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BULLETIN OF THE ASTRONOMICAL INSTITUTES OF THE NETHERLANDS

1951 JANUARY 11 VOLUME XI NUMBER 419

COMMUNICATIONS FROM THE OBSERVATORY AT LEIDEN

THE VARIATION OF THE TOTAL BRIGHTNESS OF COMETS WITH HELIOCENTRIC DISTANCE

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The variation of the total visual brightness with heliocentric distance has been investigated for a number of comets. The variations have been described by a formula due to LEVIN, the magnitude m reduced to unit distance from the earth being represented as $m' = A + B\sqrt{r}$, where r is the distance to the sun. The formula is preferred to the exponential formula because a physical meaning can be attached to it. Numerical values for the parameters A and B are given in Table 2 for 29 comets investigated by BOBROVNIKOFF, and in Table 3 for 31 comets discussed in the present article. Table 1 gives a summary of all estimates that were collected in the course of this work.

1. *Introduction.*

The apparent magnitude m of a comet depends on:
(*a*) its geocentric distance Δ,
(*b*) its heliocentric distance r,
(*c*) its intrinsic properties.

The comet's geocentric distance can easily be eliminated from the observed apparent magnitude m by considering the magnitude m' at unit distance from the earth ($m' = m - 5 \log \Delta$).

2. *The Usual Parameters.*

Owing to the fact that when m' is plotted against $\log r$ the relation can usually be represented by a nearly straight line, it has been customary in the past to consider m' as a linear function of $\log r$:

$$m' = m_0 + 2{\cdot}5\, n \log r,$$
$$\text{or } m = m_0 + 5 \log \Delta + 2{\cdot}5\, n \log r,$$
$$\text{or, in intensities, } I = I_0/\Delta^2 r^n.$$

The values of m_0 and n differ for different comets, and so belong to the properties of a comet.

Other parameters might be more useful. N. T. BOBROVNIKOFF [1]), describing some other proposed photometric formulae, remarks that they are based on the behaviour of a few exceptional comets, and certainly are not applicable in a general way.

However, also the photometric parameters m_0 and n are not very satisfactory. The magnitude of the comet at unit distance from sun and earth, m_0, has generally been called the absolute brightness. An absolute brightness, however, should fulfil the condition that, if the arbitrary unit of distance is altered, differences in absolute magnitude should remain unchanged. This is not the case for comets, because the values of n show a great range. For this reason a comparison of the values of m_0 for different comets has only limited significance.

Furthermore, the exponent, n, of the heliocentric distance, in the intensity-equation is devoid of any physical meaning.

1) *Perkins Contr.* No. 16, p. 13, 1942.

3. *The New Parameters.*

It is clear that other photometric parameters, allowing of some physical interpretation, are highly desirable.

In 1943 LEVIN [1]) showed that for a comet model based on desorption of gases, the following formula should apply

$$I = I_0\, r^{-1/4}\, e^{-L\sqrt{r}/RT_0},$$

in which L equals the heat of desorption. Neglecting the slight influence of the factor $r^{-1/4}$, the relation between magnitude and heliocentric distance becomes very simple:

$$m' = A + B\sqrt{r}, \text{ in which } B = 1{\cdot}086\, L/RT_0.$$

The advantage in using these photometric parameters is the physical interpretation which may be attached to the derived values of B; of course, the comet model might be a poor one but it seems worth while trying.

The relation between the new and old parameters can be determined as follows

1) *Russ. A. J.* **20**, 48, 1943. See also B. VORONTSOV-VELIAMINOV, *Ap. J.* **104**, 232, 1946, and MINNAERT, *Proc. Amsterdam Acad.* **50**, 833, 1947. It is to be noted that in these last two articles, as well as in WHIPPLE's article in *Ap. J.* **111**, 385, 1950, the references to LEVIN have erroneously been given as *Russ. A. J.* **21**, 48, 1943.

$$n = 0{\cdot}4 \frac{dm'}{d \log r},$$

$$B = \frac{dm'}{d\sqrt{r}} = 2{\cdot}5\, n \frac{d \log r}{d\sqrt{r}} = 5\, n \frac{{}^{10}\log e}{\sqrt{r}}.$$

Replacing $\sqrt{r}$ by its mean value $\overline{\sqrt{r}}$, the full relations become

$$B = 2{\cdot}17\, n / \overline{\sqrt{r}},$$
$$A + B = m_0.$$

4. *The Derivation of Values of A and B.*

In order to be able to carry out a statistical study of differences between "new" and "old" comets, values of A and B have been determined of those comets for which sufficiently known orbits or interesting spectroscopic data were available. In 1941 and 1942 N. T. BOBROVNIKOFF [1]) published reductions of visual estimates of the total brightness of 45 comets. After having carefully reduced the observed magnitudes to a uniform photometric and instrumental system, he computed the values of m_0 and n.

