in table 22 need some explanation; as the argument for these quantities, taken from table 2, serves the apparent magnitude. Hence the average apparent magnitude, corresponding to a given Zenithal Magnitude, must be determined. High precision is not necessary, so that an approximate method of calculation was adopted. The second interval of August 11 was assumed to represent the average conditions. For this hour the average difference between the apparent and the Zenithal magnitude was assumed to be equal to the mean reduction to the zenith [1]) for the sections from which the Horary Number of the given Zenithal Magnitude was derived [2]), the mean value being computed with weights proportional to the effective horizontal areas of the sections. In this way we obtained:

| Zen. Magn. | 4.0 | 3.5 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | 0.5 | 0.0 | −0.5 | −1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Average* Apparent Magn. 1920 | 4.15 | 3·95 | 3.52 | 3.38 | 2.88 | 3.10 | 2.60 | 2.10 | 1.60 | 1.10 | 0.60 |
| „ 1921 | 4.28 | 3.94 | 3.76 | 3.26 | 3.30 | 2.80 | 2.92 | 2.42 | 1.92 | 1.42 | 0.92 |

With these apparent magnitudes the "Red. to H. R." in table 22 were found.

According to circumstances the comparison of the magnitude scales for different observational series can be made in different ways. The following principles of comparison can be used:

a) adopting the equality of the *mean* scales of different observing groups; for a group of 3 observers the probable deviation of the magnitude scale will be about ± 0,3 st. mg., which corresponds to a p. e. in the Horary Luminosity of about ± 30 % and in the Horary Intensity (Number) from ± 30 to ± 50 % (according to the character of the Luminosity-Curve):

---

1) For 1921 given in table 13.

2) These sections are determined by the data of table 14.

b) if the groups have common observers, the systems of these observers can be assumed to be identical at different times; however, with increasing experience a change in the subjective scale may occur; e. g. the systematical difference of observers $D$ and $A$ was: in 1920, $+0.4$, and in 1921, $+0.7$ mg., so that a relative change of 0,3 magnitudes occurred; the change can be partly attributed to the different sort of observations which $D$ made: in 1920 he traced a small number of objects observed under the best conditions; in 1921 he recorded every meteor seen; but a change in the system of magnitudes of $A$ seems also to have taken place between 1920 and 1921;

c) *the Magnitude Function* gives a means for comparison of the magnitude scales if the atmospherical absorption is known; the Magnitude Function for $m > 2.7$ depends to a great extent upon the total quantity of light falling upon the observer's eye, and thus, for the same observer, can serve as a measure of the apparent brightness of the meteor after its light passes the atmosphere; it seems, too, that the average Magnitude Function for several observers is a psycho-physical function which varies only within restricted limits, and can thus be used as a standard for the comparison of the scales of apparent magnitudes;

d) on the assumption that the Luminosity-Curve of meteors belonging to a definite shower remains invariable from year to year, an objective method of comparison of the magnitude scales can be found in the comparison of the Luminosity-Curves; the following conditions must, however, be satisfied: 1) that the curve representing the *logn* as function of the magnitude must have a considerable curvature and 2) that the meteors of the shower are numerous enough to give a definite Luminosity-Curve (at least several hundreds of different objects are needed); the Perseid shower satisfies both conditions and can thus serve as a standard for comparison of the magnitude scales of different observing groups.

The last two methods of comparison must be regarded as the chief ones; both have their positive and negative sides: the Magnitude Function depends upon a psycho-physical law and is of a subjective, but unconscious character; it can be controlled experimentally and its nature is thus to some extent within our reach; but the inconvenience of using the Magnitude Function consists in allowing a comparison for only a limited range of the apparent magnitude, from 3.0 to 4.5 on the scale here adopted; the Luminosity-Curve, on the contrary, does not depend upon subjective factors and furnishes directly a comparison of the system of Zenithal Magnitudes over their whole range; but variations in the Luminosity-Curve, if small, are uncontrollable and will enter with full weight into the result of the comparison of the scales.

It may be added that if the difference of two scales proves to be constant over the whole range of magnitudes, it will be equally applicable to the apparent and the Zenithal magnitudes; but if the scales cannot be transformed into one another by a constant shift, the corrections of the systems of apparent and of Zenithal magnitudes may be very different.

Only a long series of Double-Count observations can give an answer on the question of the reliability and accuracy of the two methods of comparison; here we shall give an example of comparison for the observations made in 1920 and 1921 at Tashkent. Let $D_1$ and $D_2$ denote the systems of *normal* magnitudes of observer $D$ in 1920 and 1921, $D_0$ — the mean normal system for these years; the systems are *normal*, i. e. freed from the effect of error-dispersion and of the irregularities in the scale of comparison stars by the application of the reductions given in tables 21 and 22. Since the scales are connected by two observers recording in common in both years, $D$ and $A$, we make the assumption of the parallel nature of all scales and seek there the constant corrections of $D_1$ and $D_2$, to reduce these systems to $D_0$:

$$\left.\begin{aligned}\triangle_1 &= D_0 - D_1\\ \triangle_2 &= D_0 - D_2\end{aligned}\right\} \quad (4).$$

If $D_0$ is defined through $D_0 = \frac{D_1 + D_2}{2}$, then we have

$$\left.\begin{aligned}\triangle_1 &= -\triangle_2\\ \triangle_1 &= \frac{D_2 - D_1}{2}\end{aligned}\right\} \quad (5).$$

*Comparison of the Magnitude Function* $\chi$.

Table 23 gives the data needed for the comparison:

Table 23.

| Magn. Apparent | | | Magn. Function $\chi$ | | | | $D_2 - D_1$ | |
|---|---|---|---|---|---|---|---|---|
| Recorded | Normal | | 1920 | | 1921 | | | |
| | $D_1$ | $D_2$ | Mean | $A$ | Mean | $A$ | Mean | $A$ |
| 2.7 | 2.94 | — | 1.00 | 1.00 | — | — | — | — |
| 3.0 | 3.13 | 3.11 | 0.88 | 0.84 | 0.93 | 0.98 | +0.06 | +0.15 |
| 3.5 | 3.50 | 3.47 | 0.67 | 0.48 | 0.53 | 0.51 | —0.26 | —0.06 |
| 4.0 | 3.84 | 3.78 | 0.46 | 0.39 | 0.43 | 0.34 | —0.08 | —0.02 |
| 4.5 | 4.05 | 4.04 | 0.18 | 0.13 | 0.22 | 0.14 | +0.02 | 0.00 |
| | | | | | | Mean | —0.06 | +0.02 |
| | | | | | | Atmospheric Absorption | +0.08 | +0.08 |
| | | | | | | $\triangle_1$ | +0.01 | +0.05 |
| | | | | | | $\triangle_1$ without absorption | —0.03 | +0.01 |

Columns 4, 6 and 8 give the mean Magnitude Function for all observers in 1920, 1921 and the corresponding shift in the normal magnitude; columns 5, 7 and 9 contain the same data for $A$, the only observer for whom the Magnitude Function was determined in 1920 and 1921 [1]. The atmospheric absorption was found in the following way. For 1920 and 1921 the effective coefficients of absorption were adopted as 0.28 and 0.38 mg. respectively, in the scale of the *recorded* magnitudes between 3.0 and 4.5; this interval of the recorded magnitudes corresponds to 0.92 st. mg. in the normal scale, so that a difference of recorded apparent magnitudes must be multiplied by 0.61 to reduce the difference to the normal scale. In this way we find the absorption coefficients expressed in the normal scale as 0.17 st. mg. and 0.23 st. mg. for 1920 and 1921 respectively. Whereas the formerly adopted values appeared to be too great, these values are of the normal order of magnitude; thus the high atmospherical absorption found previously is explained through the deformation of the recorded magnitude scale, due to accidental errors. Adopting the effective Sec $Z = 1{,}4$ for the whole region, the difference of the apparent brightness comes

1) In *T.P.* $25_1$ the separate values of $\chi$ for single observers were not given, only the mean for all observers being used; the values of $\chi$ for $A$ here given were computed anew from the data of 1920.

out as 0.08 st. mg., the brightness of the same star being in 1921 smaller than in 1920 by this amount. It must be pointed out, however, that this correction for atmospheric absorption cannot be seriously relied upon, since the absolute value of the absorption coefficient for a certain normal day was taken entirely arbitrarily [1]), and thus the difference of the absorption coefficients adopted is quite illusory; the correction was introduced only as an example, and can be applied with certainty only when *direct* determinations of the atmospheric absorption are available. It is safer to assume equal absorption in 1920 and 1921; at the foot of table 23 the correction without absorption is given; it is small enough, so that within the limits of the probable error we may conclude that the comparison of *the Magnitude Function indicates identical scales for the magnitudes of 1920 and 1921.*

*Comparison of the Luminosity-Curves.* The percentages of table 18 cannot be used directly, in the comparison, for these numbers depend not only on the correction of the scale, but also upon the *interval* of magnitude (correction of the 2nd order); on the contrary, the sum of all numbers from $m = -\infty$ to the limiting magnitude $m$ is a function of this magnitude alone, and can thus give *independent* corrections for every magnitude; these sums of the percentage numbers of table 18 for the Perseids are given in table 24 and are denoted by $\Sigma$.

To determine the corrections $\triangle_1$ and $\triangle_2$ the normal magnitudes corresponding to equal values of $\log \Sigma$ must be found by interpolation. A preliminary value of the correction must be adopted for the limiting magnitude (corresponding in table 24 to $m$ recorded $= 4.25$), for which the percentage 100 was assumed; with the aid of this correction the percentage numbers must be reduced to the same limiting magnitude, say, to 3.71 in the *mean* normal system; this having been done, the first approximation of the correction of the system of magnitudes can be found etc. The problem is thus solved with the aid of successive approximations; if the Luminosity-Curve has a sufficient curvature, the approximations will soon give the final result.

---

1) In the reduction of the Double-Count observations only *differential* absorption coefficients for the single days of observation were of importance and could be determined.

Table 24.

| Limiting Zen. Mg.: | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recorded | 4.25 | 3.75 | 3.25 | 2.75 | 2.25 | 1.75 | 1.25 | 0.75 | 0.25 | −0·25 | −0.75 | −1.25 |
| Normal 1920 | 3.63 | 3.35 | 3.03 | 2.67 | 2.31 | 1.93 | 1.59 | 1.39 | 1.02 | 0.39 | −0.39 | −1.08 |
| „ 1921 | 3.77 | 3.37 | 3.05 | 2.68 | 2.25 | 1.84 | 1.45 | 1.11 | 0.81 | 0.33 | −0.40 | −0.93 |
| „ Mean | 3.71 | 3.36 | 3.04 | 2.68 | 2.28 | 1.89 | 1.51 | 1.25 | 0.92 | 0.36 | −0.39 | −1.01 |
| 1920 $\Sigma$ | 100.0 | 74.6 | 53.9 | 35.5 | 22.3 | 11.4 | 6.15 | 2.41 | 1.07 | 0.43 | 0.26 | 0.18 |
| 1920 log $\Sigma$ | 2.000 | 1.873 | 1.732 | 1.550 | 1.348 | 1.057 | 0.789 | 0.382 | 0.029 | $\bar{1}.634$ | $\bar{1}.415$ | $\bar{1}.255$ |
| 1921 $\Sigma$ | 100.0 | 82.1 | 61.0 | 36.4 | 22.3 | 12.4 | 4.72 | 2.12 | 0.76 | 0.51 | 0.31 | 0.06 |
| 1921 log $\Sigma$ | 2.000 | 1.914 | 1.785 | 1.561 | 1.348 | 1.093 | 0.674 | 0.326 | $\bar{1}.881$ | $\bar{1}.708$ | $\bar{1}.491$ | $\bar{2}.778$ |
| Mean $\Sigma$ | 100.0 | 78.2 | 57.3 | 35.8 | 22.3 | 11.8 | 5.42 | 2.25 | 0.90 | 0.46 | 0.28 | 0.12 |
| Mean log $\Sigma$ | 2.000 | 1.893 | 1.758 | 1.554 | 1.348 | 1.072 | 0.734 | 0.352 | $\bar{1}.954$ | $\bar{1}.663$ | $\bar{1}.447$ | $\bar{1}.079$ |
| Observed Number 1920 | 451 | 421 | 361 | 276 | 191 | 116 | 66 | 31 | 17 | 9 | 6 | 4 |
| Observed Number 1921 | 475 | 456 | 405 | 312 | 227 | 144 | 71 | 37 | 15 | 10 | 7 | 3 |
| Observed Number 1920+1921 | 926 | 877 | 766 | 588 | 418 | 260 | 137 | 68 | 32 | 19 | 13 | 7 |

From the comparison of the Luminosity-Curve of the Perseids for 1920 with the *mean* distribution, the following corrections were found in accordance with the data of table 24:

| Normal Syst. Zen. Magn. | 1920 Correction $\triangle_1$ 1st Approx. | 2nd Approx. |
|---|---|---|
| −1.08 | (+0.33) | (+0.27) |
| −0.39 | (−0.10) | (−0.15) |
| +0.39 | (−0.24) | (−0.32) |
| +1.02 | −0.06 | −0.08 |
| 1.39 | −0.14 | −0.16 |
| 1.59 | −0.05 | −0.08 |
| 1.93 | −0.09 | −0.12 |
| 2.31 | −0.07 | −0.11 |
| 2.67 | −0.06 | −0.11 |
| 3.03 | −0.08 | −0.12 |
| 3.35 | (−0.11) | (−0.17) |
| Mean | −0.08 | −0.11 |
| | (−0.06) | (−0.11) |

The first approximation was found on the assumption that $\triangle_1 = 0.00$ for the limiting magnitude 3.63 (1920); the values in parentheses indicate that low weight was attributed to them on account either of the small number of observed meteors (the first 3 corrections) or of the small value of $\frac{d \log n}{dm}$ (last figure, for $m = 3.35$); the mean corrections deduced from the data of full weight are given without parentheses, those deduced from all figures in parentheses. For the second approximation the correction at $m = 3.63$ was assumed $= -0.10$; the resulting mean correction, $\triangle_1 = -0.11$ ($\pm$ 0.01) differs little from this value. For 1921 we found in a similar manner $\triangle_2 = +0.10 \pm$

$\pm$ 0.01, but there is no need to determine in this case the correction independently, since $\triangle_2 = -\triangle_1$.

From an inspection of the values of $\triangle_1$ in the second approximation we can conclude that the scales of 1920 and 1921 were essentially parallel, the single corrections differring within the limits of the probable error.

As the result of the comparison of the Luminosity-Curves the following corrections of the normal magnitude scale were adopted:

$$\begin{array}{lll} \text{for } 1920 \;\ldots & \triangle_1 = -0.10 & \text{st. mg.} \\ \text{,, } 1921 \;\ldots & \triangle_2 = +0.10 & \text{,, ,,} \\ \hline & D_2 - D_1 = -0.20 & \text{,, ,,} \end{array}$$

From the comparison of the Magnitude Function we found $D_2 - D_1 = -0.06$ and $+0.02$ respectively (without absorption); the agreement is not good; it is difficult to decide what correction is the right one or what are the relative weights to be attributed to each correction.

For comparison the Horary Numbers, deduced directly from the observations according to the method described in *T.P.* $25_1$ and in the preceding sections of the present investigation, must be reduced to the same scale of magnitudes. Table 25 contains the Coefficients of Reduction or the factors by which the Horary Numbers ($I_0$, $N_0$; $I_h$, $N_h$) for 1920 and 1921 must be multiplied to reduce them to the mean system of normal magnitudes and to *the same limiting magnitude:* 3.71 for Perseids and 4.00 for Non-Perseids.

Table 25.

Coefficients of Reduction.

| | $\triangle_1 = -\triangle_2 = 0.00$ | | $\triangle_1 = -\triangle_2 = -0.10$ | |
|---|---|---|---|---|
| | 1920 | 1921 | 1920 | 1921 |
| | | Perseids | | |
| | | Limiting Magnitude | | 3.71 |
| $N_o$ | 1.06 | 0.98 | 1.17 | 0.93 |
| $J_o$ | 0.92 | 0.94 | 1.03 | 0.86 |
| | | Non-Perseids | | |
| | | Limiting Magnitude | | 4.00 |
| $N_h$ | 1.07 | 0.97 | 1.22 | 0.91 |
| $J_h$ | 0.93 | 0.94 | 1.07 | 0.84 |

These factors were computed for two cases: for $\triangle_1 = 0.00$ and $\triangle_1 = -0.10$. The method of computation of the coefficients can be illustrated by the following example, relating to the Perseids in 1920.

Calculation of the Coefficients of Reduction.
Perseids, 1920.

| Zen. Magn. Recorded | 4.0 | 3.5 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | 0.5 | 0.0 | −0.5 | −1.0 | −1.5 | ⩾−2.0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| For Recorded Magn. $n_0$ | 22.3 | 18.2 | 16.2 | 11.6 | 9.5 | 4.6 | 3.28 | 1.17 | 0.56 | 0.16 | 0.07 | 0.04 | 0.04 | $N_0$=87.7 |
| For Recorded Magn. $i_0 n_0$ | 3.6 | 4.5 | 6.4 | 7.1 | 9.5 | 7.3 | 8.2 | 4.7 | 3.5 | 1.5 | 1.1 | 1.0 | 4.0 | $I_0$=62.6 |
| Reduction of Magn. to Syst. $D_0'$ | −0.61 | −0.40 | −0.24 | −0.11 | +0.04 | +0.13 | +0.35 | +0.74 | +0.60 | +0.48 | +0.04 | +0.10 | +0.10 | — |
| Correction of $i_0 n_0$ | +2.7 | +2.0 | +1.6 | +0.7 | −0.4 | −0.7 | −1.9 | −2.2 | −1.5 | −0.5 | −0.0 | −0.1 | −0.4 | −0.7 |

Limits of the Category "Zen. Magn. 4.0":
Recorded . . . 4.25—3.75;

Reduced to Normal Scale $D_0$ . . . 3.53—3.28; difference $0.\overset{\text{mg.}}{28}$.