For 29 of these comets I have made least-squares calculations of the values of A and B, using the normal points given by BOBROVNIKOFF. The comets selected were those for which the orbits were known with sufficient accuracy to classify them into the groups used in the following article. No empirical corrections for possible periodic variations were applied to these normal points. A comparison between the mean errors obtained with the old and the new formula showed that no real difference exists. It seems that the new formula represents the variation of the brightness of a comet with the heliocentric distance just as well as the old one. In deriving his normal points BOBROVNIKOFF has applied corrections to the observed magnitudes depending on the aperture of the instrument used. All observations were thus reduced to an average aperture of 2·67 inches. For the present investigation observations were all reduced to the naked eye. In order to accomplish this a systematic correction of $-0^{m}{\cdot}4$ was applied to the values of A found from BOBROVNIKOFF's normal points. The results are given in Table 2. The values of m_0 and n in the second and third columns of this table were taken from *Perkins Contr.* No. 16, pp. 26–91 (unamended values). The last column shows the perihelion distance in a.u. The column "Group" indicates the group into which the comet has been classified in the following article. The preceding column contains the reciprocal semi-major axes and their mean errors; if the latter are unknown the period over which the observations extend is given. For groups I and II the values of $1/a$ refer to the original orbit described before the comets entered the region of the planets. The sign : indicates that the correction from osculating to original orbit was unknown. In these cases a mean correction of $+\,{\cdot}00065$ has been applied to $1/a$ of the osculating orbit, but this introduces a mean error of about $\pm{\cdot}00040$. The column q gives the perihelion distance in a.u. A letter R in the last column refers to a remark at the bottom of the table.

In order to augment the number of known values of photometric parameters, visual observations of 78 other comets have been compiled. For 31 of these comets it has been possible to obtain values of A and B. Comets for which only parabolic orbits had been computed have again been left out, with the exception of three recent comets, for which it might be of interest to compare the photometric data with spectroscopic data. For most of the comets investigated it would have been impossible to derive reliable values from the observations carried out during the periods in which they were bright, which in general cover only a short range in heliocentric distance r. As a long range in r is most important to obtain a reliable value of B, I have especially looked for observations near perihelion and at the largest values of r. This method implied the use of visual estimates carried out with the largest instruments. The instrumental correction of the visually estimated total magnitude is according to BOBROVNIKOFF

$$\Delta m = -\,0^{m}{\cdot}17\, d,$$

in which d is the aperture in inches. This correction was, however, only investigated for apertures under 15″. As it does not seem probable that the correction will increase much more for greater instruments, the following corrections were adopted for reducing the observations to the naked eye.

d (inches)	Δm
< 12	$-\,0^{m}{\cdot}17\, d$
12 — 16	— 2·0
16 — 25	— 2·5
> 25	— 3·0

All these corrections, and especially the greater ones, are rather uncertain. There might, for instance, be a correlation between the instrumental correction and the vagueness of the comet.

A reduction to a homogeneous photometric system was impossible, since the comparison stars used were only seldom given. It is hoped that the influence of the errors thus introduced is minimized by the longer range of r. In several cases the last observation of a comet was used. If the magnitude was not given and the angular distance from the sun not too small, the brightness was estimated to equal the limiting mag-

1) *Perkins Contr.* No. 15, 1941 and No. 16, 1942.

Table I

Visual observations of the total brightness of comets.

Comet	Date	m	log Δ	corr	m′	√r	Source
1853 II 1) 3)	Apr. 19	6·0	—·42	— ·5	7·6	·99	*AN* 859
	Jun. 11	13·2	·16	— 1·1	11·3	1·04	*MN* **14**, 2
1853 III	Aug. 3	6·0	·18	0	5·1	·92	*AN* 883
	'54 Jan. 11	13·2	·29	— 1·1	10·7	1·60	*MRAS* **31**, 2
1854 I 1)	Mar. 1	14·0 4)	·44	— 1·7	10·1	1·46	*AN* 905; 909
1854 V 1)	Apr. 20	14·0 4)	—·17	— 1·7	11·5	1·48	*AN* 984; 961
1855 I 1)	Jun. 5	14·5	·38	— 2·0	10·6	1·61	*AN* 984
1855 II 1)	Jun. 5	6·3	—·14	0	7·0	·76	*AN* 967
	Jul. 1	14·5	·20	— 2·0	11·5	·95	*AN* 984
1857 IV 1)	Jul. 30	> 14·0	—·18	— 1·7	> 13·2	·94	*AN* 1103
	Oct. 21	14·8	·18	— 2·0	11·9	1·15	*AN* 1133
1860 III 2)	Jun. 24	3·0	—·11	0	3·6	·62	*AN* 1271
	Jul. 1	4·5	—·23	0	5·7	·73	*AN* 1271
	Jul. 18	6·0	—·28	0	7·4	·95	*AN* 1271
	Oct. 18	13·2	·47	— 1·6 5)	9·2	1·57	*MRAS* **31**, 35
1861 I	Apr. 30	4·5	—·42	0	6·6	1·05	*AN* 1308
	May 4	3·3	—·47	0	5·7	1·03	*AN* 1309
	May 16	6·0	—·36	0	7·8	·99	*AN* 1313
	Sep. 6	13·2	·20	— 1·1	11·1	1·35	*MRAS* **31**, 42
1863 I 1)	Mar. 12	13·5	·22	— 2·3 6)	10·1	1·02	*AN* 1422
1863 IV 1)	Nov. 8	4·0	—·11	— 1·3	3·3	·84	*AN* 1446
1863 VI 1)	'64 Apr. 13	13·5	·32	— 1 3	10·6	1·42	*AN* 1490
1865 I 2)	Feb. 14	6·0	·17	0	5·1	1·03	*AN* 1526
	Mar. 18	12·2	·30	— ·8	9·9	1·31	*AN* 1529
	May 2	13·2	·41	— 1·1	10·1	1·57	*MRAS* **34**, 41
1870 II 1)	Dec. 23	14·0	·40	— 1·7	10·3	1·52	*AN* 1833; 1840
1873 V	Sep. 3	5·0 7)	—·12	0	5·6	·87	*AN* 1960
	Nov. 28	11·0 8)	·30	— 2·0	7·5	1·17	*AN* 1977
	Dec. 17	14·4 8)	·30	— 2·0	10·9	1·30	*AN* 1977
1874 IV 1)	Nov. 14	13·5	·14	— 1·7	11·1	1·50	*AN* 2034
1877 II 9)	Apr. 7	7·0	·11	— 1·3	5·1	·74	*AN* 2157
	Apr. 13	6·5	·08	0	6·1	·73	*AN* 2145
	May 1	5·5	·00	— 1·3	4·2	·99	*AN* 2157
	May 3	6·5	·00	0	6·5	1·00	*AN* 2145
	May 10	5·0	·00	— 1·3	3·7	1·02	*AN* 2145
	May 29	6·8	·13	0	6·2	1·10	*AN* 2145
	Jun. 15	10·0	·26	— 1·3	7·4	1·18	*AN* 2145
	Jun. 30	> 13·5	·34	— 1·3	> 10·5	1·25	*AN* 2145
1880 II 1)	May 3	10·0	·34	— 1·6	6·7	1·36	*AN* 2319
1881 IV 2)	Jul. 21	6·0	·20	— 1·9 10)	3·1	·96	*AN* 2390
	Aug. 20	3·6	—·23	0	4·8	·79	*AN* 2399
	Aug. 30	4·4	—·20	0	5·4	·81	*AN* 2409
	Sep. 5	9·0	—·10	— 1·3	8·2	·85	*AN* 2412
	Sep. 14	6·0	·03	0	5·8	·90	*AN* 2412
	Oct. 21	13·5	·35	— 1·3	10·4	1·16	*AN* 2409
1882 I	Apr. 21	9·61	·05	— ·9	8·46	1·20	*AN* 2453
	Apr. 24	9·63	·03	— ·9	8·56	1·17	*AN* 2453
	Apr. 25	9·63	·03	— ·9	8·59	1·16	*AN* 2453
	Apr. 26	9·41	·02	— ·9	8·39	1·16	*AN* 2453
	May 2	8·95	·00	— ·9	8·07	1·10	*AN* 2453
	May 3	9·01	—·01	— ·9	8·16	1·09	*AN* 2453
	May 6	8·62	—·02	— ·9	7·83	1·06	*AN* 2453
	May 11	8·18	—·04	— ·9	7·47	1·00	*AN* 2453
	May 12	8·29	—·04	— ·9	7·59	·99	*AN* 2453
	May 15	8·09	—·05	— ·9	7·42	·95	*AN* 2453
	May 16	8·01	—·05	— ·9	7·35	·94	*AN* 2453
	May 18	7·71	—·05	— ·9	7·06	·91	*AN* 2453
	May 19	7·51	—·05	— ·9	6·86	·90	*AN* 2453
1882 II	Oct. 6/7	1·8	·13	— ·9	0·3	·89	*AN* 2466
	'83 Feb. 8	6·5	·38	0	4·6	1·74	*AN* 2495
	Mar. 7	6·5	·49	0	4·1	1·84	*AN* 2538
1885 III 1)	Sep. 3	9·0	·04	— ·8 11)	8·0	·94	*AN* 2678
	Oct. 5	14·8	·01	— 2·5 11)	12·2	1·14	*MN* **46**, 59
1886 I	'85 Dec. 9	14·1	·19	— 1·7	11·4	1·48	*AN* 2712
	'86 Mar. 1	6·0	·19	0	5·1	·98	*AN* 2733
	Mar. 8	5·4	·16	0	4·6	·93	*AN* 2733
	Mar. 9	5·6	·15	0	4·8	·93	*AN* 2733
	Mar. 10	5·1	·15	0	4·4	·92	*AN* 2733
	Mar. 18	5·1	·10	0	4·6	·86	*AN* 2733
	Mar. 25	4·5	·04	0	4·3	·83	*AN* 2733
	Apr. 1	4·2	—·04	0	4·4	·80	*AN* 2733
	Apr. 3/9	5·0	—·14	0	5·7	·81	*AN* 2723
	Apr. 22	3·1	—·48	0	5·5	·86	*AN* 2733
	Apr. 22	2·8	—·48	0	5·2	·86	*AN* 2733
	Apr. 25	1·6	—·59	0	4·5	·87	*AN* 2733
	May 15	6·0	—·32	0	7·8	1·00	*VJS* **22**
	Jul. 30	13·2	·36	— 1·1	10·3	1·46	*MN* **47**, 279
1886 V 1)	May 6	8·0	·12	— 2·5	4·9	·96	*AN* 2729
	Jul. 30	13·2	·29	— 1·1	10·7	1·16	*AN* 2780
1886 VIII 2)	'87 Jan. 24	10·0	·33	— 1·7 12)	6·7	1·29	*AN* 2769
	May 22	14·4	·52	— 2·0	9·8	1·66	*AN* 2840
1887 II 1)	Jan. 25	9·5	·09	— 2·0	7·1	1·30	*AN* 2772
1887 IV 1) 13)	May 19	9·5	—·36	— 1·7	9·6	1·20	*AN* 2787
	Aug. 11	12·9	—·11	— 1·5	12·0	1·27	*AN* 2808
1888 I 14)	Apr. 2	4·0	·07	0	3·7	·88	*AN* 2839
	Jun. 3	6·0	·28	0	4·6	1·27	*AN* 2849
	Sep. 4	15·3	·36	— 2·5	11·0	1·69	*AN* 2893
1888 V 1)	Oct. 31	11·5	·17	— 2·0	8·7	1·20	*AN* 2865
1889 I	'88 Sep. 3	11·0	·47	— 2·0	6·7	1·60	*AN* 2862
	Nov. 27	6·0	·04	0	5·8	1·41	*AN* 2897
	'89 Jan. 4	6·0	·26	0	4·7	1·36	*AN* 2887
	'90 Aug. 17	13·8	·76	— 3·0	7·0	2·49	*VJS* **26**
	'91 May 1	16·1	·87	— 3·0	8·7	2·86	*AN* 3035
1889 II	Mar. 31	12·5	·40	— 2·0	8·5	1·55	*AN* 2894