Reduction to Limiting Magnitude 3.71 . . . +0.18 or $\frac{0,18}{0,28} = 0,643$ of the Interval of Magnitude comprised in the Category "4.0".

Reduction of the Normal Intensity to Limiting Magnitude 3.71 . . . . . $\triangle N_0 = + 22,3 \times 0,643 = + 14,4$.

Coefficient of Reduction for Normal Intensity . . . .

$$\frac{87,7 + 14,4}{87,7} = \mathbf{1,17}.$$

Reduction of the Horary Luminosity to Limiting Magnitude 3.71 . . . . $+ 3.6 \times 0,643 = + 2.3$.

Correction of Horary Luminosity $= + 2.3 - 0.7 = + 1.7$.

Coefficient of Reduction for Horary Luminosity . . . .

$$\frac{62,6 + 1.7}{62.6} = \mathbf{1,03}.$$

The Coefficients of Reduction depend on the 3 following arguments: 1) the adopted reductions to the normal scale of magnitudes; 2) the constant reduction of the magnitudes to the mean scale; 3) the character of the Luminosity-Curve. This explains why the factors in Table 24 are different for Perseids and Non-Perseids.

The difference between the Coefficients of Reduction, computed on two assumptions as to the correction of the magnitude scales, $\triangle = 0$ and $\triangle = -0.10$, gives an idea of the uncertainty produced by the difference in the magnitude scales; the difference is of the order of $\pm 10\%$, so that this may be assumed as the upper limit of the probable error of the results of Double-Count observations of meteors. I doubt whether results of simple counts made by different observers under different conditions can give on the average an accuracy as high as $\pm 50\%$.

The Horary Intensity ($N$) and Horary Luminosity ($I$) are almost equally affected by the uncertainty of the magnitude scale; but taking into account that the numbers of faint meteors are more liable to be influenced by errors in the Coefficients of Perception, and that these numbers are deduced from a relatively small number of observed objects, the Horary Luminosity must be regarded as somewhat less subject to accidental and systematical errors than the Horary Intensity, since faint meteors enter in the latter with their full weight; the difference in precision cannot, however, be great, and both quantities, the $N$ and the $I$, must be regarded as two almost independent characteristics *sui generis* of the meteor numbers.

We are inclined to think that the corrections of the magnitude scales found from the comparison of the Luminosity-Curves of the Perseids have a greater weight than the corrections found otherwise. Assuming these corrections, we reduced the Horary Numbers found for 1920 and 1921 with the aid of the coefficients given in the 4th and 5th columns of Table 25; the observed mean Horary Numbers were taken from Table 10 of *T.P.* $25_1$ and from Table 17 of this paper. The results are contained in Table 26.

In comparing the Horary Numbers of the Perseids it is interesting to note that on the day of maximum, the 11th August, the intensity of the shower was sensibly the same in 1920 and 1921; on the other days the intensity was somewhat less in 1921. Taking as the characteristic of the intensity the mean for the days August 9—13, we find that in 1920 the mean Horary Intensity ($N_0$) was 22%, and the mean Horary Luminosity 15% greater than in 1921.

Comparing the relative variation of $N_0$ and $I_0$ for the Perseids, it may be noted that the increase of the Horary Luminosity on the day of maximum is more pronounced than the in-

Table 26.

Mean Horary Numbers, Reduced to the Normal Scale of Magnitudes, $D_0$. Difference of Magnitude Scales of 1920 and 1921 determined from comparison of the Luminosity-Cuves.

| Date | August 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Average Aug.9—13 |
|---|---|---|---|---|---|---|---|---|---|
| | Perseids 1920. Limiting Magn. 3.71 | | | | | | | | |
| $N_0$ | — | — | 46.7 | 91.0 | 229.5 | 90.8 | 52.1 | 41.2 | 102.0 |
| $I_0$ | — | — | 25.3 | 38.4 | 177.0 | 49.2 | 31.9 | 34.0 | 64.4 |
| | Perseids 1921. Limiting Magn. 3.71 | | | | | | | | |
| $N_0$ | 30.9 | 27.2 | 28.0 | 31.0 | 231.3 | 86.5 | 40.3 | — | 83.4 |
| $I_0$ | 17.7 | 12.6 | 16.0 | 14.3 | 183.8 | 42.6 | 25.3 | — | 56.4 |
| | Non-Perseids 1920. Limiting Magn. 4.00 | | | | | | | | Average All Days |
| $N_h$ | — | — | 9.2 | 36.5 | 38.2 | 20.6 | 29.4 | 38.8 | 28.8 |
| $I_h$ | — | — | 3.5 | 19.9 | 21.4 | 8.4 | 7.5 | 8.1 | 11.5 |
| | Non-Perseids 1921. Limiting Magn. 4.00 | | | | | | | | |
| $N_h$ | 73.3 | 46.6 | 39.3 | 23.2 | 34.5 | 22.6 | 47.0 | — | 40.9 |
| $I_h$ | 15.6 | 13.7 | 17.6 | 9.8 | 15.3 | 8.9 | 11.1 | — | 13.2 |

crease of the Horary Intensity; this indicates that the percentage of luminous meteors on the day of maximum increases with the increasing number of all meteors; thus the Luminosity-Curve of the Perseids is subject to certain modifications, and the question arises whether our comparison of the magnitude scales was affected by such a variation. As a general characteristic of the Luminosity-Curve the *average luminosity*, given by the ratio

$\bar{I} = \frac{I_0}{N_0}$ may be taken. Table 27 contains the values of $\bar{I}$ for different periods of observation.

Table 27.

Average Luminosity of Perseids. Limiting Magn. 3.71 on Normal Scale.

| | Days without Maximum | Day of Maximum (Aug. 11) | All Days |
|---|---|---|---|
| 1920 | 0.555 | 0.770 | 0.645 |
| 1921 | 0.528 | 0.790 | 0.656 |
| 1920+1921 | 0.542 | 0 780 | 0.650 |

The data for both years are in perfect agreement and show a very pronounced increase of the average brightness of the Perseids on August 11th; there can be no doubt of the reality of the phenomenon; in several records of other observers observing in the usual manner can be found hints on the same circumstance, but ordinarily this was ascribed to the observer noting only the more conspicuous objects and omitting the faint ones when they are abundant; our Double-Count method excludes the influence of such systematic selection; besides, no selection of luminous objects by the observers was found on the day of maximum, the Magnitude-Function retaining its normal form; thus we are led te the conclusion that *the factors which spread the Perseids away from their main orbit acted more intensely on the small particles than on the big ones;* on the cause of this separation it is difficult to form any opinion. Must it be attributed to the radiation-pressure, reducing the force of the central attraction and producing thus a change in the orbital elements? Or to the action of a hypothetical primitive eruption which separated the particles from the comet and gave greater velocities to the smaller particles?

As to the bearing of the variations in the Luminosity-Curve on the comparison of the magnitude scales, the happy circumstance may be noted that the average luminosity for *all days* was sensibly the same in 1920 and 1921, and equal to 0,65; the data which were compared representing the sum for all days, the practical identity of the compared Luminosity-Curves is thus established.

The following question must be answered next: shall the reduction to the normal scale be applied in the first reduction of the observational data, so that results freed from the effect of error-dispersion and of the comparison stars be obtained? We think not. The data must be reduced and arranged according to the recorded magnitudes, as in *T.P.* $25_1$ and in sections 1—4 of the present paper. The comparison of the scales and the reduction to a uniform system can be made afterwards, when sufficient material will be available for comparison; and the safest method of comparison will be found only when numerous data for testing the method will be at our disposal.

## 6. General Considerations on the Magnitudes and on the Number of Meteors.

a) An estimate of the average Coefficient of Perception for meteors of different magnitudes was made by W. F. Denning [1]) on the basis of the average radius of the field of visibility, estimated by T. W. Backhouse [2]); the Coefficient of Perception was assumed proportional to the square of the radius of visibility. Our Magnitude Function must correspond to the Coefficient of Perception adopted by Denning, and a comparison of our results with the theoretical radii of visibility given by Backhouse will be interesting.

Table 28 gives the mean Magnitude Function $\chi$ for the 5 persons who observed in 1920 and 1921; in forming the mean each observer received equal weight; the function $\chi$ for *A* was therefore taken as the average of the observations of 1920 and 1921, and this average value received the same weight as the values of the remaining observers deduced from a single year's observations.

Table 28.
Mean Magnitude Function for 5 Observers: *A, B, C, D, Z.*
Mean of 1920 and 1921.

| | | | | | |
|---|---|---|---|---|---|
| Apparent Magn. Recorded ($m'$) | 2.70 | 3.00 | 3.50 | 4.00 | 4.50 |
| „ „ Normal ($m_0$) | 2.93 | 3.12 | 3.48 | 3.81 | 4.04 |
| Mean $\chi$ | 1.00 | 0.90 | 0.62 | 0.46 | 0.21 |
| Radius of Field of Visibility ($r$) | 40° | 38° | 32° | 27° | 18° |
| Magnitude, Backhouse ($m''$) | 3.5 | 3.7 | 4.3 | 4.8 | 5.5 |
| $m''-m$ | +0.8 | +0.7 | +0.8 | +0.8 | +1.0 |
| $m''-m_0$ | +0.6 | +0.6 | +0.8 | +1.0 | +1.5 |

The radius of the field of visibility for $\chi=1.00$ ($m$ recorded $=2.7$) was estimated in the following way: the diameter of the region was about 60°; according to the instructions, the observer kept his eye on a circle at a median distance between the centre and the boundaries of the region (see *T.P.* $25_1$, p. 48); the distance of this circle from the centre being estimated as 10° (the Coeffi-

1) *Observatory*, vol. 38 (1915), p. 141, in the paper by A. G. Cooke on the Magnitudes of Meteors.

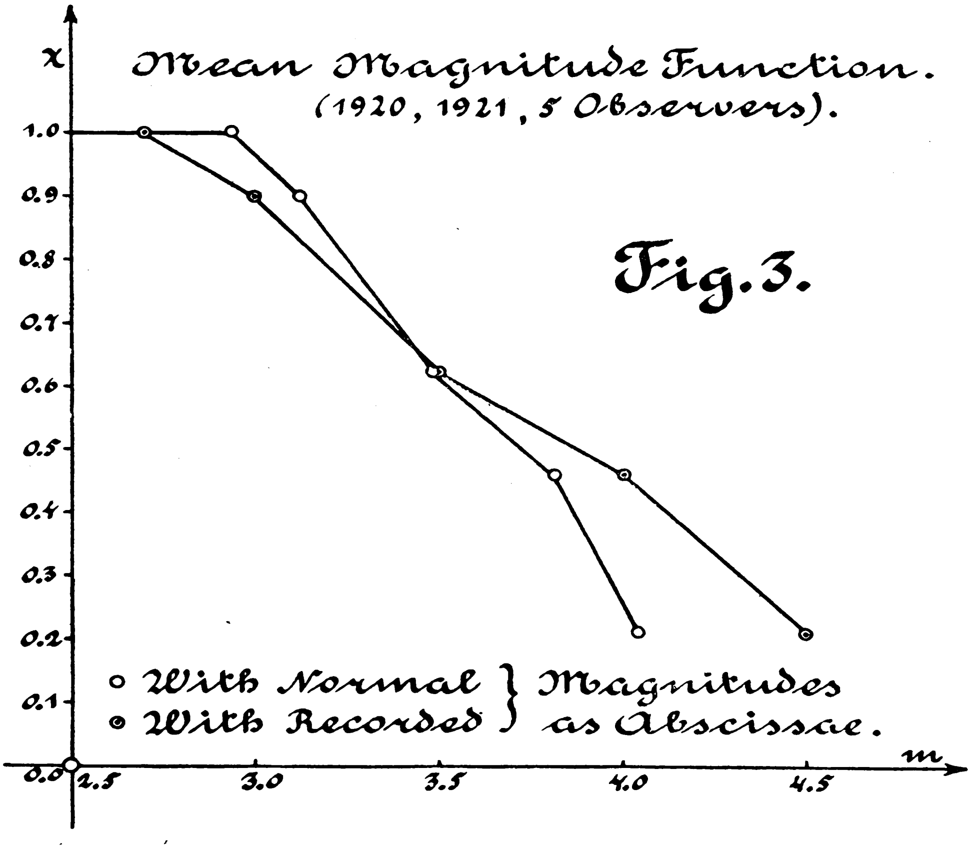
2) *Observatory*, vol. 7, (1884), p. 299; the original paper of T. W. Backhouse was not available to me; the data are cited from the discussion of A. G. Co ke (loc. cit.).

cients of Attention seem to indicate such a value), a field of visibility equal to 40° is needed to keep a survey of the whole region.

The other radii were computed according to the formula

$$r = 40^{0} \sqrt{\chi}. \quad (6).$$

The 5th line of the table contains the magnitude which, according to *Backhouse*, has the same field of visibility as found from our values of $\chi$; the last two lines give the difference between these magnitudes and our two systems of magnitudes.




From these differences it may be inferred that the system of magnitudes used by *Backhouse* is similar to our system of *recorded* magnitudes, and can be reduced to this with the aid of a correction of — 0.82 st. mg., whereas the scale of our "normal" magnitudes cannot be made to agree with the scale of Backhouse.

The mean $\chi$ from table 28 are plotted on fig. 3, separately, with the *recorded* and the *normal* magnitudes as abscissae. The variation of $\chi$ with the normal apparent magnitude *(m)* can be represented by a straight line,

$\chi = 1.00 - \frac{2}{3}\,(m - 2{,}93)$ . . . (7), the mean deviation from this line being about $\pm 0.05$ stellar magnitudes. This gives for the minimal brightness $i$ of a meteor which can be perceived on the distance $r$ from the centre of the field of visibility an expression of the form

$$i = C e^{kr^2} \quad . . . \quad (8),$$ or the inverse of the Gaussian error-function.

b) In *T.P.* $25_1$ (pp. 25—27) we found that the effect of motion is small for the naked-eye observations of the Perseids, so that if the formula $i = C d^{-a}$ represents the variation of the apparent brightness $i$ with the distance $d$, the exponent $a$ can be assumed equal to 2; from the discussion of the observational data we found $a = 2.12 \pm 0.13$ for the system of *recorded magnitudes*. But if the magnitudes are reduced to the *normal scale*, a smaller value of $a$ would be obtained. Since the method of "Equivalent Groups" was applied to groups at nearly the same zenith distance, the reduction to the normal scale of *the Zenithal Magnitudes* must be used here; the range of Zenithal Magnitude used in the derivation of $a$ comprised the interval 1.5—3.5 = 2.0 magnitudes. From table 22 we find the *mean* reduction for *all* meteors as $+0.23$ and $-0.23$ for $m = 1.5$ and 3.5 respectively, the weights 4 and 1 being adopted for the Perseids and Non-Perseids; this gives a foreshortening of the magnitude scale in the ratio $\frac{2.00-0.46}{2.00}$ and a diminution of the effective exponent $a$ in the same ratio; so that in the system of normal magnitudes we find

$$a = 1.64 \pm 0.09.$$

This value would indicate a sensible, though not very great effect of motion; in our previous investigation it was counterbalanced by the effect of the error-dispersion in the estimations of the magnitudes. Our chief conclusion arrived at in *T.P.* $25_1$, that the *recorded* magnitudes can by reduced to the zenith assuming the exponent $a=2$, remains unaltered, if the probable error of the magnitude of one meteor will be comprised within $\pm 0.3$ — $\pm 0.4$. It may be remarked that an uncertainty in $a$ attaining as large a value as $\pm 0.2$ or 10% will *on the average* affect the Zenithal Magnitudes by less than 0.1 st. mg. And the variety of the error-dispersion for different observing groups can never produce so large a deviation in $a$. The effect of motion and the error-dispersion acting in opposite directions and nearly counterbalancing one another, this affords good reason for using directly the recorded magnitudes in the first reduction of the observations, instead of freeing them from the error-dispersion.

Our conclusion as to the invariability of the brightness of the meteor with the distance from the radiant (*T.P.* $25_1$ p.28—29) is unaffected by the above considerations.

c) If the effect of motion is small for the naked-eye observations, in the case of telescopic meteors it must be very pronounced; the effect increasing with the apparent angular velocity, for a magnifying power of 100 an apparent diminution of about 5 magnitudes can be expected. This may serve as an explanation for the strange phenomenon found by *Denning* and others[1]), that the majority of telescopic meteors have a slow apparent motion, so that Denning was inclined to suppose the existence of visible meteoric objects at a height of 1000 miles above the earth surface; instead of this incredible hypothesis a subjective source of the phenomenon can be found. The effect of motion acts especially upon quickly moving objects, so that out of the number of meteors with ordinary angular velocities only a small proportion of the brightest ones will be noted by the observer; whereas a meteor appearing near the radiant will be but little subject to the effect of motion, thanks to its slow angular motion; thus the observations are incomparably more favourable to telescopic meteors appearing near their radiant, whence the abundancy of slow-moving objects noted by Denning. The effect of motion must be indeed enormous; let us assume that the telescope can show meteors up to the apparent brightness 10, and that for a meteor of normal angular speed the effect of motion will be 5 mg.[2]); thus a quickly moving meteor which for the nacked eye will appear of magnitude 5, will be estimated in the telescope as of magnitude 10 and will be on the limit of visibility; for ordinary meteors the telescope will therefore give only the same objects which can be seen with the naked eye. But for meteors $1^0$ from the radiant the effect of motion will be 57 times smaller and such meteors up

1) Observatory, **37** (1914), pp. 211—215.