	'90 Aug. 23	14·8	·61	— 3·0	8·8	2·25	*VJS* **26**
1889 III 1)	Aug. 6	14·4	·15	— 2·0	11·6	1·16	*AJ* 203
1890 VI 1)	Aug. end	12·0	·08	— 2·5 15)	9·1	1·16	*VJS* **26**
1891 I 1)	Mar. 29	10·5	·09	— 2·0	8·1	·90	*VJS* **27**
	Apr. 1	8·0	·09	— 3·0	4·6	·90	*Publ. Kiel* **9**, 13.
1892 I	Apr. 6	3·5	·02	0	3·4	1·01	*VJS* **28**
	'93 Feb. 16	15·2	·68	— 2·5	9·3	2·07	*AN* 3203
1892 II	'93 Jan. 12	15·2	·46	— 2·5	10·4	1·86	*AN* 3203
1893 III	Jul. 16	4·0	—·25	0 16)	5·2	·84	*CR* **117**, 159; *AN* 3189
	Jul. 31	6·0	·04	0 16)	5·8	·91	*AN* 3189
	Aug. 12	7·7	·18	— ·3 17)	6·5	1·00	*AN* 3189
	Nov. 7	13·4	·47	— 2·0	9·1	1·50	*CR* **117**, 658
1894 II	May 1	4·5	—·46	0	6·8	1·02	*VJS* **30**
	May 30	8·0	—·03	— 1·1	7·0	1·14	*AN* 3253
	Jul. 28	14·6	·34	— 2·0	10·9	1·38	*AN* 3253
1895 IV 2)	Nov. 19	7·0	·18	— 1·0	5·1	·93	*AN* 3321
	Dec. 21	0·4	·01	0	0·4	·48	*AN* 3339
	'96 Aug. 9	16·7	·57	— 3·0	10·9	2·00	*AJ* 392
1896 III	Apr. 23	7·0	—·26	— 1·8	6·5	·75	*AN* 3349
	Apr. 28	6·5	—·22	— 1·0	6·6	·79	*AN* 3393
	May 5	6·7	—·17	— 1·0	6·5	·82	*AN* 3393
	May 11	7·3	—·12	— 1·0	6·9	·87	*AN* 3393
	May 15	8·3	—·09	— 1·0	7·7	·90	*AN* 3393
	May 19	9·0	—·07	— 1·0	8·3	·92	*AN* 3393
	May 28	10·5	—·01	— 1·0	9·5	·99	*AN* 3393
	Jun. 2	10·3	·01	— 1·0	9·3	1·01	*AN* 3393
	Jun. 8	11·0	·04	— 1·0	9·8	1·10	*AN* 3393
	Jun. 15	12·0	·06	— 1·0	10·7	1·15	*AN* 3393
	Jun. 20	16·7 18)	·08	— 3·0	13·3	1·19	*AN* 3550
1897 I 1) 19)	'96 Nov. 2	11·0	·18	— 2·0	8·1	1·36	*VJS* **32**
	'97 Apr. 27	13·5	—·12	— 1·3	12·3	1·27	*AN* 3427
1898 VII	Jun. 14	9·5	·03	— 1·3	8·0	1·45	*AN* 3499
	Jun. 16	9·0	·03	— 1·0	7·8	1·45	*AN* 3500
	'99 Dec. 1	16·7	·64	— 3·0	10·5	2·29	*AN* 3634
1898 VIII	Nov. 24	11·0	·31	— 2·0	7·5	1·53	*AJ* 451
	Dec. 2	12·0	·30	— 3·0	7·5	1·53	*AJ* 453
	'99 Jun. 26	15·5	·60	— 2·5	10·0	1·94	*AJ* 474
1898 X 1)	Oct. 21	7·0	—·21	— 1·3	6·7	·99	*AN* 3526
	Oct. 23	7·8	—·21	— 1·0	7·8	·98	*AN* 3556
	Oct. 27	8·0	—·20	— 1·0	8·0	·96	*AN* 3556
	Oct. 28	7·9	—·19	— 1·0	7·8	·95	*AN* 3556
	Oct. 30	7·9	—·17	— 1·0	7·7	·94	*AN* 3556
	Nov. 2	7·6	—·14	— 1·0	7·3	·92	*AN* 3556
	Nov. 3	7·7	—·13	— 1·0	7·3	·92	*AN* 3556
	Nov. 7	8·1	—·07	— 1·0	7·5	·90	*AN* 3556
	Nov. 9	7·8	—·05	— 1·0	7·1	·89	*AN* 3556
	Nov. 10	8·2	—·03	— 1·0	7·4	·89	*AN* 3556
	Nov. 19	8·3	·07	— 1·0	7·0	·87	*AN* 3556
	Nov. 20	8·4	·08	— 1·0	7·0	·87	*AN* 3556
	Nov. 26	8·9	·14	— 1·0	7·2	·87	*AN* 3556
1899 V 1)	Oct. 8	11·0	·34	— 1·3	8·0	1·35	*AN* 3598
	Dec. 23	13·0	·45	— 3·0	7·8	1·48	*AJ* 478
1900 I 1) 2)	Jan. 31	11·0	·20	— 3·0	7·0	1·36	*VJS* **36**
	Feb. 22	10·0	·28	— 2·0	7·4	1·29	*AN* 3628; *AJ* 478
	May 31	10·8	·28	— 2·0	6·6	1·19	*AN* 3642
	Jul. 22	12·5	·06	— 3·0	9·2	1·35	*AJ* 484
1903 I 2) 20)	Jan. 19	10·0	·24	— 3·0	5·8	1·14	*AN* 3841
	Jan. 19	10·0	·24	— 2·0	6·8	1·14	*AN* 3841
	Jan. 21	10·0	·23	— 1·0	7·8	1·12	*AN* 3841; 3845
	Feb. end	6·0	·12	0	5·4	·82	*VJS* **39**
	Mar. beg	5·0	·05	0	4·7	·74	*VJS* **39**
	May 4	13·2	—·20	— 1·1	13·1	1·10	*AN* 3906
1904 II 2)	Dec. 17	11·0	·37	— 3·0	6·1	1·40	*AN* 3986
	'05 May 2	14·0	·53	— 3·0	8·3	1·70	*VJS* **44**
1905 III 1)	Mar. 26	11·0	—·14	— 3·0	8·7	1·06	*VJS* **41**
	Apr. 6	11·7	—·14	— 1·6	10·8	1·06	*AN* 4011
	May 29	15·0	·06	— 2·5	12·2	1·19	*AN* 4031
1905 IV	'06 Mar. 5	11·0	·42	— 2·5	6·4	1·88	*AN* 4166
	Jun. 12	13·5	·58	— 2·5	8·1	2·00	*AN* 4135
	'07 Apr. 20	14·3	·69	— 3·0	7·9	2·43	*AN* 4187
1905 VI	Jan. 30	9·0	·00	— 1·7	7·3	1·20	*AN* 4073
	Mar. 27	12·5	·25	— 2·5	8·8	1·38	*AN* 4116
1906 I 2)	'05 Dec. 10	10·0	·18	— 1·7	7·4	1·14	*AN* 4058
	Dec. 18	9·0	·10	— 3·0	5·5	·99	*AN* 4068
	'06 Jan. 1	4·5	·04	0 21)	4·3	·81	*AN* 4065
	Jan. 14	0·7	·05	0	0·5	·59	*AN* 4090
	Feb. 22	9·2	·14	— 2·5	6·0	·96	*AN* 4090
	Mar. 21	12·9	·30	— 2·5	8·9	1·21	*AN* 4090
1907 I	Mar. 9	11·0	·16	— 2·0	8·2	1·43	*AN* 4160
	'08 Feb. 26	16·4	·66	— 3·0	10·1	2·07	*VJS* **44**
1907 II 1)	May 7	13·5	—·04	0	13·7	1·08	*AN* 4177
1910 I	Jan. 24	1·3	·03	0	1·1	·59	*VJS* **46**
	Jan. end	4·0	·11	0	3·4	·72	*VJS* **46**
	Apr. 15	11·5	·43	— 2·0	7·3	1·43	*AN* 4471
1910 III	Aug. 24	11·0	·26	— 1·7	8·0	1·40	*AN* 4441
	'11 May 24	14·0	·58	— 2·0	9·1	1·87	*AN* 4531
1914 III 1)	Jul. 1-2	12·5	·44	— 1·6	8·7	1·93	*AN* 4751
	Aug. 24	13·8	·52	— 3·0	8·2	1·95	*AN* 4807
	Sep. 14	16·7 22)	·56	— 3·0	10·9	1·96	*LOB* **8**, 137
1917 I	Apr. beg.	2·0	—·02	0	2·1	·57	*VJS* **53**
	May 5	5·0	·14	0	4·3	·89	*VJS* **53**
1919 V	Aug. 31	10·5	·36	— 2·0	6·7	1·37	*AN* 5019

TABLE I (*continued*)

Comet	Date	m	log Δ	corr	m'	$\sqrt{r}$	Source
1919 V	Sep. 1	10·0	·36	— ·5	7·7	1·37	*AN* 5018
	Sep. 14	8·3	·34	— 1·0	5·6	1·30	*AN* 5051
	Sep. 15	10·0	·34	— 2·0	6·3	1 30	*AN* 5019
	Nov. 11	6·8	·28	— 1·0	4·4	1·08	*AN* 5051
	Nov. 22	7·0	·28	— 2·0	3·6	1·07	*VJS* **57**
1922 II	Oct. 25	11·0	·24	— 2·0	7·8	1·51	*AN* 5195
	'23 Aug. 16	14·0	·60	— 3·0	8·0	1·97	*BZ* 1923 nr. 23
1923 I 1)	Feb. 24	15·1	·16	— 2·5	11·8	1·13	*AJ* 827; *VJS* **59**
1925 III	Apr. 1	8·8	·12	— ·4	7·8	1·50	*AN* 5410
	Apr. 23	7·6	·06	— ·4	6·9	1·45	*AN* 5410
	'26 Jul. 17	15·5	·63	— 3·0	9·3	2·10	*BZ* 1926 nr. 28
1925 VII	Nov. 1	8·0	·22	— ·7	6·2	1·30	*AJ* 958
	Nov. 22	8·5	·19	— ·5	7·0	1·28	*AN* 5411
	Nov. 27	9·0	·19	— 1·7	6·3	1·29	*AN* 5411
	'26 May	13·0	·48	— 3·0	7·6	1·80	*VJS* **62**
1927 IV	Mar. 10	10·0	·47	— 2·5	5·2	1·92	*PA* **35**, 227
	Sep. 21	13·5	·67	— 3·0	7·2	2·04	*PA* **35**, 474
	Dec. 21	13·0	·68	— 3·0	6·6	2·10	*PA* **36**, 69
	'28 Jan. 22	12·5	·68	— 3·0	6·1	2·14	*PA* **36**, 120
	Feb. 20	13·0	·67	— 3·0	6·6	2·16	*PA* **36**, 202
	Mar. 22	13·5	·67	— 3·0	7·1	2·21	*PA* **36**, 260
	Apr. 20	14·0	·68	— 3·0	7·6	2·24	*PA* **36**, 321
	Nov. 4	15·5	·79	— 3·0	8·5	2·47	*PA* **36**, 621
	'29 Jan. 1	16 23)	·82	— 3·0	8·9	2·56	*PA* **37**, 112
	Mar. 10	15·5 23)	·86	— 3·0	8·2	2·64	*PA* **37**, 246
	Apr. 14	16 23)	·87	— 3·0	8·6	2·69	*PA* **37**, 300
	Jun. 15, 29	15·5	·90	— 3·0	8·0	2·77	*PA* **37**, 404
	Jul. 5	15·5	·90	— 3·0	8·0	2·79	*PA* **37**, 404
	Sep. 3	15·5	·90	— 3·0	8·0	2·86	*PA* **37**, 475
	Nov. 22	16	·92	— 3·0	8·4	2·93	*PA* **37**, 607
	'30 Apr. 22	17 23)	1·00	— 3·0	9·0	3·15	*PA* **38**, 311
	Jul. 1	17 23)	1·01	— 3·0	9·0	3·20	*PA* **38**, 441
	Aug. 24	17 23)	1·01	— 3·0	9·0	3·19	*PA* **38**, 484
	Oct. 21	17 23)	1·01	— 3·0	9·0	3·20	*PA* **38**, 565
	Nov. 15	17 23)	1·02	— 3·0	8·9	3·23	*PA* **38**, 618
	'31 Jan. 15	17 23)	1·04	— 3·0	8·8	3·35	*PA* **39**, 108
	Feb. 14	17·5 23)	1·06	— 3·0	9·2	3·38	*PA* **39**, 156
	Mar. 12	17·5 23)	1·08	— 3·0	9·1	3·40	*PA* **39**, 224
1927 IX 2)	Dec. 19	1·0	—·04	0	1·2	·42	*VJS* **64**
	'28 Feb. 20	10·0	·32	— 1·0	7·4	1·26	
1930 IV	Apr. 22	11·6	·35	— ·8	9·0	1·44	*VJS* **67**
	Nov. 18	15·0	·56	— 3·0	9·2	1·79	*VJS* **67**
1931 III	Jul. 20	7·0	·24	— ·5	5·3	1·11	*PA* **39**, 486
	Jul. 22	9·0	·24	— 3·0	4·8	1·11	*VJS* **68**
	'32 Apr. 9	17·5	·60	— 3·0	11·5	2·04	*VJS* **69**
1932 I	Apr. 21	9·0	—·74	— 3·0	9·7	1·08	*PA* **40**, 295
	May 23	13·5	·00	— 3·0	10·5	1·33	*VJS* **69**
	Jun. 5	15·0	·12	— 3·0	11·4	1·38	*VJS* **69**
1936 I 1)	Apr. 16	16·0	·65	— 3·0	9·7	2·02	*VJS* **73**
	Dec. 20	17·2 24)	·66	— 3·0	10·9	2·13	*PA* **45**, 40, 91; *VJS* **73**
1937 VI	Sep. 3	18	·11	— 3·0	14·4	1·41	*BZ* 1937 nr. 34
(Encke)	Nov. 27	7	—·50	— 1·3	8·2	·89	*BZ* 1937 nr. 46
1941 I	Oct. 30	7·7	·14	— ·5	6·5	1·30	*AN* **272**, 259
	Nov. 8	7·4	·12	— ·5	6·3	1·24	*AN* **272**, 259
	Nov. 24	6·8	·08	— ·4	6·0	1·12	*AN* **272**, 259
	Dec. 3	6·3	·04	— ·4	5·7	1·05	*AN* **272**, 259
	Dec. 5	6	·04	0	5·7	1·04	*PA* **49**, 97
	Dec. 15	5·5	—·02	— ·4	5·2	·94	*AN* **272**, 259
	Dec. 23	4·7	—·08	— ·3	4·8	·86	*AN* **272**, 259
	'42 Jan. 2	3·7	—·18	— ·3	4·3	·73	*AN* **272**, 259
	Jan. 2	3·5	—·18	0	4·4	·73	*PA* **49**, 97
	Jan. 4	3·4	—·20	0	4·4	·71	*PA* **49**, 97