2) For an angular velocity of $20^0$ per second and a magnifying power of 100 the apparent angular velocity will attain $2000^0$ per second; the diminution of the apparent intensity due to the shortness of the time of action upon the eye must be enormous.

to the 9.5 intrinsic magnitude will be perceived in the telescope. From this reasoning it appears that true telescopic meteors can be seen only if very near their radiant. The ordinary estimates of the number of telescopic meteors[1]) give in this case not even the remotest approximation to the truth; the *true number must be many hundred times greater.*

## 7. Summary and Conclusions.

1) Double-Count observations of meteors made at Tashkent on August 7—13, 1921, are discussed and Standard Horary Numbers for Perseids and Non-Perseids deduced.

2) The subjective functions and systematic differences proved to be of the same general character as in 1920.

3) The Magnitude Function is subject to certain personal variations.

4) The Horary Numbers of the Perseids indicate a different structure of the cross-section of the shower in 1920 and 1921.

5) The Luminosity-Curves of the Perseids and Non-Perseids were sensibly the same in 1920 and 1921.

6) A method of eliminating the effect of the error-dispersion of the magnitudes upon the Horary Numbers is given.

7) Methods of comparison of the magnitude scales of different observing groups are discussed; the chief methods are the comparison of the Magnitude Function and of the Luminosity-Curves; the uncertainty of the comparison is safely within the limits $\pm 0.1$ st. mg.

8) A sample reduction of the observations of 1920 and 1921 to a common magnitude scale is made. The result is that on the day of maximum the intensity of the Perseids was almost exactly the same in 1921 as in 1920; on the other days the intensity was considerably lower in 1921 than in 1920.

9) The Luminosity-Curve of the Perseids on the day of maximum differs considerably from the distribution of luminosities on the other days, the proportion of luminous meteors being increased with the increased intensity on Aug. 11. In comparing the Luminosity-Curves of different years this circumstance must be taken into account, only observations made at

---

1) Such as made by W. F. Denning: Observatory 38 (1915), p. 141.

equivalent epochs being comparable. As a criterion of the identity of the Luminosity-Curves to be compared *the average brightness* of all meteors up to a certain Zenithal Magnitude may serve.

10) The correction for the error-dispersion and the reduction to a normal magnitude scale must be made only in the final treatment of the data, when results of different observers are to be compared; the introduction of these corrections in the first reduction of the observations is in the most favourable case useless.

11) For a normal accuracy of the magnitude-estimations of meteors about $\pm 0.3 - \pm 0.4$ st. mg. (p. e.) the error-dispersion practically counterbalances the supposed effect of motion, so that the *recorded* magnitudes are reduced to the zenith according to the law of inverse squares.

12) The mean Magnitude Function, found for 5 different observers, can be represented within the limits of the probable error by a linear function of the magnitude; this means that the sensibility of the eye to the apparition of luminous objects is a Gaussian error-function of the angular distance from the centre of the field of visibility.

13) The abundance of slow-moving objects among telescopic meteors is explained in the most natural way by the effect of motion increased by the magnifying power of the telescope; intrinsically faint meteors can be observed in a telescope only if near their radiant; the number of telescopic meteors deduced from direct observations must be strongly underestimated.

14) Meteors traced on a map can be used as true Double-Count observations, if *all* meteors seen are recorded without regard to their radiant or to the supposed accuracy of the observed path; a skilful observer can even work alone, counting by ear the seconds of the chronometer, if the meteor numbers are moderate, say not more than 20 per hour.

Tartu Observatory. January 1923.

# Table 29.
## Observational Records [1] [2].

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 7, I Interval* | | | |
| 1 | D | 11 35 | 45 | 4.5 | 4.5 | IX | IX | NW | P |
| 2 | A;Z | 36 | 18; 17 | 2.5; 3.0 | 3.2 | α Per.; Cam. | XIV | NE; NE | P |
| 3 | D; A;Z | 38 | 1; 4; 4 | 3b;2.0;2.0 | 2.8 | XI; α Per; α Per. | XI | N; N; NE | P |
| 4 | A | 38 | 38 | 2.5 | 3.2 | Cas. | 0,9 I | W | N |
| 5 | D | 44 | 20 | 3b | 3.5 | XI | XI | N | P |
| 6 | D; Z | 49 | 20; 21 | 3c; 3.0 | 3.4 | VIII; γ And. | VIII | E; SE | N |
| 7 | Z | 51 | 38 | 4.0 | 4.3 | Psc. | 0,6VII;0,3 VIII;0.1 IV | NW | P |
| 8 | Z | 52 | 40 | 3.0 | 3.3 | λ And | 0.6 II; 0,4 III | NE | N |
| 9 | Z | 55 | 37 | 4.0 | 4.3 | Cam. | 0,9 XIV | SE | P |
| 10 | Z | 56 | 32 | 4.0 | 4.3 | λ And. | 0,6 II; 0,4 III | S | N |
| 11 | A | 57 | 26 | 3.5 | 4.2 | λ And. | II | N | N |
| 12 | Z | 57 | 54 | 4.0 | 4.3 | λ And. | 0,6 II; 0,4 III | NE | N |
| 13 | D; A; Z | 59 | 57;67*;57 | 2a;2.0;1.0 | 2.1 | VIII; Tri; Tri (βAnd) | VIII | NW; NW; NW | P |
| 14 | D | 12 3 | 54 | 5.0 | 5.0 | III | III | SE | N |
| 15 | D | 5 | 29 | 4.0 | 4.0 | II | II | SE | N |
| 16 | Z | 9 | 17 | 2.0 | 2.3 | Cam. | 0,9 XIV | SE | P |
| 17 | D; A; Z | 9 | 36; 36; 37 | 2b;3.5;2.5 | 3.2 | I; Cas.; Cas. | I | SE; E; SE | N |
| 18 | Z | 11 | 12 | 3.0 | 3.3 | Plej. | 0,7 XIII; 0,2 XV | S | N |
| 19 | D; Z | 13 | 16; 17 | 4.0; 3.5 | 3.9 | II; Cas. | II | SE; SE | N |
| 20 | Z | 17 | 23 | 4.0 | 4.3 | α Per. | 0,9 XI; 0,1 X | NE | P |
| 21 | D; A; | 18 | 3; 3 | 0.5;2.0 | 1.6 | VII; α Ari. | VII | NW; NW | P |
| 22 | Z | 18 | 18 | — 2.0 | 0.3 | Out (Psc) | Out | NE | N |
| 23 | Z | 19 | 2 | 2.0 | 2.3 | α And | IV | NW | P |
| 24 | D; A ;Z | 19 | 45; 46; 47 | 4b;3.5;4.0 | 4.2 | XIII; β Per; β Per. | XIII | N; N; NW | P |
| | | | | | | *Aug. 7, II Interval* | | | |
| 25 | D; Z | 31 | 18; 20 | 2c; 1.0 | 1.9 | IV; α And. | IV | NW; NW | P |
| 26 | A;Z | 31 | 50; 52 | 2.0; 2.5 | 2.7 | χ Per.; α Per. | X | N; NW | P |
| 27 | D | 37 | 16 | 5.0 | 5.0 | XIV | XIV | NE | P |
| 28 | Z | 43 | 5 | 2.5 | 2.8 | λ And. | 0,6 II; 0,4 III | SE | N |
| 29 | D | 43 | 30 | 3.0 | 3.0 | Out | Out | SW | P |
| 30 | Z | 13 0 | 7 | 5.0 | 5.3 | Cas. | 0,8 I; 0,1 X | SE | P |
| 31 | D | 0 | 58 | 3b | 3.5 | XIII | XIII | E | N |
| 32 | Z | 1 | 37 | 3.5 | 3.8 | α And. | IV | SW | N |
| 33 | Z | 8 | 12 | 4.5 | 4.8 | λ And. | 0,6 II; 0,4 III | SE | N |
| 34 | D | 9 | 51 | 3c | 3.5 | VI | VI | NW | P |
| 35 | Z | 10 | 11 | -1.0 | 1.3 | λ And. | Out | W | P |
| 36 | A | 10 | 11 | 3.0 | 3.7 | λ And. | II | SW | P |
| 37 | Z | 10 | 17 | 4.0 | 4.3 | λ And. | 0,6 II; 0,4 III | W | P |
| 38 | D; Z | 12 | 51; 51 | 2c; 2.5 | 2.6 | VI; Tri | VI | NW; NW | P |
| 39 | D; A; Z | 13 | 48; 47; 48 | 2a;2.0;1.5 | 2.2 | XIII; β Per.; β Per. | XIII | ENE; NE; NE | N |
| 40 | Z | 14 | 32 | 5.0 | 5.3 | α Per. | 0.9 XI; 0,1 X | NE | P |
| 41 | D | 21 | 36 | 3b | 3.5 | V | V | NW | P |
| 42 | D | 24 | 13 | — | — | Out | Out | WSW | P |
| 43 | D | 26 | 3 | 4.0 | 4.0 | XII | XII | E | N |
| 44 | A;Z | 28 | 25; 26 | 3.0;3.0 | 3.5 | β Per.; δ Per. (?) | XI | NE; NE | N |

1) The explanation of the different data contained in the table can be found on pp. 7, 9, 12 and 13.
2) An asterisk indicates that a mistake in the record is suspected.

## Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| *Aug. 7, III Interval* | | | | | | | | | |
| 45 | D | 13 44 | 54 | 3.0 | 3.0 | Out | Out | N | N |
| 46 | D; Z | 47 | 14; 12 | 3b; 4.5 | 4.1 | X; γAnd. | X | NW; NW | P |
| 47 | Z | 47 | 32 | 5.0 | 5.3 | Cas. | 0,8I; 0,1X | SW | P |
| 48 | D; A; Z | 54 | 58; 58; 58 | 1b; 1.5; -1.0 | 1.7 | I; Cas.; Cas. | I | SE; SE; SE | N |
| 49 | A | 56 | 0 | 3.5 | 4.2 | Psc. | 0,7VII; 0,2IV | NW | P |
| 50 | D; A; Z | 57 | 30; 30; 30 | 3c; 3.0; 3.0 | 3.5 | I; Cas.; Cas. | I | NE; NE; NE | N |
| 51 | Z | 14 5 | 56 | 5.5 | 5.8 | αAnd. | IV | NW | P |
| 52 | D; A | 6 | 0; 0 | 3c; 2.0 | 3.1 | X; Cas.-γAnd. | X | W; W | P |
| 53 | Z | 6 | 2 | 5.0 | 5.3 | Cas. | 0,8I; 0,1X | NW | N |
| 54 | D; A | 8 | 26; 25 | 3c; 0.5 | 2.3 | XVI; ιAur. | XVI | NE; NE | P |
| 55 | D; A | 16 | 24; 23 | 4.0; 4.0 | 4.3 | XI; δPer. | XI | SE; E | N |
| 56 | D | 23 | 35 | 5.0 | 5.0 | XIV | XIV | E | P |
| 57 | A | 23 | 42 | 2.0 | 2.7 | αAnd. | IV | N | N |
| 58 | D; Z | 26 | 42; 42 | 3.0; 1.0 | 2.1 | IV; Psc. | IV | NNE; NE | N |
| 59 | A | 27 | 19 | 3.5 | 4.2 | δPer. | XI | NE | P |
| *Aug. 8, I Interval* | | | | | | | | | |
| 60 | D | 11 53 | 37 | 3c | 3.5 | II | II | NE | N |
| 61 | A | 54 | 44 | 4.0 | 4.7 | αAnd. | IV | NE | N |
| 62 | D | 56 | 45 | 4.0 | 4.0 | XIV | XIV | ESE | N |
| 63 | D | 58 | 20 | 3c | 3.5 | X | X | ESE | P |
| 64 | D | 59 | 43 | 4.0 | 4.0 | VII | VII | NE | N |
| 65 | D; A | 12 5 | 45; 46 | 3b; 3.0 | 3.6 | IV; αAnd. | IV | ENE; E | N |
| 66 | D; A | 10 | 55; 58 | 3c; 2.5 | 3.3 | XV; αPer. | XV | NNE; NE | N |
| 67 | A | 11 | 12 | 4.0 | 4.7 | χPer. | X | NE | P |
| 68 | D; A | 13 | 2; 3 | 3c; 3.5 | 3.8 | XIV; χPer. | XIV | ESE; E | N |
| 69 | D; A | 14 | 56; 57 | 3c; 3.5 | 3.8 | X; γAnd. | X | E; NE | N |
| 70 | A | 15 | 13 | 3.5 | 4.2 | Tri | 0,5VIII; 0,25VI; 0,25V | NW | P |
| 71 | D; A | 15 | 62; 58 | 3b(c); 4.0 | 4.1 | II; λAnd. | II | ESE; SE | N |
| 72 | A | 16 | 17 | 3.0 | 3.7 | Cas. | 0.9I | NW | N |
| 73 | D | 18 | 7 | 4.0 | 4.0 | II | II | NNE | N |
| 74 | D | 22 | 51 | 3a | 3.2 | IV | IV | SW | N |
| 75 | A | 22 | 59 | 3.0 | 3.7 | δPer. | XI | NE | P |
| 76 | A | 23 | 25 | 2.0 | 2.7 | Cas. | 0.9I | SW | P |
| 77 | D; A | 32 | 46; 46 | 3.0(a); 2.0 | 2.9 | IX; αAri | IX | NW; NW | N |
| 78 | A | 33 | 36 | 2.5 | 3.2 | Psc. | 0,7VII; 0,2IV | NW | P |
| 79 | D | ? | 45 | 2c | 2.5 | VII | VII | NW | P |
| 80 | A | 35 | 6 | 3.0 | 3.7 | Psc. | 0,7VII; 0,2IV | E | N |
| *Aug. 8, II Interval* | | | | | | | | | |
| 81 | D; A | 55 | 4; 1 | 3c; 3.0 | 3.6 | VII; Psc. | VII | NW | P |
| 82 | D | 56 | 37 | 5.0 | 5.0 | VI | VI | NE | N |
| 83 | D; A | 57 | 46; 47 | 4b; 3.5 | 4.3 | XI; δPer. | XI | N; N | P |
| 84 | D | 13 2 | 42 | 3b | 3.5 | IX | IX | SSW | N |
| 85 | D | ? | 38 | 3c | 3.5 | VIII | VIII | WNW | N |
| 86 | D; A | 7 | 18; 20 | 4.0(3b); 3.0 | 3.7 | XV; Cam. | XV | N; N | N |
| 87 | D; A | 9 | 7; 7 | 3b; 3.0 | 3.6 | XV; Per-Aur. | XV | N: N | N |
| 88 | D | 13 | 4 | 4.0(3c) | 3.8 | I | I | SW | P |
| 89 | A | 15? | 40 | 4.0 | 4.7 | Psc. | 0,7VII; 0,2IV | NW | P |
| 90 | D | 16 | 48 | 4b | 4.5 | V | V | NNE | N |
| 91 | D; A | 20 | 3; 3 | 3b; 3.0 | 3.6 | I; Cas. | I | SE; E | N |

## Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 8, II Interval. Continued* | | | |
| 92 | D; A | 13 21 | 33; 32 | 2.0; 2.0 | 2.3 | IX; α Ari | IX | ENE; NE | N |
| 93 | A | 23 | 38 | 2.5 | 3.2 | Plej | XIII | NE | N |
| 94 | D | 23 | 52 | 3.0 | 3.0 | Out | Out | SE | P |
| 95 | D; A | 28 | 16; 17 | 2.0; 1.5 | 2.1 | III; β And | III | WNW; NW | P |
| 96 | D | 30 | 36 | 5.0 | 5.0 | III | III | NE | N |
| 97 | D; A | 31 | 57; 57 | 3c; 2.5 | 3.3 | VI; Tri | VI | S; S | N |
| 98 | A | 34 | 1 | 5.0 | 5.7 | Plej | XIII | NW | P |
| 99 | D | 34 | 59 | 3b | 3.5 | XV | XV | SE | N |
| 100 | D | 36 | 11 | 4.0 | 4.0 | VII | VII | NNE | N |
| 101 | D | 38 | 31 | 4.0 | 4.0 | X | X | SE | N |
| 102 | D | 40 | 9 | 3b (c) | 3.5 | VII | VII | NNE | N |
| | | | | | | *Aug. 8, III Interval* | | | |
| 103 | A | 52 | 39 | 2.0 | 2.7 | Tri | 0,5VIII;0,25VI;0.25V | NW | P |
| 104 | D; A | 55 | 52; 52 | 3a; 4.0 | 3.9 | III; βAnd. | III | E; SE | N |
| 105 | A | 56 | 45 | 4.0 | 4.7 | αAnd. | IV | NW | P |
| 106 | D | 58 | 54 | 4b | 4.5 | I | I | S | P |
| 107 | A | 59 | 41 | 5.0 | 5.7 | Plej-Ari | IX | N | P |
| 108 | D; A | 14 1 | 26*;34 | 3b; 1.5 | 2.8 | XV; Aur-Per. | XV | NE; N | P |
| 109 | A | 3 | 15 | 5.0 | 5.7 | βAnd. | 0,7VI; 0,3III | SE | N |
| 110 | D | 3 | 51 | 3c | 3.5 | XIV | XIV | ESE | P |
| 111 | A | 4 | 13 | 4.5 | 5.2 | ιAur. | XV | NE | P |
| 112 | D | 4 | 55 | 4.0 | 4.0 | XI | XI | NE | P |
| 113 | D | 10 | 12 | 3c | 3.5 | X | X | NE | P |
| 114 | A | 10 | 33 | 3.0 | 3.7 | βPer. | 0.5XII; 0.5XI | NW | P |
| 115 | A | 17 | 30 | 3.0 | 3.7 | Cam. | 0.9XIV | NE | P |
| 116 | D | 18 | 29 | 5.0 (4c) | 4.8 | XIV | XIV | NNE | N |
| 117 | A | 19 | 17 | 2.5 | 3.2 | αAur. | 0.6XVI; 0.4XV | NE | P |
| 118 | D; A | 19 | 59; 60 | 2c (3.0); 2.0 | 2.7 | XIII; Plej. | XIII | NNW; NW | P |
| 119 | D; A | 21 | 49; 51 | 3.0; 2.0 | 2.8 | VI; Psc. | VI | NW; N | P |
| 120 | D | 23 | 32 | 3c | 3.5 | VIII | VIII | SSE | N |
| 121 | D; A | 25 | 48; 50 | 2b; 1.5 | 2.3 | IX; αAri | IX | NW; NW | N |
| 122 | D; A | 27 | 15; 16 | 2c(3.0); 2.0 | 2.7 | X; Cas. | X | SSW; SW | P |
| 123 | A | 27 | 28 | 3.5 | 4.2 | Tri | 0.5VIII; 0.25VI;0.25V | SW | N |
| 124 | D; A | 30 | 15; 15 | 3.0 (2c); 2.0 | 2.7 | I; Cas. | I | SW; SW | P |
| 125 | A | 31 | 14 | 1.5 | 2.2 | Plej. | XIII | NE | N |
| 126 | D | 31 | 33 | 3a | 3.2 | XII | XII | NW | P |
| 127 | A | 32 | 30 | 3.5 | 4.2 | Tri | 0.5VIII; 0.25VI;0.25V | N | N |
| 128 | D | 33 | 28 | 4.0 (4b) | 4.2 | VIII | VIII | NW | P |
| 129 | D; A | 37 | 20; 14 | 3c; 2.0 | 3.1 | XVI; βAur. | XVI | ENE; E | P |
| 130 | D | 38 | 50 | 4.0 | 4.0 | VIII | VIII | N | N |
| | | | | | | *Aug. 9, I Interval* | | | |
| 131 | A | 11 38 | 20 | 4.0 | 4.7 | Tri. | 0.5VIII;0.25VI;0.25V | NW | P |
| 132 | A | 40 | 2 | 5.0 | 5.7 | γAnd. | 0.8V; 0.2III | N | N |
| 133 | A | 42 | 41 | 4.5 | 5.2 | Cam. | 0.9XIV | N | N |
| 134 | D | 43 | 13 | 3.5 | 3.5 | IV | IV | WNW | P |
| 135 | D | 47 | 15 | 4.5 | 4.5 | VIII | VIII | NW | P |
| 136 | A | 47 | 30 | 5.0 | 5.7 | γAnd. | 0.8V; 0.2III | NW | P |
| 137 | D; A | 48 | 18; 22 | 4.5; 3.0 | 4.1 | IX; αAri | IX | ENE; E | N |
| 138 | D; A; Z | 49 | 15; 16; 16 | 3.5; 3.0; 3.0 | 3.5 | Out; Cas.; Cas. | Out. | S; S; SW | P |

Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 9, I Interval. Continued* | | | |
| 139 | D; Z | 11 49 | 35; 31 | 2.5; 4.0 | 3.4 | I; Cam. | I | NW; NW | N |
| 140 | D | 53 | 21 | 4.0 | 4.0 | VIII | VIII | NE | N |
| 141 | D | 54 | 49 | 3b | 3.5 | I | I | SSE | P |
| 142 | A | 56 | 55 | 5.0 | 5.7 | $\beta$And. | 0.7VI; 0.3III | NW | P |
| 143 | D | 58 | 15 | 3b | 3.5 | II | II | SE | N |
| 144 | Z | 59 | 40 | 2.0 | 2.3 | Plej. | 0.7XIII; 0.2XV | N | P |
| 145 | D; Z | 12 1 | 4; 4 | 3.5; 3.5 | 3.6 | III; $\beta$And. | III | WNW; NW | P |
| 146 | D; A | 2 | 13; 13 | 3a; 2.0 | 2.9 | XI; $\alpha$Per-Cam. | XI | NE; NE | P |
| 147 | Z | 2 | 31 | 3.0 | 3.3 | Ari | IX | NW | P |
| 148 | D | 5 | 0 | 3b | 3.5 | I | I | SE | P |
| 149 | D | 8 | 14 | 4.0 | 4.0 | I | I | NE | N |
| 150 | D | 9 | 10 | 3.5 | 3.5 | II | II | ESE | N |
| 151 | D | 12 | 13 | 4.0 | 4.0 | I | I | N | N |
| 152 | D | 15 | 0 | 3.5 | 3.5 | III | III | NW | N |
| 153 | Z | 15 | 3 | 3.0 | 3.3 | $\alpha$And. | IV | E | N |
| 154 | A; Z | 15 | 39; 36 | 3.5; 3.0 | 3.7 | Tri; Ari | IX | NW; NW | P |
| 155 | D | 16 | 9 | 4.0 | 4.0 | IV | IV | E | N |
| 156 | D | 19 | 25 | 4.5 | 4.5 | X | X | NE | N |
| 157 | D; A; Z | 20 | 39; 41; 40 | 3b; 3.0; 2.5 | 3.2 | XIV; Cam.; Cam. | XIV | N; N; NW | N |
| 158 | D | 23 | 12 | 3.5 | 3.5 | Out | Out | SW | P |
| 159 | D | 24 | 31 | 4.0 | 4.0 | XVI | XVI | ESE | N |
| 160 | D | 25 | 8 | 3.5 | 3.5 | Out | Out | ESE | P |
| 161 | D | 25 | 18 | 3b | 3.5 | XV | XV | NE | N |
| | | | | | | *Aug. 9, II Interval.* | | | |
| 162 | D; A; Z | 40 | 50; 52; 50 | 2b; 3.0; 2.0 | 2.8 | IX; Psc.; Ari | IX | NW; NW; NW | P |
| 163 | D; A; Z | 43 | 2; 4; 4 | 1b; 1.0; 2.0 | 1.8 | IX; Plej.; Ari | IX | NNW; NW; NW | P |
| 164 | D | 45 | 20 | 4.0 | 4.0 | VII | VII | N | N |
| 165 | D | 47 | 21 | 4.0 | 4.0 | I | I | SE | N |
| 166 | D; A | 49 | 33; 34 | 3.5; 2.5 | 3.3 | XIII; Plej. | XIII | NNW; N | N |
| 167 | D | 50 | 8 | 3b | 3.5 | Out | Out | NNE | N |
| 168 | D | 50 | 20 | 3b | 3.5 | Out | Out | NW | P |
| 169 | D; A | 51 | 12; 17 | 3a; 2.0 | 2.9 | VII; Ari | VII | E; E | N |
| 170 | D; A; Z | 52 | 51; 52; 51 | 3.5; 2.0; 3.0 | 3.2 | XII; $\beta$Per.; $\beta$Per. | XII | NE; NE; NW | N |
| 171 | D; A; Z | 55 | 47; 48; 48 | 3.0; 2.0; 3.0 | 3.0 | I; Cas.; Cam. | I | ESE; SE; E | N |
| 172 | D | 57 | 42 | 1.5 | 1.5 | XVI | XVI | N | N |
| 173 | D; A; Z | 13 3 | 50; 52; 50 | 3a; 2.5; 3.5 | 3.3 | III; $\gamma$And.; $\lambda$And. | III | NNE; N; NE | N |
| 174 | D | 8 | 0 | 5.0 | 5.0 | X | X | E | N |
| 175 | Z | 8 | 44 | 4.0 | 4.3 | $\beta$Per. | 0,7XII; 0.3XIII | E | N |
| 176 | D; A | 9 | 30; 31 | 3.5; 3.0 | 3.6 | III; Cas. | III | SE; SE | N |
| 177 | D | 11 | 20 | 3b | 3.5 | XII | XII | NNW | P |
| 178 | D | 13 | 17 | 3a | 3.2 | IV | IV | NW | P |
| 179 | Z | 13 | 22 | 2.0 | 2.3 | $\beta$And. | 0.5VI; 0.5III | NW | P |
| 180 | A; Z | 13 | 30; 30 | 3.5; 3.0 | 3.7 | Psc.; $\beta$And. | VI | E; SE | N |
| 181 | D; A | 16 | 35; 35 | 3.5; 1.0 | 2.6 | XVI; $\beta$Aur. | XVI | NE; E | N |
| 182 | D; A; Z | 17 | 26; 24; 29 | 0.5; 1.0; 1.0 | 1.2 | Out; Cam.; Cam. | Out | ENE; E; E | N |
| 183 | A | 19 | 4 | 2.5 | 3.2 | Ari | IX | E | N |
| 184 | D; A; Z | 22 | 13; 14; 14 | 3.5; 2.0; 2.5 | 3.0 | XIV; $\alpha$Per.; $\alpha$Per. | XIV | N; NW; NW | N |
| 185 | D; A; Z | 26 | 39; 40; 39 | 1.0; 1.5; 1.0 | 1.5 | III; $\gamma$And.; $\gamma$And. | III | NW; NW; NW | P |

Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 9, III Interval* | | | |
| 186 | Z | 13 43 | 24 | 2.5 | 2.8 | αAnd. | IV | W | P |
| 187 | A; Z | 43 | 41; 42 | 3.0; 4.0 | 4.0 | γAnd.; βAnd. | III | NW; W | P |
| 188 | D; A | 45 | 15; 15 | 3b; 4.0 | 4.1 | V; γAnd. | V | ESE; SE | N |
| 189 | D | 55 | 31 | 3b | 3.5 | Out. | Out | N | N |
| 190 | D | 56 | 33 | 4.0 | 4.0 | XVI | XVI | ENE | P |
| 191 | D | 14 0 | 3 | 4.0 | 4.0 | IX | IX | ESE | N |
| 192 | D | 7 | 44 | 3b | 3.5 | IX | IX | NNE | N |
| 193 | D | 8 | 56 | 3.5 | 3.5 | I | I | WSW | P |
| 194 | D | 11 | 27 | 4.0 | 4.0 | Out. | Out | NE | N |
| 195 | A | 12 | 47 | 3.5 | 4.2 | Tri | 0.5VIII; 0.25VI; 0.25V | SW | N |
| 196 | D | 12 | 53 | 3.5 | 3.5 | Out. | Out | SE | P |
| 197 | D | 15 | 6 | 3a | 3.2 | Out. | Out | NNE | P |
| 198 | D | 17 | 27 | 4.0 | 4.0 | XIV | XIV | SE | P |
| 199 | D; A; Z | 18 | 39; 39; 38 | 2.5; 1.5; 2.0 | 2.2 | IX; αAri; Ari | IX | NW; NW; NW | P |
| 200 | D | 25 | 54 | 4.0 | 4.0 | I | I | N | N |
| 201 | D | 26 | 13 | 3.0 | 3.0 | IX | IX | NE | N |
| 202 | A | 26 | 23 | 2.0 | 2.7 | αAri. | IX | SE | N |
| 203 | A | 26 | 28 | 2.0 | 2.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| | | | | | | *Aug. 10, I Interval* | | | |
| 204 | A | 11 38 | 22 | 3.0 | 3.7 | Cas. | 0.9I | SW | P |
| 205 | A | 39 | 25 | 2.0 | 2.7 | Cam. | 0.9XIV | NE | P |
| 206 | D | 42 | 45 | 4.0 | 4.0 | III | III | ESE | N |
| 207 | D; Z | 47 | 45; 48 | 1.5; 1.5 | 1.6 | I; Cas. | I | SW; SW | P |
| 208 | A | 47 | 59 | 4.5 | 5.2 | βAnd. | 0.7VI; 0.3III | NW | P |
| 209 | D; A | 48 | 17; 18 | 2b; 1.0 | 2.1 | XI; εPer.(?) | XI | NE; NE | P |
| 210 | D | 52 | 5 | 3b | 3.5 | XIV | XIV | SE | P |
| 211 | D; Z | 55 | 39; 38 | 5.0; 4.5 | 4.9 | VI; γAnd. | VI | ESE; SE | N |
| 212 | A | 55 | 40 | 3.5 | 4.2 | βPer. | 0.5XII; 0.5XI | NE | N |
| 213 | A | 56 | 39 | 4.0 | 4.7 | γAnd. | 0.8V; 0.2III | E | N |
| 214 | Z | 56 | 49 | 4.0 | 4.3 | αAur. | XIV | E | P |
| 215 | A | 58 | 50 | 4.5 | 5.2 | αAnd. | IV | NW | P |
| 216 | D | 12 2 | 40 | 4.0 | 4.0 | VI | VI | NE | N |
| 217 | D | 5 | 38 | 5.0 | 5.0 | VIII | VIII | NNW | N |
| 218 | D | 9 | 49 | 3b | 3.5 | XI | XI | ESE | N |
| 219 | A | 10 | 31 | 4.0 | 4.7 | αAnd. | IV | SW | N |
| 220 | D | 13 | 46 | 4.0 | 4.0 | XIV | XIV | NE | N |
| 221 | A | 15 | 20 | 4.5 | 5.2 | Psc. | 0.7VII; 0.2IV | NW | P |
| 222 | D; A; Z | 17 | 56; 57; 57 | 3b; 4.0; 3.5 | 4.0 | X; χPer.; αPer. | X | SSE; SE; SE | N |
| 223 | D | 19 | 5 | 2b | 2.5 | X | X | WNW | P |
| 224 | D; A; Z | 24 | 45; 44; 43 | 4.0; 3.5; 4.0 | 4.2 | III; βAnd.; βAnd. | III | NW; NW; NW | N |
| 225 | A | 26 | 24 | 5.0 | 5.7 | Tri. | 0.5VIII; 0.25VI; 0.25V | N | N |
| | | | | | | *Aug. 10, II Interval* | | | |
| 226 | D | 38 | 22 | 5.0 | 5.0 | X | X | SSW | N |
| 227 | D | 41 | 46 | 4.5 | 4.5 | XII | XII | NNE | N |
| 228 | Z | 45 | 8 | 5.0 | 5.3 | Tri. | VIII | N | N |
| 229 | A | 48 | 39 | 2.0 | 2.7 | Cas. | 0.9I | SE | P |
| 230 | D | 57 | 12 | 4.0 | 4.0 | VIII | VIII | NE | N |
| 231 | A | 57 | 13 | 4.0 | 4.7 | Plej. | XIII | NE | N |
| 232 | D | 58 | 34 | 4.0 | 4.0 | IX | IX | ENE | N |

# Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Aug. 10, II Interval. Continued* | | | | | |
| 233 | D; Z | 13 1 | 7; 7 | 4.0; 5.0 | 4.6 | X; γAnd. | X | NE; E | N |
| 234 | Z | 2 | 36 | 3.0 | 3.3 | αPer. | 0.9XI; 0.1X | NE | P |
| 235 | A; Z | 5 | 53; 52 | 2.0; 3.5 | 3.2 | βAnd.; Psc. | VII | NW; NW | P |
| 236 | D | 5 | 56 | 3.5 | 3.5 | Out | Out | NE | P |
| 237 | A | 6 | 47 | 3.0 | 3.7 | αAur. | 0.6XVI; 0.4XV | E | P |
| 238 | A | 7 | 44 | 3.0 | 3.7 | Cas. | 0.9I | S | P |
| 239 | D | 9 | 8 | 3.5 | 3.5 | I | I | SW | P |
| 240 | D; A | 15 | 19; 21 | -0.4; 0.0 | +0.1 | I; Cam. | I | NE; NE | N |
| 241 | Z | 16 | 25 | 4.0 | 4.3 | αAur. | 0.7XVI; 0.3XIV | NE | P |
| 242 | Z | 16 | 42 | 4.5 | 4.8 | βAnd. | 0.5VI; 0.5III | W | P |
| 243 | A | 17 | 43 | 4.0 | 4.7 | N.And. | 0.8III; 0.2II | NW | P |
| 244 | D; A; Z | 18 | 47*;36;35 | 2.5; 2.0; 2.5 | 2.7 | XI; αPer.; αPer. | XI | ENE; NE; E | N |
| 245 | D | 20 | 19 | 4.0 | 4.0 | III | III | SE | N |
| 246 | Z | 23 | 2 | 3.5 | 3.8 | βAnd. | 0.5VI; 0.5III | W | P |
| 247 | D; Z | 23 | 46; 44 | 3.5; 3.5 | 3.6 | XVI; αAur. | XVI | NNE; NW | N |
| 248 | D | 25 | 30 | 3b | 3.5 | III | III | NW | P |
| 249 | Z | 26 | 1 | 3.0 | 3.3 | αPer. | 0.9XI; 0.1X | N | P |
| 250 | D; A | 27 | 16; 17 | 3.5; 3.5 | 3.8 | V; Tri | V | NW; NW | P |
| | | | | *Aug. 10, III Interval* | | | | | |
| 251 | D | 41 | 2 | 4.5 | 4.5 | IX | IX | NW | P |
| 252 | Z | 42 | 48 | 5.0 | 5.3 | Cas. | 0.8I; 0.1X | E | N |
| 253 | D | 47 | 21 | 4.0 | 4.0 | XI | XI | NNE | P |
| 254 | A | 50 | 20 | 2.5 | 3.2 | Cam. | 0.9XIV | NW | N |
| 255 | D | 52 | 21 | 4.0 | 4.0 | Out | Out | NNE | P |
| 256 | D; A | 55 | 21; 17 | 3.5; 2.5 | 3.3 | I; Cas.-αAnd. | I | W; W | P |
| 257 | A | 55 | 36 | 2.0 | 2.7 | χPer.(Cas.) | X | SE | P |
| 258 | D; A | 57 | 32; 33 | 3.0; 1.0 | 2.3 | XVI; αAur | XVI | ESE; E | N |
| 259 | A | 58 | 19 | 3.0 | 3.7 | βAur. | XVI | NE | P |
| 260 | D | 14 4 | 34 | 3.5 | 3.5 | Out | Out | E | N |
| 261 | A | 4 | 44 | 2.0 | 2.7 | ιAur. | XV | N | P |
| 262 | D; A | 8 | 8; 4 | 2.0; 1.5 | 2.1 | VIII; Tri | VIII | NW; NW | P |
| 263 | D; A | 10 | 14; 14 | 4.0; 2.5 | 3.6 | XV; ιAur. | XV | ENE; NE | N |
| 264 | A; Z | 12 | 1; 2 | 2.0; 3.0 | 3.0 | αAri; Ari | IX | E; NE | N |
| 265 | A | 16 | 14 | 2.5 | 3.2 | αAur. | 0.6XVI; 0.4XV | N | P |
| 266 | Z | 16 | 30 | 3.5 | 3.8 | Psc. | 0.6VII; 0.3VIII; 0.1IV | NW | P |
| 267 | D; A; Z | 16 | 40; 39; 38 | 3b; 2.0; 3.0 | 3.2 | VI; βAnd.; βAnd. | VI | WNW; NW; NW | P |
| 268 | D; Z | 19 | 17; 18 | 4.0; 4.0 | 4.1 | II; λAnd. | II | W; NW | N |
| 269 | Z | 19 | 36 | 4.0 | 4.3 | Tri | VIII | NW | P |
| 270 | A; Z | 19 | 56; 58 | 2.0; 4.0 | 3.5 | ιAur.; ιAur. | XV | N; NW | N |
| 271 | D; A; Z | 23 | 50; 51; 50 | 3.5; 2.0; 3.0 | 3.2 | XI; αPer.; αPer. | XI | E; E; E | N |
| 272 | A | 24 | 7 | 4.0 | 4.7 | Tri | 0.5VIII;0.25VI;0.25V | E | N |
| 273 | D; A; Z | 25 | 18; 14; 17 | 2b; 2.0; 2.5 | 2.7 | XI; χPer.; αPer. | XI | SW; SW; SW | N |
| 274 | A | 26 | 10 | 2.5 | 3.2 | γAnd. | 0.8V; 0.2III | NW | P |
| 275 | D; A; Z | 26 | 21; 17; 22 | 3.0; 2.0; 3.0 | 3.0 | XV; Plej.; Plej. | XV | NNE; N; N | P |
| | | | | *Aug. 11, I Interval* | | | | | |
| 276 | D; Z | 11 40 | 4; 4 | 3.5; 3.0 | 3.4 | VII; Psc. | VII | NW; NW | P |
| 277 | D | 40 | 48 | 4.0 | 4.0 | IX | IX | NW | P |
| 278 | A | 41 | 5 | 2.5 | 3.2 | Psc. | 0.7VII; 0.2IV | NW | P |
| 279 | D | 41 | 30 | 4.0 | 4.0 | XIII | XIII | NW | N |

## Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Aug. 11, I Interval. Continued* | | | | | |
| 280 | D; Z | 11 42 | 28; 28 | 3a; 2.5 | 3.0 | V; βAnd. | V | NW; NW | P |
| 281 | D; A; Z | 43 | 5; 6; 5 | 3.5; 2.5; 3.0 | 3.2 | II; λAnd.; λAnd. | II | WNW; W; NW | N |
| 282 | D; Z | 43 | 19; 19 | 2b; 2.0 | 2.4 | V; γAnd. | V | NW; NW | P |
| 283 | A | 43 | 32 | 1.5 | 2.2 | γAnd. | 0.8V; 0.2III | NW | P |
| 284 | Z | 43 | 35 | 3.5 | 3.8 | Cas. | 0.8I; 0.1X | NW | N |
| 285 | D | 44 | 26 | 2b(?) | 2.5 | I | I | WSW | P |
| 286 | A; Z | 44 | 35; 34 | 2.5; 3.0 | 3.2 | Psc.; Psc. | VII | NW; NW | P |
| 287 | A | 44 | 45 | 3.5 | 4.2 | βAnd. | 0.7VI; 0.3III | NW | P |
| 288 | A; Z | 44 | 59; 60 | 2.5; 3.0 | 3.2 | Psc.; Psc. | VII | NW; NW | P |
| 289 | D; A; Z | 45 | 3; 5; 4 | 3b; 2.0; 3.0 | 3.2 | VIII; Tri; Ari. | VIII | NW; NW; NW | P |
| 290 | D | 45 | 57 | 3b | 3.5 | VIII | VIII | NW | P |
| 291 | D | 46 | 12 | 3b | 3.5 | VIII | VIII | NW | P |
| 292 | D | 46 | 31 | 4.0 | 4.0 | I | I | S | N |
| 293 | A; Z | 47 | 7; 6 | 2.5; 4.0 | 3.7 | Cas.; χPer. | X | SW; W | P |
| 294 | D; A; Z | 47 | 12; 11; 13 | -0.5; 0.0; -3.0 | -0.2 | I; χPer.; Cas. | I | SSW; SW; SW | P |
| 295 | D | 47 | 50 | 3.5 | 3.5 | I | I | NNE | N |
| 296 | D; A | 48 | 15; 15 | 3.5; 2.0 | 3.1 | XV; αAur. | XV | NNW; —; NW | N |
| 297 | D; A | 49 | 10; 9 | 3.5; 3.0 | 3.6 | III; αAnd.-Cas. | III | W; W | P |
| 298 | Z | 49 | 10 | 4.5 | 4.8 | λAnd. | 0.6II; 0.4III | SW | P |
| 299 | D | 50 | 29 | 4.0 | 4.0 | XIII | XIII | N | P |
| 300 | D; A; Z | 51 | 4; 3; 3 | 3.3; 3.0; 1.5 | 3.0 | IV; —; αAnd. | IV | NW; —; NW | P |
| 301 | A | 51 | 8 | 2.0 | 2.7 | — | XI* | (Persei ) | P |
| 302 | D; A; Z | 51 | 9; 9; 8 | 3a; 3.0; 3.0 | 3.4 | VI; —; γAnd. | VI | WNW; —; NW | P |
| 303 | 1)D; A | 51 | 10; 10 | —; 3.0 | 3.7 | — | VIII* | (Perseid) | P |
| 304 | A | 51 | 12 | 2.0 | 2.7 | — | VIII* | (Perseid) | P |
| 305 | A | 51 | 16 | 3.0 | 3.7 | — | V* | (Perseid) | P |
| 306 | 1)D; A; Z | 51 | 40.5; 39; 39 | —; 2.0; 3.0 | 3.0 | —; αAnd.; αAnd. | IV | —; NW; W | P |
| 307 | Z | 51 | 43 | 3.0 | 3.3 | γAnd. | 0.7V; 0.3X | W | P |
| 308 | D; A; Z | 52 | 48; 49; 49 | -0.5; 0.0; -3.0 | -0.2 | VII; Psc.; Psc. | VII | NW; NW; NW | P |
| 309 | D; A; Z | 52 | 59.5; 58; 52* | 1.3; 1.5; -1.0 | 1.6 | V; βAnd.; βAnd. | V | NW; NW; NW | P |
| 310 | Z | 52 | 59 | 1.0 | 1.3 | Plej. | 0.7XIII; 0.2XV | N | P |
| 311 | D; A | 56 | 9; 9 | 3.0; 2.5 | 3.1 | XI; βPer. | XI | NNW; NW | P |
| 312 | A; Z | 56 | 45; 45 | 2.5; 2.0 | 2.7 | Cas.; Cas. | 0.9I | S; S | P |
| 313 | D; A | 57 | 15; 16 | 3.5; 3.0 | 3.6 | I; Cas. | I | E; E | N |
| 314 | D | 57 | 45 | 2.0 | 2.0 | XV | XV | NE | P |
| 315 | D; A; Z | 58 | 41; 41; 41 | 2.5; 3.0; 3.0 | 3.2 | VII; Psc.; Psc. | VII | NW; NW; NW | P |
| 316 | D; A; Z | 58 | 58; 58; 58 | 1.5; 1.5; 1.0 | 1.7 | X; χPer.; χPer. | X | SSE; SE; S | P |
| 317 | Z | 59 | 10 | 3.0 | 3.3 | βPer. | 0.7XII; 0.3XIII | N | P |
| 318 | Z | 59 | 18 | 2.5 | 2.8 | βAur. | XVI | N | N |
| 319 | A | 59 | 20 | 3.0 | 3.7 | εPer. | XV | NE | P |
| 320 | D; A; Z | 59 | 49; 49; 50 | —; 1.5; 1.0 | 1.7 | XIV; Cam.; Cam. | XIV | SE; SE; E | P |
| 321 | D | 12 0 | 36 | 2b | 2.5 | XI | XI | N | P |
| 322 | A; Z | 0 | 60; 59 | 3.5; 4.5 | 4.5 | Psc.; Psc. | VII | NE; N | N |
| 323 | D; Z | 1 | 35; 35 | 2.5; 2.5 | 2.6 | XI; βPer. | XI | N; N | P |
| 324 | A; Z | 1 | 47; 45 | 0.0; 2.0 | 1.5 | Plej.; Plej. | XIII | N; N | P |
| 325 | D | 2 | 9 | 3.5 | 3.5 | I | I | S | P |
| 326 | Z | 4 | 2 | 4.5 | 4.8 | Plej. | 0.7XIII; 0.2XV | N | P |
| 327 | D; A; Z | 4 | 28; 28; 29 | 3a; 1.5; 2.0 | 2.6 | II; αAnd.; λAnd. | II | W; W; W | P |
| 328 | D; A; Z | 5 | 18.5; 17; 17 | 3.5; 4.0; 4.0 | 4.2 | V; βPer.; βPer. | V | E; NE; NE | N |

1) Not traced on the map by *D.*

## Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 11, I Interval. Continued.* | | | |
| 329 | A; Z | 12 5 | 25; 25 | 2.0; 3.0 | 3.0 | Tri; Tri | VIII | NW; NW | P |
| 330 | D; A | 6 | 57.5; 57 | 3.0; 2.0 | 2.8 | V; Andr.-αPer. | V | NW; NW | P |
| 331 | D; A; Z | 7 | 37.5; 38; 38 | 2.5; 2.5; 1.5 | 2.5 | VIII; Tri; Psc. | VIII | NW; NW; NW | P |
| 332 | Z | 8 | 15 | 3.0 | 3.3 | αAnd. | IV | W | P |
| 333 | A | 8 | 16 | 2.5 | 3.2 | Cas. | 0.9I | S | P |
| 334 | D | 8 | 54 | 3b | 3.5 | VI | VI | WNW | P |
| 335 | A; Z | 9 | 3; 0 | 3.5; 3.0 | 3.7 | Tri; βAnd. | V | NW; W | P |
| 336 | Z | 9 | 2 | 3.5 | 3.8 | Per. | XI | W | P |
| 337 | D; A; Z | 9 | 14; 13; 14 | 2.5; 2.0; 2.5 | 2.7 | IV; Psc.; αAnd. | IV | NW; NW; W | P |
| 338 | D; A; Z | 10 | 5.5; 5; 5 | 2b; 2.0; 2.5 | 2.7 | IV; αAnd.; αAnd. | IV | WNW; NW; NW | P |
| 339 | D | 10 | 54.5 | 3.5 | 3.5 | XII | XII | N | P |
| 340 | D; A; Z | 11 | 14; 14; 13 | 2.5; 2.0; 2.0 | 2.5 | III; N.And.; βAnd. | III | W; W; NW | P |
| 341 | Z | 11 | 35 | 3.5 | 3.8 | βPer. | 0.7XII; 0.3XIII | NW | P |
| 342 | D; A; Z | 12 | 22; 23; 23 | 3.5; 2.5; 3.0 | 3.2 | XIII; βPer.; βPer. | XIII | NNW; N; NW | P |
| 343 | A | 12 | 24 | 2.0 | 2.7 | Tri | 0.5VIII; 0.25VI; 0.25V | NW | P |
| 344 | Z | 12 | 34 | 3.0 | 3.3 | Tri | VIII | NW | P |
| 345 | D | 13 | 22 | — | (4.0*) | XII | XII | N | P |
| 346 | D | 14 | 6.5 | — | (3.5*) | IX | IX | NW | P |
| 347 | D; A; Z | 14 | 25; 25; 24 | 1b; 1.0; -1.0 | 1.5 | I; Cas.; Cas. | I | S; S; S | P |
| 348 | D; A; Z | 14 | 54; 54; 54 | 2.3; 1.0; -0.5 | 1.9 | VIII; Psc.; Psc. | VIII | NW; NW; NW | P |
| 349 | D; A; Z | 15 | 5; 4; 5 | —; 1.0; 3.0 | 2.5 | I; Cas.; Cas. | I | SW; SW; S | P |
| 350 | A; Z | 15 | 6; 6 | 2.5; 2.5 | 3.0 | αAnd.; αAnd. | IV | NW; NW | P |
| 351 | D; A; Z | 15 | 58,5; 58; 58 | 3.0; 4.0; 3.5 | 3.7 | V; Tri; γAnd. | V | NW; NW; NW | P |
| 352 | D | 16 | 18 | 3b | 3.5 | VIII | VIII | NW | P |
| 353 | D; A; Z | 16 | 31; 30*; 30 | 2b; 2.0; 1.5 | 2.2 | IX; αAri; Ari | IX | NW; NW; NW | P |
| 354 | Z | 18 | 3 | 3.5 | 3.8 | Plej | 0.7XIII; 0.2XV | N | P |
| 355 | D; A; Z | 18 | 33; 32; 33 | 3a; 2.0; 3.0 | 3.1 | VIII; Tri; Tri | VIII | NW; NW; NW | P |
| 356 | D; A; Z | 18 | 36; 34; 36 | 2b; 3.0; 3.0 | 3.2 | XI; αPer.; αPer. | XI | N; NE; N | P |
| 357 | D; A; Z | 19 | 6; 6; 7 | 2.5; 2.0; 2.5 | 2.7 | IX; Ari; Ari | IX | NW; NW; NW | P |
| 358 | D; A | 20 | 16; 15 | 3.0; 2.0 | 2.8 | II; λAnd. | II | W; SW | P |
| 359 | A; Z | 20 | 25; 25 | 1.5; 2.0 | 2.2 | αAri; Ari | IX | NW; NW | P |
| 360 | D | 21 | 0 | 3b | 3.5 | XI | XI | N | P |
| 361 | D | 21 | 17.5 | 4.0 | 4.0 | V | V | NE | N |
| 362 | Z | 21 | 23 | 3.5 | 3.8 | Cam. | 0.9XIV | E | P |
| 363 | D | 22 | 26.5 | 4.5 | 4.5 | V | V | NNW | N |
| 364 | A | 22 | 32 | 3.0 | 3.7 | IX | IX | NW | P |
| 365 | A | 22 | 45 | 3.0 | 3.7 | Plej. | XIII | N | P |
| 366 | D; A; Z | 23 | 26 5; 27; 26 | 3.5; 3.0; 3.5 | 3.7 | IV; Psc.; Psc. | IV | NNE; NE; NE | N |
| 367 | D; A; Z | 24 | 29; 29; 28 | 1a; 0.0; -0.5 | +1.2 | VII; Psc.; Psc. | VII | NW; NW; NW | P |
| 368 | A | 24 | 37 | 2.5 | 3.2 | Cas. | 0.9I | SW | P |
| 369 | D; A | 25 | 3; 3 | 3.0; 3.0 | 3.3 | Out; Psc. | Out | NW; NW | P |
| 370 | A | 25 | 9 | 1.0 | 1.7 | λAnd. | II | W | P |
| 371 | D; Z | 25 | 35; 33 | 2b; 3.0 | 2.9 | V; γAnd. | V | NW; NW | P |
| 372 | D; A; Z | 25 | 35; 34; 34 | 3.0; 2.0; 3.5 | 3.2 | IX; Ari-Plej.; Ari | IX | NNW; NW; NW | P |
| 373 | D | 26 | 15.5 | 1b | 1.5 | X | X | NE | P |
| 374 | D | 26 | 20 | 3a | 3.2 | XIV | XIV | NE | P |
| 375 | D | 26 | 56 | 3a | 3.2 | X | X | NW | N |
| 376 | D; A; Z | 27 | 34; 33; 33 | 2b; 1.0; 2.0 | 2.2 | XIV; Cam.; Cam. | XIV | E; NE; E | P |
| 377 | D; A | 28 | 7; 6 | 2b; 1.5 | 2.3 | II; λAnd. | II | WSW; SW | P |
| 378 | A | 28 | 32 | 2.0 | 2.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 379 | D | 28 | 40 | 4.0 | 4.0 | IX | IX | NW | P |

## Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Seconds | Magnitude Recorded | Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 11, I Interval. Continued* | | | |
| 380 | [1])D; A; Z | 12 28 | 48; 46; 46 | 3.5; 2.0; 2.0 | 2.8 | $\chi$Per.; Cas.; Cas. | X | E; SE; S | N |
| 381 | D: A; Z | 28 | 55; 60; 62 | 3.0; 2.5; 3.0 | 3.2 | XII; $\beta$Per.; $\alpha$Per. | XII | NNW; N; N | P |
| | | | | | | *Aug. 11, II Interval* | | | |
| 382 | A | 39 | 25 | 3.0 | 3.7 | Cas. | 0.9I | SE | P |
| 383 | D | 39 | 48 | 4.0 | 4.0 | XIII | XIII | N | P |
| 384 | A | 39 | 49 | 3.5 | 4.2 | Tri. | 0.5VIII; 0.25VI; 0.25V | NW | P |
| 385 | A | 40 | 8 | 2.0 | 2.7 | Cam. | 0.9XIV | SE | P |
| 386 | D; A; Z | 41 | 55; 55; 54 | 3b; 2.0; 2.0 | 2.8 | IV; $\alpha$And.; $\alpha$And. | IV | W; W; W | P |
| 387 | A | 42 | 31 | 2.0 | 2.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 388 | D; A; Z | 42 | 42; 42; 41 | 3.5; 3.0; 2.5 | 3.2 | VI; Psc.; Tri | VI | SW; NW; W | N |
| 389 | D | 43 | 25 | 4.0 | 4.0 | XII | XII | N | P |
| 390 | A | 43 | 40 | 2.5 | 3.2 | Psc. | 0.7VII; 0.2IV | NW | P |
| 391 | A | 43 | 42 | 3.0 | 3.7 | Psc.* | 0.7VII; 0.2IV | NW | P |
| 392 | A | 43 | 58 | 2.0 | 2.7 | Cas. | 0.9I | SW | P |
| 393 | A; Z | 44 | 1; 1 | 3.5; 4.0 | 4.2 | N. And.; $\beta$And. | III | W; NW | P |
| 394 | D | 44 | 2.5 | 3b | 3.5 | IX | IX | NW | P |
| 395 | D | 45 | 2.5 | 3.0 | 3.0 | V | V | NW | P |
| 396 | A | 45 | 8 | 1.5 | 2.2 | Psc. | 0.7VII; 0.2IV | NW | P |
| 397 | A | 45 | 26 | 2.0 | 2.7 | $\delta$ Per. | XI | NE | P |
| 398 | D; Z | 46 | 50.5; 50 | 4.5; 3.0 | 3.9 | XII; Ari. | XII | NNW; NW | P |
| 399 | D | 47 | 30.5 | 4.0 | 4.0 | XII | XII | NNW | P |
| 400 | A | 47 | 40 | 3.0 | 3.7 | Cas. | 0.9I | SE | P |
| 401 | D | 47 | 52.5 | 3.5 | 3.5 | VII | VII | NW | P |
| 402 | A | 48 | 2 | 2.0 | 2.7 | Cam. | 0.9XIV | E | P |
| 403 | D | 48 | 19 | 3a | 3.2 | XV | XV | NE | P |
| 404 | A; Z | 48 | 39; 40 | 2.0; 2.5 | 2.7 | $\beta$Per.; $\beta$Per. | XII | NW; N | P |
| 405 | Z | 48 | 41 | 2.0 | 2.3 | Psc. | 0.6VII; 0.3VIII; 0.1IV | N | P* |
| 406 | D | 50 | 1 | 3b | 3.5 | XIII | XIII | N | P |
| 407 | [1])D | 50 | 56 | 3.5(?) | 3.5 | $\chi$Per. | X | NE | P |
| 408 | D | 50 | 59.5 | 3.5(?) | 3.5 | XIII | XIII | N | P |
| 409 | D; A | 51 | 48.5; 48 | 4.0; 2.5 | 3.6 | VII; Psc. | VII | N; N | N |
| 410 | A | 51 | 58 | 3.0 | 3.7 | $\gamma$And.-Cas. | III | W | P |
| 411 | D; A; Z | 53 | 28; 28; 28* | 3.0; 2.0; 3.0 | 3.0 | XI; $\beta$Per.; $\alpha$Per. | XI | NNW; N; N | P |
| 412 | D; A | 53 | 57.5; 58 | 3.5; 3.0 | 3.6 | VII; Psc. | VII | NW; NW | P |
| 413 | [1])D | 54 | 2 | 3.5 | 3.5 | $\chi$Per. | X | NE | N |
| 414 | A | 54 | 17 | 2.0 | 2.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 415 | D | 55 | 5 | 3.0 | 3.0 | Out. | Out | WNW | P |
| 416 | D | 55 | 26.5 | 3.0 | 3.0 | XV | XV | NNE | P |
| 417 | D | 56 | 42.5 | 2.5 | 2.5 | XI | XI | NNE | P |
| 418 | A | 58 | 23 | 2.0 | 2.7 | Cam. | 0.9XIV | E | P |
| 419 | D; Z | 58 | 45; 45 | 2.5; 2.5 | 2.6 | III; Cas. | III | W; SW | P |
| 420 | Z | 58 | 49 | 4.0 | 4.3 | Tri. | VIII | NW | P |
| 421 | Z | 59 | 5 | 4.0 | 4.3 | $\beta$And. | 0.5VI; 0.5III | N | N |
| 422 | D | 13 0 | 5 | 4.0 | 4.0 | IX | IX | NW | P |
| 423 | A | 0 | 25 | 2.5 | 3.2 | $\alpha$And. | IV | NW | P |
| 424 | A | 0 | 31 | 0.5 | 1.2 | Psc. | 0.7VII; 0.2IV | NW | P |
| 425 | D; A; Z | 0 | 53; 51; 50 | 2.5; 1.5; 2.0 | 2.2 | IX; Ari.-Plej.; Ari. | IX | NNW; NW; NW | P |
| 426 | Z | 0 | 59 | 3.0 | 3.3 | Cam. | 0.9XIV | E | P |

1) Not traced on the map by *D*.

## Table 29. Continued.

| № | Obser-vers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Rediant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 11, II Interval. Continued* | | | |
| 427 | Z | 13 1 | 16 | 2.0 | 2.3 | γAnd. | 0.7V; 0.3X | NW | P |
| 428 | D; Z | 1 | 58; 58 | 2.5; 3.5 | 3.1 | IX; Ari | IX | NW; NW | P |
| 429 | A | 2 | 8 | 1.0 | 1.7 | βPer. | 0.5XII; 0.5XI | NE | P |
| 430 | D; A; Z | 2 | 14; 15; 14 | 2b; 2.0; 3.0 | 2.8 | VIII; Tri; Tri | VIII | NW; NW; W | P |
| 431 | Z | 2 | 16 | 4.0 | 4.3 | λAnd. | 0.6II; 0.4III | W | P |
| 432 | A | 2 | 18 | 3.0 | 3.7 | γAnd. | 0.8V; 0.2III | NW | P |
| 433 | D | 2 | 41.5 | 3.0 | 3.0 | IV | IV | WNW | P |
| 434 | A | 2 | 48 | 2.0 | 2.7 | αPer. | 0.8XI; 0.2XIV | NE | P |
| 435 | D; A; Z | 2 | 55; 56; 55 | 2a; 0.0; 1.0 | 1.4 | II; N.-And.; λAnd. | II | W; W; W | P |
| 436 | A; Z | 3 | 59; 59 | 1.5; 2.0 | 2.2 | Ari-Plej.; Plej. | IX | NW; NW | P |
| 437 | Z | 4 | 0 | 2.0 | 2.3 | Plej. | 0.7XIII; 0.2XV | NW | P |
| 438 | A | 4 | 10 | 2.0 | 2.7 | Plej. | XIII | N | P |
| 439 | Z | 4 | 12 | 3.5 | 3.8 | βPer. | 0.7XII; 0.3XIII | NW | P |
| 440 | A | 5 | 35 | 3.0 | 3.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 441 | A | 5 | 56 | 2.5 | 3.2 | χPer. | X | S | P |
| 442 | A; Z | 6 | 44; 45 | 2.5; 3.5 | 3.5 | αAri; Ari | IX | NW; NW | P |
| 443 | D; A; Z | 7 | 13; 12; 13 | 2b; 3.0; 3.0 | 3.2 | IX; αAri; Ari | IX | NW; NW; NW | P |
| 444 | Z | 7 | 20 | 3.5 | 3.8 | Tri | VIII | NW | P |
| 445 | Z | 7 | 56 | 3.0 | 3.3 | Cam. | 0.9XIV | NE | P |
| 446 | D; A; Z | 8 | 8; 9; 10 | 2.5; 1.5; 2.0 | 2.2 | XIII; Plej.; Plej. | XIII | N; N; N | P |
| 447 | D | 8 | 13 | 3.5 | 3.5 | XIII | XIII | N | P |
| 448 | D | 9 | 10.5 | 4.0 | 4.0 | IX | IX | NE | N |
| 449 | A; Z | 9 | 31; 31 | 2.0; 4.0 | 3.5 | Plej.; Plej. | XIII | N; NW | P |
| 450 | D; A; Z | 9 | 42; 41; 42 | 3a; 2.0; 2.5 | 2.9 | III; N.-And.; βAnd. | III | WNW; NW; NW | P |
| 451 | D; A; Z | 10 | 8.5; 8; 9 | 2a; 2.0; 2.0 | 2.4 | V; γAnd.; γAnd. | V | NW; NW; NW | P |
| 452 | D | 10 | 8.5 | 3.0 | 3.0 | XIV | XIV | NE | P |
| 453 | Z | 10 | 10 | 2.5 | 2.8 | Psc. | 0.6VII; 0.3VIII; 0.1IV | W | P |
| 454 | A | 10 | 16 | 2.0 | 2.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 455 | Z | 10 | 18 | 2.0 | 2.3 | Per. | XI | NW | P |
| 456 | A | 10 | 18 | 3.0 | 3.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 457 | D; A; Z | 11 | 52; 53; 52 | 3.0; 2.0; 4.0 | 3.3 | XI; iAur.; iAur. | XI | NE; NE; NE | N |
| 458 | D; Z | 12 | 11; 11 | 2b; 3.0 | 2.9 | XV; iAur. | XV | NNE; N | P |
| 459 | D; Z | 12 | 47; 52* | 3a; 3.5 | 3.5 | XII; βPer. | XII | NNW; NW | P |
| 460 | D | 13 | 34 | 3.5 | 3.5 | XI | XI | NNE | P |
| 461 | D | 14 | 53 | 3b | 3.5 | X | X | S | P |
| 462 | D | 15 | 20 | 3.5 | 3.5 | XI | XI | N | P |
| 463 | A | 15 | 21 | 2.5 | 3.2 | Plej. | XIII | N | P |
| 464 | D; A; Z | 15 | 51.5; 51; 52 | 1b; 1.0; 1.0 | 1.5 | I; Cas.; Cas. | I | S; SE; S | P |
| 465 | Z | 16 | 45 | 3.0 | 3.3 | Ari | IX | NE | N |
| 466 | D; Z | 16 | 49.5; 49 | 3a; 2.5 | 3.0 | IX; Ari | IX | NW; NW | P |
| 467 | D; Z | 17 | 34.5; 33 | 3.0; 4.0 | 3.6 | Out; Plej. | Out | NNE; NW | P |
| 468 | Z | 17 | 58 | 3.0 | 3.3 | iAur. | XV | NE | N |
| 469 | D; A | 18 | 4.5; 2 | 3.5; 3.0 | 3.6 | XI; αPer.-αAur. | XI | NE; NE | P |
| 470 | Z | 18 | 29 | 3.0 | 3.3 | Cam. | 0.9XIV | E | P |
| 471 | D; A | 18 | 33; 33 | 3.0; 2.0 | 2.8 | XIII; ζPer. | XIII | N; NW | P |
| 472 | Z | 18 | 44 | 2.0 | 2.3 | χPer. | X | W | P |
| 473 | A; Z | 18 | 58; 59 | 2.5; 1.5 | 2.5 | iAur.; iAur. | XV | N; NE | P |
| 474 | Z | 19 | 0 | 2.5 | 2.8 | Plej. | 0.7XIII; 0.2XV | NW | P |
| 475 | A | 19 | 33 | 2.0 | 2.7 | λAnd. | II | W | P |
| 476 | Z | 19 | 35 | 2.0 | 2.3 | Cas. | 0.8I; 0.1X | S | P |
| 477 | D | 19 | 42 | 2.7 | 2.7 | XI | XI | N | P |

# Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 11, II Interval.* | *Continued* | | |
| 478 | D; A | 13 19 | 44; 43 | 2.5; 2.0 | 2.6 | XI; $\gamma$Per. | XI | NNE; N | P |
| 479 | A | 19 | 48 | (2.0?) | (2.*7) | — | IX* | — | P |
| 480 | A | 19 | 58 | 2.0 | 2.7 | $\delta$Per. | XI | N | P |
| 481 | A | 19 | 59 | 1.0 | 1.7 | Plej. | XIII | N | P |
| 482 | D | 20 | 34 | 2.5 | 2.5 | I | I | SSW | P |
| 483 | A | 20 | 40 | 2.5 | 3.2 | Plej.-$\alpha$Ari | IX | NW | P |
| 484 | A | 20 | 55 | 3.0 | 3.7 | Cas. | 0.9I | E | N |
| 485 | D | 21 | 13.5 | 2.5 | 2.5 | XIII | XIII | NNE | P |
| 486 | D | 21 | 23 | 3.0 | 3.0 | XV | XV | NE | P |
| 487 | Z | 21 | 40 | 3.0 | 3.3 | Ari | IX | NW | P |
| 488 | D | 21 | 59.5 | 3.5 | 3.5 | VIII | VIII | NW | P |
| 489 | D | 22 | 32.5 | 4.0 | 4.0 | X | X | NW | P |
| 490 | D; A; Z | 23 | 4; 4; 4 | 1a; 1.0; 1.5 | 1.9 | XVI; $\beta$Aur.; $\alpha$Aur. | XVI | ENE; E; E | P |
| 491 | D; A | 23 | 39.5; 39 | 3a; 2.0 | 2.9 | XII; Plej.-$\alpha$Ari | XII | N; NW | P |
| 492 | D | 23 | 43.5 | 3.0 | 3.0 | XII | XII | N | P |
| 493 | A | 24 | 6 | 2.0 | 2.7 | $\gamma$Per. | XI | E | P |
| 494 | A | 24 | 16 | 2.0 | 2.7 | $\beta$Per. | 0.5XII; 0.5XI | NW | P |
| 495 | D; Z | 24 | 17; 15 | 2b; 2.0 | 2.4 | IV; $\alpha$And. | IV | NW; NW | P |
| 496 | A | 24 | 23 | 1.5 | 2.2 | Cam. | 0.9XIV | NE | P |
| 497 | D | 25 | 26.5 | 3.0 | 3.0 | XIV | XIV | NNE | N |
| 498 | A; Z | 25 | 33; 34 | 3.0; 3.0 | 3.5 | $\alpha$Ari.; Psc. | VII | NW; NW | P |
| 499 | A | 26 | 2 | 3.0 | 3.7 | $\varepsilon$Per. | XV | N | P |
| 500 | D; A | 26 | 14.5; 14 | 3.5; 3.0 | 3.6 | VIII; $\gamma$And. | VIII | NW: NW | P |
| 501 | D; A | 27 | 12; 11 | 3.5; 2.5 | 3.3 | IV; $\lambda$And. | IV | W; SW | N |
| 502 | D; Z | 27 | 53.5; 54 | 3b; 5.0 | 4.4 | XI; $\alpha$Per. | XI | NE; NE | P |
| | | | | | | *Aug. 11, III Interval* | | | |
| 503 | D; Z | 39 | 34; 35 | 3.5; 2.0 | 2.9 | XIII; Plej. | XIII | N; N | P |
| 504 | D; Z | 39 | 34.5; 36 | 3a; 2.0 | 2.7 | XIII; Plej. | XIII | N; N | P |
| 505 | A | 40 | 6 | 2.0 | 2.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 506 | A | 40 | 16 | 2.0 | 2.7 | Ari. | IX | NW | P |
| 507 | D; A | 41 | 5; 5 | 3b; 3.0 | 3.6 | XI; *$\beta$Per. | XI | NE; E | P |
| 508 | D; A; Z | 41 | 6; 6; 5 | 3a; 3.5; 4.0 | 3.9 | XIV; $\alpha$Per.; Cam. | XIV | ESE; NE; E | P |
| 509 | Z | 41 | 13 | 4.0 | 4.3 | Psc. | 0.6VII; 0.3VIII; 0.1IV | NW | P |
| 510 | A | 41 | 14 | 3.5 | 4.2 | Tri. | 0 5VIII; 0.25VI; 0.25V | N | N |
| 511 | D; A; Z | 42 | 55; 55; 55 | 3.1; 2.0; 2.5 | 2.9 | XI; $\gamma$And-$\alpha$Per; $\alpha$Per. | XI | N; N; NW | P |
| 512 | A; Z | 42 | 58; 63* | 2.0; 3.5 | 3.2 | $\beta$Per.; $\beta$Per. | XII | N; NW | P |
| 513 | D; A | 43 | 25; 25 | 3b; 3.0 | 3.6 | IX; Plej.-Ari. | IX | NW; NW | P |
| 514 | D; A; Z | 44 | 12; 9; 15* | 1a; -0.5; 1.0 | 0.9 | I; Cas.; Cas. | I | SW; SW; SW | P |
| 515 | D | 44 | 25.5 | 2.0 | 2.0 | I | I | SW | N |
| 516 | A; Z | 44 | 25; 28 | 1.5; 3.0 | 2.7 | $\alpha$Per.; $\alpha$Aur. | XV | NE; N | P |
| 517 | D | 45 | 26 | 3b | 3.5 | XI | XI | N | P |
| 518 | A | 45 | 36 | 4.0 | 4.7 | $\gamma$And. | 0.8V; 0.2III | NW | P |
| 519 | D | 45 | 48.5 | 4.0 | 4.0 | VIII | VIII | NW | P |
| 520 | A | 46 | 40 | 3.0 | 3.7 | Plej.-Ari. | IX | NW | P |
| 521 | D; A | 46 | 49; 50 | 3b; 4.0 | 4.1 | XIII; Plej. | XIII | N; N | P |
| 522 | Z | 46 | 57 | 2.0 | 2.3 | $\gamma$And. | 0.7V; 0 3X | NW | P |
| 523 | A | 47 | 2 | 3.0 | 3.7 | $\gamma$And.-$\gamma$Per. | XI | N | P |
| 524 | D; A; Z | 47 | 29; 29; 29 | 3.5; 2.0; 3.0 | 3.2 | VII; $\beta$And.; Psc. | VII | NW; W; NW | P |
| 525 | A | 47 | 40 | 2.5 | 3.2 | N. And. | 0.8III; 0.2II | W | P |
| 526 | D; A; Z | 47 | 58.5; 59; 60 | 2b; 2.0; 2.0 | 2.5 | X; $\gamma$And-$\chi$Per.; $\gamma$And | X | NW; NW; NW | P |

## Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Seconds | Magnitude Recorded | Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Aug. 11, III Interval. Continued* | | | | | |
| 527 | D | 13 48 | 34 | 3a | 3.2 | XI | XI | NE | P |
| 528 | A | 48 | 40 | 2.5 | 3.2 | ιAur. | XV | NE | P |
| 529 | D; A | 49 | 4; 4 | 3b; 4.0 | 4.1 | XV; ιAur. | XV | NE; NE | P |
| 530 | Z | 49 | 8 | 2.0 | 2.3 | λAnd. | 0.6II; 0.4III | SW | P |
| 531 | D; A; Z | 49 | 29; 29; 29 | 1b; 2.0; 2.0 | 2.2 | XII; βPer.; βPer. | XII | NNW; NW; NW | P |
| 532 | D | 49 | 30 | 4.0 | 4.0 | V | V | NNW | P |
| 533 | A; Z | 50 | 5; 4 | 2.0; 2.5 | 2.7 | εPer.; ιAur. | XV | N; N | P |
| 534 | D; A | 50 | 35; 35 | 3.5; 3.0 | 3.6 | IX; Ari-Plej. | IX | NE; NE | N |
| 535 | Z | 50 | 47 | 4.0 | 4.3 | ιAur. | XV | N | P |
| 536 | D; A; Z | 51 | 3; 3; 3; | 2.5; 2.0; 3.0 | 2.8 | IX; Ari-Plej.; Ari | IX | NNW; NW; NW | P |
| 537 | 1)D | 51 | 6 | 3b | 3.5 | χPer. | X | NE | P |
| 538 | A | 51 | 6 | 4.0 | 4.7 | Ari-Plej. | IX | NW | P |
| 539 | A; Z | 51 | 31; 32 | 2.0; 2.5 | 2.7 | γAnd.-γCas; αPer. | X | NW; NW | P |
| 540 | D; A; Z | 51 | 57; 56; 55 | 2b; 1.5; 3.0 | 2.7 | XIII; Plej.-ιAur.; Plej. | XIII | NNE; N; N | P |
| 541 | D | 52 | 53 | 3b | 3.5 | XV | XV | NE | P |
| 542 | D; A | 53 | 15.5; 15 | 3.5; 2.0 | 3.1 | I; Cas. | I | SW; SW | P |
| 543 | A | 53 | 41 | 1.0 | 1.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 544 | A | 53 | 49 | 2.5 | 3.2 | αPer. | 0.8XI; 0.2XIV | NE | P |
| 545 | D; A | 53 | 53; 54 | 3b; 2.0 | 3.1 | XI; αPer. | XI | NNW; NE | P |
| 546 | D | 54 | 10 | 3b | 3.5 | IX | IX | N | P |
| 547 | A | 55 | 14 | 1.5 | 2.2 | γPer. | XI | N | P |
| 548 | D | 55 | 38 | 3a | 3.2 | XIV | XIV | ESE | P |
| 549 | A | 55 | 50 | 2.0 | 2.7 | Cam. | 0.9XIV | E | P |
| 550 | D | 56 | 17 | 3b | 3.5 | VIII | VIII | NW | P |
| 551 | D; A; Z | 57 | 3; 2; 5 | 3.0; 2.0; 3.0 | 3.0 | IX; αAri; Ari | IX | NW; NW; NW | P |
| 552 | D | 57 | 28 | 4.0 | 4.0 | XIII | XIII | NNE | P |
| 553 | A; Z | 57 | 31; 30 | 3.0; 4.0 | 4.0 | βAri; Ari | IX | NW; NW | P |
| 554 | D; A; Z | 58 | 3; 3; 3 | 1.5; 1.5; 1.5 | 1.8 | XV; αAur.; αAur. | XV | ENE; E; NE | P |
| 555 | A; Z | 58 | 36; 37 | 2.5; 4.0 | 3.7 | γAnd.; Tri | V | NW; NW | P |
| 556 | D; A; Z | 58 | 38; 38; 38 | 3b; 2.0; 4.0 | 3.5 | IX; Tri; Ari | IX | N; NW; NW | P |
| 557 | A | 58 | 49 | 3.0 | 3.7 | Tri | 0.5VIII;0.25IV;0.25V | NW | P |
| 558 | D | 59 | 25 | 3b | 3.5 | III | III | NE | N |
| 559 | D; Z | 14 0 | 9; 10 | 4.0; 4.0 | 4.1 | XVI; ιAur. | XVI | NE; N | P |
| 560 | D; A | 0 | 27.5; 28 | 3.0; 2.0 | 2.8 | XIII; Plej.-αAri | XIII | N: NW | P |
| 561 | D | 1 | 6 | 1.0 | 1.0 | XVI | XVI | NE | P |
| 562 | D; A; Z | 2 | 5; 5; 5 | -0.5; -0.5; -0.5 | -0.5 | XVI; ιAur.; ιAur. | XVI | NE; NNE; N | P |
| 563 | D; A | 3 | 4.5; 4 | 3.0; 2.0 | 2.8 | I; Cas. | I | SW; SW | P |
| 564 | D; A; Z | 3 | 52; 51; 51 | 2.0; 2.5; 3.0 | 2.8 | IX; Plej.-Ari; Ari | IX | N; NW; NW | P |
| 565 | Z | 4 | 9 | 4.0 | 4.3 | Cas. | 0.8I; 0.1X | SE | P |
| 566 | D | 4 | 46.5 | 3b | 3.5 | I | I | S | P |
| 567 | D; Z | 5 | 25.5; 24 | 3b; 3.0 | 3.4 | V; Tri | V | NW; NW | P |
| 568 | D | 6 | 3 | 2b | 2.5 | XIII | XIII | N | P |
| 569 | D | 7 | 4 | 3b | 3.5 | XV | XV | NE | P |
| 570 | D | 7 | 41 | 4.0 | 4.0 | VI | VI | NW | P |
| 571 | D | 8 | 33 | 3b | 3.5 | XIV | XIV | ESE | P |
| 572 | D; Z | 10 | 25; 25 | 4.0; 3.5 | 3.9 | V; βAnd. | V | NW; NW | P |
| 573 | A; Z | 10 | 57; 57 | 2.0; 3.0 | 3.0 | Cam.; Cam. | 0.9XIV | SE; SE | P |
| 574 | D | 11 | 4.5 | 3b | 3.5 | IX | IX | N | P |
| 575 | D; A | 11 | 48; 48 | 3.5; 3.0 | 3.6 | IX; Ari-Plej. | IX | N; NW | P |

1) Not traced on the map by D.

Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Seconds | Magnitude Recorded | Adopt. | Position Recorded | Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 11, III Interval.* | *Continued* | | |
| 576 | D; A | 14 11 | 53; 53 | 3.5; 40 | 4.1 | XIII; Ari.-Plej. | XIII | N; NW | P |
| 577 | A | 12 | 42 | 1.5 | 2.2 | γPer. | XI | E | P |
| 578 | D | 14 | 17 | 3b | 3.5 | XV | XV | NE | P |
| 579 | D | 14 | 50 | 4.0 | 4.0 | XV | XV | NE | P |
| 580 | D; A | 15 | 38; 37 | 3.5; 4.0 | 4.1 | X; αPer. | X | SE; SE | N |
| 581 | D; A; Z | 15 | 51; 51; 50 | 2b; 1.5; 1.5 | 2.2 | XIV; αPer.; αAur. | XIV | NE; E; NE | P |
| 582 | D | 18 | 13 | 3a | 3·2 | XIV | XIV | E | P |
| 583 | Z | 18 | 30 | -0.5 | 1.8 | ιAur. | XV | NE | P |
| 584 | A | 18 | 54 | 3.5 | 4.2 | Plej.-Ari. | IX | NW | P |
| 585 | D; A | 19 | 7.5; 8 | 3.5; 2.0 | 3.1 | IX; Tri. | IX | NW; NW | P |
| 586 | D; A | 19 | 45; 45 | 3.0; 2.0 | 2.8 | XV; αPer.-αAur. | XV | NE; NE | P |
| 587 | D; A | 20 | 8; 8 | 4.0; 3.0 | 3.8 | V; Tri. | V | NW; NW | P |
| 588 | A | 20 | 28 | 2.5 | 3.2 | Cam. | 0.9XIV | SE | P |
| 589 | D; A; Z | 20 | 47; 47; 46 | 3a; 3.0; 3.0 | 3.4 | III; N. And.; λAnd. | III | WNW; W; W | P |
| 590 | D; A; Z | 21 | 30.5; 30; 30 | 3b; 2.5; 2.0 | 3.0 | VI; Psc.; Psc. | VI | NW; NW; NW | P |
| 591 | D | 23 | 37 | 4.0 | 4.0 | IX | IX | NW | P |
| 592 | A | 23 | 59 | 4.0 | 4.7 | γAnd.-Cas. | III | W | P |
| 593 | Z | 24 | 0 | 3.0 | 3.3 | λAnd. | 0.6II; 0.4III | W | P |
| 594 | D; A; Z | 24 | 17.5; 18; 18 | 1b; 2.0; 2.0 | 2.2 | XV; ζPer.; Plej. | XV | N; N; N | P |
| 595 | A | 24 | 45 | 3.0 | 3.7 | ζPer. | XIII | N | P |
| 596 | D; A; Z | 25 | 14; 13; 15 | -0.5; 0.0; -1.0 | +0.5 | XIV; Cam.; αAur. | XIV | ENE; NE; NE | N |
| 597 | A | 25 | 50 | 3.0 | 3.7 | ζPer. | XIII | N | P |
| 598 | A; Z | 26 | 24; 24 | 2.0; 3.0 | 3.0 | βAnd.; Psc. | VII | NW; NW | P |
| 599 | A; Z | 26 | 31; 32 | 2.5; 4.0 | 3.7 | αAri.; Psc. | IX | NW; NW | P |
| 600 | D | 26 | 34 | 3.5 | 3.5 | VIII | VIII | NW | P |
| 601 | D; A; Z | 27 | 1; 0; 3 | 3.5; 2.5; 4.0 | 3.7 | XII; Ari.-Plej.; Plej. | XII | N; NW; NW | P |
| 602 | D; A | 28 | 48; 48 | 3b; 3.0 | 3.6 | VI; αAnd. | VI | NW; W | P |
| | | | | | | *Aug. 12, I Interval* | | | |
| 603 | D | 12 2 | 33 | 3b | 3.5 | XV | XV | NNE | P |
| 604 | D | 4 | 56 | 4.0 | 4.0 | I | I | ESE | N |
| 605 | D; A | 5 | 33; 35 | 3b; 3.5 | 3.8 | VI; βAnd. | VI | NE; NE | N |
| 606 | A | 6 | 20 | 0.0 | 0.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 607 | A | 11 | 1 | 5.0 | 5.7 | βAnd. | 0.7VI; 0.3III | SW | N |
| 608 | D; A | 13 | 33; 34 | 3b; 2.0 | 3.1 | IV; αAnd. | IV | NW; NW | P |
| 609 | D; A | 14 | 28.5; 31 | 4.0; 3.0 | 3.8 | VI; βAnd. | VI | NE; NE | N |
| 610 | D | 15 | 48.5 | 4.0 | 4.0 | V | V | NW | P |
| 611 | A | 17 | 13 | 4.0 | 4.7 | χPer. | X | SW | P |
| 612 | A | 17 | 15 | 4.0 | 4.7 | γPer. | XI | NE | P |
| 613 | A | 17 | 16 | 3.0 | 3.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 614 | D | 19 | 48 | 3b | 3.5 | X | X | NW | P |
| 615 | D; A | 19 | 55; 56 | 3a; 4.5 | 4.2 | VI; Tri. | VI | ESE; E | N |
| 616 | A | 21 | 29 | 3.0 | 3.7 | λAnd. | II | SW | P |
| 617 | D; A | 22 | 57; 59 | 3.5; 2.5 | 3.3 | VIII; Tri. | VIII | NW; NW | P |
| 618 | D; A | 23 | 59; 61 | 3.0; 1.5 | 2.6 | Out; Cas. | Out. | SE; SE | P |
| 619 | D | 28 | 27.5 | 4.0 (3b) | 3.8 | II | II | W | P |
| 620 | D | 29 | 13 | 3.0 | 3.0 | VII | VII | NW | P |
| 621 | A | 29 | 34 | 4.0 | 4.7 | Psc. | 0.7VII; 0.2IV | NW | P |
| 622 | D; A | 31 | 1; 2 | 2.0; 2.0 | 2.3 | VII; Psc. | VII | NW; NW | P |
| 623 | D; A | 34 | 54; 57 | 2b; 2.0 | 2.6 | I; Cas. | I | SW; SW | P |
| 624 | D | 35 | 43 | 3.5 | 3.5 | XI | XI | NNE | P |

Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 12, I Interval: Continued* | | | |
| 625 | D | 12 39 | 8 | 3.5 | 3.5 | II | II | W | P |
| 626 | D | 46 | 51.5 | 3b | 3.5 | III | III | WNW | P |
| 627 | D | 47 | 40 | 4.0 (3b) | 3.8 | I | I | SW | P |
| 628 | A | 47 | 45 | 2.5 | 3.2 | Cam. | 0.9XIV | SE | P |
| 629 | D | 51 | 38 | 3.5 | 3.5 | XI | XI | NE | P |
| 630 | D | 51 | 58 | 3.5 | 3.5 | X | X | NW | P |
| | | | | | | *Aug. 12, II Interval* | | | |
| 631 | D | 13 4 | 4 | 4.0 | 4.0 | VIII | VIII | NW | P |
| 632 | A | 4 | 41 | 2.5 | 3.2 | $\alpha$And.-$\beta$And. | IV | NW | P |
| 633 | A | 4 | 42 | 3.0 | 3.7 | $\alpha$And.-$\beta$And. | VI | NW | P |
| 634 | D | 5 | 34.5 | 3.0 | 3.0 | IX | IX | NW | P |
| 635 | D; A | 6 | 5; 5 | 2.5; 2.0 | 2.6 | IX; Tri. | IX | NW; NW | P |
| 636 | D; A | 12 | 59; 60 | 1.0; 0.0 | 0.8 | VII; Tri. | VII | ENE; NE | N |
| 637 | A | 16 | 56 | 3.0 | 3.7 | Tri. | 0.5VIII;0.25VI;0.25V | NW | P |
| 638 | D; A | 17 | 25; 26 | 4.0; 3.0 | 3.8 | V; $\gamma$And. | V | NW; NW | P |
| 639 | D; A | 18 | 51; 51 | 2.5; 2.0 | 2.6 | VII; Psc. | VII | NW; W | P |
| 640 | D; A | 19 | 40.5; 43 | 3.5; 3.5 | 3.8 | XIV; Cam. | XIV | ESE; E | P |
| 641 | D | 21 | 12 | 4.0 | 4.0 | XII | XII | N | N |
| 642 | D; A | 21 | 38.5; 40 | 3.0; 1.5 | 2.6 | XIII; Plej. | XIII | NNE; N | P |
| 643 | D | 26 | 37.5 | 2.0 | 2.0 | Out. | Out. | SE | N |
| 644 | D | 27 | 20.5 | 3b | 3.5 | VIII | VIII | NE | N |
| 645 | D | 28 | 45 | 3b | 3.5 | XI | XI | NE | N |
| 646 | D; A | 29 | 32; 33 | 3a; 2.0 | 2.9 | V; $\gamma$And. | V | NW; NW | P |
| 647 | A | 30 | 21 | 1.5 | 2.2 | $\beta$Per. | 0.5XII; 0.5XI | NW | P |
| 648 | D | 30 | 36 | 4.0 | 4.0 | X | X | NE | N |
| 649 | D; A | 33 | 51.5; 54 | 2.5; 2.0 | 2.6 | V; $\gamma$And. | V | NW; NW | P |
| 650 | D; A | 36 | 27; 27 | 4.0; 2.0 | 3.3 | XIV; Cam. | XIV | SE; SE | P |
| 651 | [1])D; A | 36 | 28; 29 | 4.0; 2.5 | 3.6 | $\chi$Per.; Cas. | X | SE; SE | P |
| 652 | D | 37 | 50 | 4.5 | 4.5 | IX | IX | NW | P |
| 653 | D | 45 | 39 | 4.0 | 4.0 | XI | XI | NNE | P |
| 654 | D | 46 | 33 | 2.5 | 2.5 | I | I | SW | P |
| 655 | D | 47 | 11 | 3.0 | 3.0 | VIII | VIII | SSE | N |
| 656 | D | 49 | 3 | 4.0 | 4.0 | XVI | XVI | ENE | P |
| 657 | D | 49 | 48 | 1.0 | 1.0 | XV | XV | NE | P |
| | | | | | | *Aug. 12, III Interval* | | | |
| 658 | D | 14 3 | 36 (?) | 3b | 3.5 | VII | VII | NW | P |
| 659 | D | 4 | 13 | 4.5 | 4.5 | Out. | Out. | NE | P |
| 660 | D | 6 | 10 | 4.0 | 4.0 | Out. | Out. | NE | P |
| 661 | A | 6 | 14 | 2.0 | 2.7 | $\gamma$Per. | XI | NE | P |
| 662 | D; A | 7 | 40; 40 | 2.5; 2.5 | 2.8 | XVI; $\beta$Aur. | XVI | NE; NE | P |
| 663 | A | 8 | 18 | 3.5 | 4.2 | $\alpha$Per. | 0.8XI; 0.2XIV | NW | P |
| 664 | A | 9 | 1 | 5.0 | 5.7 | Tri. | 0.5VIII;0.25VI;0.25V | NW | P |
| 665 | D; A | 9 | 14.5; 17 | 3a; 1.5 | 2.7 | XV; $\varepsilon$Per. | XV | NNE; N | P |
| 666 | D; A | 12 | 58; 59 | 3.5; 2.0 | 3.1 | VIII; Tri. | VIII | NE; NE | N |
| 667 | D; A | 13 | 39; 41 | 3.0; 1.5 | 2.6 | XIII; Plej. | XIII | N; N | P |
| 668 | D; A | 14 | 54; 55 | 1.0; 1.0 | 1.3 | V; Tri. | V | S; SE | N |
| 669 | D | 23 | 14 | 3b | 3.5 | Out. | Out. | NE | P |

1) Not traced on the map by *D*.