1941 VIII	Jun. 24	6·4	—·20	— ·2	7·2	1·23	*AJ* 1145
1941 VIII	Aug. 15	7·0	·10	— ·2	6·3	·97	*AJ* 1145
	Dec. 19	11·0	·00	— 3·0	8·0	1·40	*AJ* 1145
	'42 Jan. 9	12·0	·18	— 3·0	8·1	1·50	*AJ* 1145
	Jan. 21	13·0	·26	— 3·0	8·7	1·55	*AJ* 1145
	Feb. 8	15·0	·38	— 3·0	10·1	1·62	*AJ* 1145
	Feb. 18	16·5	·42	— 3·0	11·4	1·66	*AJ* 1145
	Jul. 2	7·4	—·18	— ·5	7·8	1·18	*AN* **272**, 265
	Jul. 13	7·2	—·10	— ·5	7·2	1·13	*AN* **272**, 265
	Aug. 10	7·1	·08	— ·5	6·2	·99	*AN* **272**, 265
	Sep. 2	7·4	·14	— ·5	6·2	·94	*AN* **272**, 265
	Sep. 21	7·4	·14	— ·4	6·3	·97	*AN* **272**, 265
	Oct. 14	7·8	·06	— ·4	7·1	1·07	*AN* **272**, 265
	Oct. 23	7·9	·04	— ·4	7·3	1·12	*AN* **272**, 265
	Nov. 15	8·1	—·08	— ·4	8·1	1·24	*AN* **272**, 265
	Dec. 17	9·5	00	— ·5	9·0	1·39	*AN* **272**, 265
1942 IV	Feb. 14	7·1	—·04	— ·2	7·1	1·34	*AJ* 1145
	Feb. 23	6·3	—·12	— ·2	6·8	1·31	*AJ* 1145
	Mar. 10	5·8	—·18	— ·2	6·6	1·27	*AJ* 1145
	Mar. 23	6·4	—·14	— ·2	6·9	1·24	*AJ* 1145
	Apr. 18	8·5	·04	— ·2	8·1	1·21	*AJ* 1145
	Feb. 26	6·8	—·14	— ·4	7·1	1·30	*AN* **275**, 238
	Mar. 5	6·2	—·18	— ·4	6·7	1·29	*AN* **275**, 238
	Mar. 13	6·0	—·18	— ·3	6·6	1·27	*AN* **275**, 238
	Mar. 17	6·3	—·16	— ·4	6·7	1·26	*AN* **275**, 238
	Mar. 26	6·9	—·10	— ·4	7·0	1·24	*AN* **275**, 238
	Apr. 4	7·0:	—·04	— ·5	6·7	1·22	*AN* **275**, 238
	Apr. 15	7·7:	·02	— ·5	7·1	1·21	*AN* **275**, 238
1947 XI	Oct. 13	8·7	—·34	— ·5	9·9	1·02	*Circ. War.* 23
(Encke)	Oct. 20	7·4	—·38	— ·5	8·9	·96	*Circ. War.* 23
	Oct. 21	7·9	—·38	— ·4	9·3	·94	*Circ. War.* 23
	Oct. 25	7·2	—·36	— ·5	8·5	·91	*Circ. War.* 23
	Oct. 27	7·6	—·36	— ·5	8·9	·89	*Circ. War.* 23
	Oct. 30	7·7	—·32	— ·6	8·7	·86	*Circ. War.* 23
	Nov. 4	7·0	—·26	— ·5	7·7	·80	*Circ. War.* 23
	Nov. 5	6·8	—·26	— ·5	7·6	·79	*Circ. War.* 23
	Nov. 8	6·5	—·22	— ·5	7·1	·76	*Circ. War.* 23
1947 XII	Dec. 10	4·5	—·06	— 3·0	1·8	·58	*UAIC* 1125
	Dec. 13	5·5	—·04	— 3·0	2·7	·65	*UAIC* 1125
	Dec. 14	6·0	—·03	— 3·0	3·1	·67	*UAIC* 1125
	Dec. 15	7·6	—·02	— 3·0	4·7	·69	*UAIC* 1125
	Dec. 16	8·5	·00	— 3·0	5·5	·73	*UAIC* 1125
	Dec. 17	9·0	·00	— 3·0	6·0	·75	*UAIC* 1125
	Dec. 18	9·0	·02	— 3·0	5·9	·76	*UAIC* 1125
	Dec. 19	9·3	·04	— 3·0	6·1	·78	*UAIC* 1125
	Dec. 20	9·0	·05	— 3·0	5·8	·80	*UAIC* 1125
	Dec. 31	7·7	·16	— ·5	6·4	·95	*BA Czech.* **1** nr. 5
	'48 Jan. 1	8·5	·17	— ·5	7·2	·95	*BA Czech.* **1** nr. 5
	Jan. 2	7·3	·19	— ·5	5·9	·98	*BA Czech.* **1** nr. 5
	Jan. 3	7·9	·20	— ·5	6·4	·99	*BA Czech.* **1** nr. 5
	Jan. 4	7·3	·21	— ·5	5·8	1·00	*BA Czech.* **1** nr. 5
	Jan. 5	7·5	·22	— ·5	5·9	1·01	*BA Czech.* **1** nr. 5
	Jan. 11	8·8	·27	— ·5	7·0	1·08	*BA Czech.* **1** nr. 5
	Jan. 12	8·8	·28	— ·5	6·9	1·09	*BA Czech.* **1** nr. 5
	Jan. 13	9·0	·28	— ·5	7·1	1·10	*BA Czech.* **1** nr. 5
1948 I 1) 2)	Mar. 13	6·1	·03	— ·2	5·8	·95	*BA Czech.* **1** nr. 5
	Mar. 14	6·1	·02	— ·2	5·8	·95	*BA Czech.* **1** nr. 5
	Mar. 17	6·5	—·01	— ·2	6·3	·97	*BA Czech.* **1** nr. 5
	Mar. 21	5·6	—·05	— ·2	5·6	1·00	*BA Czech.* **1** nr. 5
	Mar. 24	6·4	—·07	— ·2	6·6	1·02	*BA Czech.* **1** nr. 5
	Mar. 30	6·4	—·11	— ·2	6·8	1·05	*BA Czech.* **1** nr. 5
	Mar. 31	6·4	—·11	— ·2	6·8	1·05	*BA Czech.* **1** nr. 5
	Apr. 1	6·5	—·12	— ·2	6·9	1·06	*BA Czech.* **1** nr. 5
	Apr. 2	6·0	—·12	— ·2	6·4	1·06	*BA Czech.* **1** nr. 5

1) Not used for determination of A and B because of small range in $\sqrt{r}$, or because there was only one observation. 2) Not used for determination of A and B because only parabolic elements are available. 3) If observed with 8″ the comet's corrected magnitude would have been $4^{\mathrm{m}}{\cdot}7$ and it would have been an easy naked-eye object. The correction was accordingly supposed to be $-{}^{\mathrm{m}}{\cdot}5$ in stead of $-1^{\mathrm{m}}{\cdot}3$. The observations indicate an extremely rapid fading, m' increasing by 3 to $4\frac{1}{2}$ magnitudes while $\sqrt{r}$ remained practically constant. The comet passed through perihelion on May 9. 4) Limiting magnitude 10″-telescope. 5) Extra correction of $-{}^{\mathrm{m}}{\cdot}5$ for moon and poor definition. 6) Extra correction of $-1^{\mathrm{m}}{\cdot}0$ for proximity to sun. 7) Easy for naked eye. Assumed as $5^{\mathrm{m}}{\cdot}0$. 8) Limiting magnitude diminished by ${}^{\mathrm{m}}{\cdot}5$. 9) Determination of A and B impossible on account of large dispersion in m'. 10) Observation assumed to have been made with 29-cm refractor, and not with naked eye. 11) For first observation assumed 5″ comet finder. Second observation assumed to be limiting magnitude diminished by ${}^{\mathrm{m}}{\cdot}5$. 12) Observation assumed to have been made with 10″. 13) Extra correction of $-{}^{\mathrm{m}}{\cdot}5$ for poor definition on Aug. 11. The large difference in m' between the two dates indicates abnormal fading. The comet passed perihelion on June 16. 14) Comet Sawerthal. This comet is known to have shown quite abnormal changes in brightness. For this reason no determination of A and B was made. 15) Observation assumed to have been made with more than 16″ aperture. 16) Observations assumed to have been naked-eye estimates. 17) Observations assumed to have been made with 2″ finder. 18) Observation discarded since it seemed improbable that the comet could really have been at the limit of visibility in the 36″. 19) This comet shows an abnormal weakening between the two dates given, which cannot be ascribed to a change in r. It passed through perihelion in the interval (T = Feb. 8). It was assumed that the magnitude at discovery has been estimated in a 12″ telescope. 20) All observations are before perihelion (March 15), except the last one, for which m' is more than 6^{m} fainter than at the same r before perihelion. 21) This observation was supposed to be a naked-eye estimate. 22) The comet was supposed to be at the limit of the 36″ although this was not explicitly said. 23) Photographic observations with 24″ reflector. These were reduced to the visual magnitudes by a comparison in the interval where the comet was observed visually as well as photographically. 24) This is the mean of estimates made on three different nights.