# Table 29. Continued.

| № | Observers | Tashkent M.T. H. M | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 12, III Interval. Continued* | | | |
| 670 | D; A | 14 25 | 10; 11 | 2a; 1.5 | 2.2 | I; Cas. | I | SW; SW | P |
| 671 | D | 25 | 51.5 | 4.0 | 4.0 | I | I | WSW | P |
| 672 | D | 27 | 6 | 3.5 | 3.5 | III | III | W | P |
| 673 | D; A | 27 | 56.5; 57 | 3b; 2.0 | 3.1 | IV; βAnd. | IV | WNW; NW | P |
| 674 | A | 28 | 18 | 4.0 | 4.7 | γPer. | XI | N | P |
| 675 | D; A | 29 | 9.5; 11 | 3b; 2.0 | 3.1 | IX; Tri | IX | ENE; E | N |
| 676 | D | 29 | 26 | 4.0 | 4.0 | III | III | W | P |
| 677 | D | 29 | 26 | 3b | 3.5 | VI | VI | NW | P |
| 678 | D | 33 | 17 | 3.5(a) | 3.4 | Out | Out | WSW | P |
| 679 | D; A | 35 | 18; 19 | 4.0; 3.5 | 4.1 | XIII; ζPer. | XIII | ESE; E | N |
| 680 | D; A | 36 | 52.5; 54 | 3.5; 4.0 | 4.1 | IV; Psc. | IV | S; S | N |
| 681 | D | 37 | 36 | 4.0 | 4.0 | XV | XV | ESE | N |
| 682 | D | 42 | 43 | 3.5 | 3.5 | III | III | W | P |
| 683 | D; A | 43 | 42.5; 43 | 3.0; 1.5 | 2.6 | I; Cas. | I | SE; E | N |
| 684 | D | 44 | 23 | 3.5 | 3.5 | Out | Out | NE | P |
| 685 | D | 46 | 29 | 2b | 2.5 | I | I | N | N |
| 686 | D | 47 | 35.5 | 3.5 | 3.5 | X | X | NE | P |
| 687 | A | 47 | 55 | 3.0 | 3.7 | αAur. | 0.6XVI; 0.4XV | NE | P |
| 688 | D | 48 | 2 | 3b | 3.5 | Out | Out | NE | P |
| 689 | D | 48 | 55 | 4.0 | 4.0 | XVI | XVI | NE | P |
| | | | | | | *Aug. 13, I Interval* | | | |
| 690 | A | 11 50 | 22 | 3.5 | 4.2 | λAnd. | II | SW | P |
| 691 | Z | 56 | 6 | 1.5 | 1.8 | Ari | IX | NW | P |
| 692 | D | 56 | 38.5 | 3.5 | 3.5 | IX | IX | NW | P |
| 693 | D | 57 | 0.5 | 3.0 | 3.0 | IX | IX | NW | P |
| 694 | D | 57 | 6 | 1.0 | 1.0 | IX | IX | NNW | P |
| 695 | D | 58 | 44.5 | 3.5 | 3.5 | I | I | SW | N |
| 696 | A | 59 | 0 | 3.5 | 4.2 | αAnd.-βAnd. | IV | S | N |
| 697 | A | 12 2 | 41 | 2.0 | 2.7 | αAnd. | IV | NW | P |
| 698 | D | 3 | 0 | 3b | 3.5 | III | III | N | N |
| 699 | A | 3 | 25 | 3.0 | 3.7 | γAnd. | 0.8V; 0.2III | SW | N |
| 700 | D; A | 6 | 26; 27 | 1b; 0.0 | 1.1 | VI; Tri | VI | NW; NW | P |
| 701 | D | 11 | 31 | 2b | 2.5 | II | II | W | P |
| 702 | A | 20 | 50 | 2.0 | 2.7 | αAnd. | IV | N | N |
| 703 | D; Z | 25 | 12; 13 | 3b; 3.0 | 3.4 | I; Cas. | I | SE; SE | N |
| 704 | A | 28 | 34 | 2.5 | 3.2 | λAnd. | II | SW | P |
| | | | | | | *Aug. 13, II Interval* | | | |
| 705 | D | 49 | 9 | 3b | 3.5 | XI | XI | NNE | P |
| 706 | D; A; Z | 49 | 41; 45; 41 | 4.0; 3.0; 3.0 | 3.7 | XIII; βPer.; βPer. | XIII | NE; NE; N | N |
| 707 | D; A; Z | 51 | 12; 7*; 12 | 4.0; 4.0; 3.5 | 4.2 | III; N.And.; λAnd. | III | NE; NE; NE | N |
| 708 | A | 51 | 42 | 3.0 | 3.7 | Cas. | 0.9I | SW | P |
| 709 | D | 53 | 25 | 4.0 | 4.0 | IX | IX | NE | N |
| 710 | A; Z | 53 | 59; 58 | 3.5; 3.0 | 3.7 | N.And.; λAnd. | III | W; W | P |
| 711 | Z | 55 | 4 | 4.0 | 4.3 | βAnd. | 0.5VI; 0.5III | N | N |
| 712 | D; A; Z | 57 | 8; 10; 9 | 3a; 2.0; 2.5 | 2.9 | XIV; Cas.; Cam. | XIV | ESE; SE; E | N |
| 713 | Z | 13 4 | 28 | 3.5 | 3.8 | Psc. | 0.6VII; 0.3VIII; 0.1IV | NW | P |
| 714 | Z | 4 | 55 | 2.5 | 2.8 | αAur. | 0.7XVI; 0.3XIV | NE | P |
| 715 | D | 7 | 36.5 | 3.0 | 3.0 | Out | Out | SW | P |
| 716 | A | 8 | 24 | 2.5 | 3.2 | αAur. | 0.6XVI; 0.4XV | E | P |

Table 29. Continued.

| № | Observers | Tashkent M.T. H. M. | Tashkent M.T. Seconds | Magnitude Recorded | Magnitude Adopt. | Position Recorded | Position Adopted | Direction | Radiant Adopted |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Aug. 13, II Interval. Continued* | | | |
| 717 | D: Z | 13 9 | 16; 16 | 3b; 2.0 | 2.9 | XVI; (β)Aur. | XVI | ENE; NE | P |
| 718 | D | 9 | 50 | 3b | 3.5 | III | III | E | N |
| 719 | D; A | 13 | 42; 44 | 4.0; 3.0 | 3.8 | II; λAnd. | II | SW; SW | N |
| 720 | Z | 14 | 21 | 2.0 | 2.3 | βAnd. | 0.5VI; 0.5III | NW | P |
| 721 | D; A | 18 | 31.5; 34 | 3a; 2.0 | 2.9 | XIV; αAur. | XIV | NE; E | P |
| 722 | A; Z | 20 | 2; 1 | 3.0; 3.0 | 3.5 | Cas.; Cas. | 0.9I | SW; SW | P |
| 723 | D; A; Z | 22 | 53; 53; 52 | 4.0; 2.0; 2.0 | 3.0 | II; λAnd.; λAnd. | II | N; NW; NE | N |
| 724 | Z | 24 | 7 | 3.5 | 3.8 | βAur. | XVI | NE | P |
| 725 | D; Z | 26 | 14; 14 | 3.5; 3.0 | 3.4 | VIII; Ari | VIII | NW; NW | P |
| 726 | Z | 30 | 7 | 4.0 | 4.3 | χPer. | X | NE | N |
| 727 | D; Z | 33 | 16; 15 | 4.0; 3.5 | 3.9 | VI; βAnd. | VI | ESE; E | N |
| 728 | D | 36 | 26 | 3.0 | 3.0 | XIV | XIV | SE | P |
| 729 | D | 37 | 5 | 3.5 | 3.5 | XIV | XIV | SE | P |
| | | | | | | *Aug. 13, III Interval* | | | |
| 730 | D; Z | 50 | 43.5; 44 | 3b; 3.5 | 3.6 | IX; Plej. | IX | NNW; NW | P |
| 731 | Z | 52 | 10 | 4.5 | 4.8 | αPer. | 0.9XI; 0.1X | NE | P |
| 732 | D | 55 | 52.5 | 3.5 | 3.5 | Out | Out | NNE | P |
| 733 | A | 58 | 15 | 2.0 | 2.7 | βPer. | 0.5XII; 0.5XI | NE | N |
| 734 | D | 58 | 51.5 | 3.5 | 3.5 | V | V | NW | P |
| 735 | D | 14 0 | 35.5 | 3b | 3.5 | I | I | SE | N |
| 736 | Z | 0 | 51 | 4.0 | 4.3 | αPer. | 0.9XI; 0.1X | SE | N |
| 737 | Z | 0 | 52 | 3.5 | 3.8 | αPer. | 0.9XI; 0.1X | E | P |
| 738 | A | 1 | 9 | 4.0 | 4.7 | αPer. | 0.8XI; 0.2XIV | NE | P |
| 739 | A | 2 | 26 | 3.0 | 3.7 | Cas. | 0.9I | S | P |
| 740 | D; A; Z | 8 | 11; 9; 8 | 3.5; 2.0; 2.5 | 3.0 | XIV; Cam.; Cam. | XIV | ESE; E; E | P |
| 741 | D; A; Z | 8 | 13; 14; 11 | 2b; 2.0; 2.5 | 2.7 | XV; αAur.; αAur. | XV | NE; NE; NE | P |
| 742 | A; Z | 8 | 44; 43 | 3.0; 3.5 | 3.7 | Ari; Tri | IX | NW; NW | P |
| 743 | D | 11 | 57 | 4.0 | 4.0 | XVI | XVI | E | P |
| 744 | D | 13 | 37 | 4.0 | 4.0 | III | III | E | N |
| 745 | D | 16 | 43.5 | 4.0 | 4.0 | XII | XII | SE | N |
| 746 | Z | 20 | 53 | 3.0 | 3.3 | Plej. | 0.7XIII; 0.2XV | NW | P |
| 747 | D; A | 21 | 39; 39 | 4.0; 3.0 | 3.8 | VII; Ari | VII | NNE; NW | N |
| 748 | D; Z | 23 | 32.5; 32 | 5.0; 4.0 | 4.6 | XIII; Plej. | XIII | NE; NE | N |
| 749 | D; A | 25 | 52.5; 54 | 3.0; 1.5 | 2.6 | XVI; βAur. | XVI | E; E | P |
| 750 | A | 28 | 47 | 2.5 | 3.2 | αAur. | 0.6XVI; 0.4XV | E | P |
| 751 | D; A; Z | 29 | 24; 24; 23 | 2b; 2.0; 2.5 | 2.7 | IV; αAnd.; αAnd. | IV | WSW; W; W | N |
| 752 | A; Z | 29 | 50; 49 | 3.5; 3.0 | 3.7 | Ari; Ari | IX | W; W | N |
| 753 | D; A | 30 | 31; 32 | 3.5; 3.0 | 3.6 | XI; γPer. | XI | NNW; NE | P |
| 754 | D | 31 | 57 | 3b | 3.5 | V | V | NW | P |
| 755 | D | 33 | 26 | 4.5 | 4.5 | Out | Out | NE | P |
| 756 | Z | 33 | 55 | 4.0 | 4.3 | Plej. | 0.7XIII; 0.2XV | N | P |

## Table 30.
### Reduction of Magnitude to the Zenith without Absorption $H = 100$ kilom.

| $m - m_z$ | Cos $Z$ | $m - m_z$ | Cos $Z$ |
|---|---|---|---|
| 0.0 | 1.000—0.973 | 1.9 | 0.411—0.392 |
| 0.1 | 0.972—0.932 | 2.0 | 0.391—0.372 |
| 0.2 | 0.931—0.890 | 2.1 | 0.371—0.354 |
| 0.3 | 0.889—0.850 | 2.2 | 0.353—0.336 |
| 0.4 | 0.849—0.811 | 2.3 | 0.335—0.319 |
| 0.5 | 0.810—0.773 | 2.4 | 0.318—0.302 |
| 0.6 | 0.772—0.736 | 2.5 | 0.301—0.286 |
| 0.7 | 0.735—0.701 | 2.6 | 0.285—0.272 |
| 0.8 | 0.700—0.669 | 2.7 | 0.271—0.258 |
| 0.9 | 0.668—0.639 | 2.8 | 0.257—0.243 |
| 1.0 | 0.638—0.609 | 2.9 | 0.242—0.230 |
| 1.1 | 0.608—0.581 | 3.0 | 0.229—0.218 |
| 1.2 | 0.580—0.553 | 3.1 | 0.217—0.204 |
| 1.3 | 0.552—0.528 | 3.2 | 0.203—0.190 |
| 1.4 | 0.527—0.502 | 3.3 | 0.189—0.177 |
| 1.5 | 0.501—0.478 | 3.4 | 0.176—0.166 |
| 1.6 | 0.477—0.455 | 3.5 | 0.165—0.155 |
| 1.7 | 0.454—0.433 | 3.6 | 0.154—0.144 |
| 1.8 | 0.432—0.412 | 3.7 | 0.143—0.135 |

## Table 31.
### Atmospherical Absorption at Sea Level (Müller).

| $\Delta m$ | Cos $Z$ |
|---|---|
| 0.00 | 1.000—0.900 |
| 0.05 | 0.899—0.740 |
| 0.10 | 0.739—0.640 |
| 0.15 | 0.639—0.580 |
| 0.20 | 0.579—0.510 |
| 0 25 | 0.509—0.460 |
| 0.30 | 0.459—0.420 |
| 0.35 | 0.419—0.380 |
| 0.40 | 0.379—0.350 |
| 0.45 | 0.349—0.326 |
| 0.50 | 0.325—0.306 |
| 0.60 | 0.305—0.257 |
| 0.70 | 0.256—0.224 |
| 0.80 | 0.223—0.198 |
| 0.90 | 0.197—0.177 |
| 1.00 | 0.176—0.158 |
| 1.10 | 0.157—0.140 |

## Table 31.
### Values of $z = 1 : (1 - y)$ for Computation of the Extrapolation Factor.

| $y$ | $z$ | $y$ | $z$ | $y$ | $z$ | $y$ | $z$ | $y$ | $z$ |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 1.00 | 0.26 | 1.35 | 0.50 | 2.00 | 0.74 | 3.85 | 0.89 | 9.1 |
| 0.02 | 1.02 | 0.28 | 1.39 | 0.52 | 2.08 | 0.76 | 4.17 | 0.90 | 10.0 |
| 0.04 | 1.04 | 0.30 | 1.43 | 0.54 | 2.17 | 0.78 | 4.55 | 0.91 | 11.1 |
| 0.06 | 1.06 | 0.32 | 1.47 | 0.56 | 2.27 | 0.80 | 5.00 | 0.92 | 12.5 |
| 0.08 | 1.09 | 0.34 | 1.51 | 0.58 | 2.38 | 0.81 | 5.3 | 0.93 | 14.3 |
| 0.10 | 1.11 | 0.36 | 1.56 | 0.60 | 2.50 | 0.82 | 5.6 | 0.94 | 16.7 |
| 0.12 | 1.14 | 0.38 | 1.61 | 0.62 | 2.63 | 0.83 | 5.9 | 0.95 | 20.0 |
| 0.14 | 1.16 | 0.40 | 1.67 | 0.64 | 2.78 | 0.84 | 6.3 | 0.96 | 25.0 |
| 0.16 | 1.19 | 0.42 | 1.73 | 0.66 | 2.94 | 0.85 | 6.7 | 0.97 | 33.3 |
| 0.18 | 1.22 | 0 44 | 1.79 | 0.68 | 3.13 | 0.86 | 7.1 | 0.98 | 50.0 |
| 0.20 | 1.25 | 0.46 | 1.85 | 0.70 | 3.33 | 0.87 | 7.7 | 0.99 | 100.0 |
| 0.22 | 1.28 | 0.48 | 1.92 | 0.72 | 3.57 | 0.88 | 8.3 | 1.00 | $\infty$ |
| 0.24 | 1.32 | | | | | | | | |