TABLE 2

Values of A and B from observations collected by N. T. BOBROVNIKOFF.

Comet	m_0	n	p.e.	A	B	range $\sqrt{r}$		$1/a$	m.e. or interv. of obs.	Group	q
1858 VI	3·73	3·76	± ·42	— 6·2	9·7	·76 to	·92	·00657	± ·00002	III	·58
1861 II	5·08	·47	·38	+ 3·5	1·2	·95	1·24	1814	1	III	·82
1874 III 1)	6·24	4·78	·34	— 5·5	11·4	·82	1·00	337	6 months	III	·68
1881 III	5·65	2·40	·10	+ 0·6	4·6	·87	1·48	554	4 months	III	·77
1884 I 2)	5·21	3·13	·15	+ 0·3	5·9	·88	1·46	5810		IV	·78
1886 II	6·66	2·05	·06	+ 1·8	4·4	·70	1·33	32	± ·00001	II	·48
1886 IX	4·79	2·63	·47	— 1·4	5·8	·82	1·07	6	3	I	·66
1890 II	5·47	2·55	·65	+ 2·5	3·1	1·38	1·82	7	1	I	1·91
1898 I	4·62	5·93	·79	— 7·5	11·7	1·05	1·30	1834	1½ month	III	1·10
1900 II	8·62	6·55	·35	— 4·7	12·9	1·01	1·16	32:	± ·00010	II	1·02
1902 III	6·77	2·63	·09	+ 1·0	5·3	·76	1·32	1	2	I	.40
1904 I	3·36	3·45	·26	0·0	4·0	1·66	1·98	22	1	II	2.71
1906 VII	7·58	6·89	·55	— 6·0	13·3	1·10	1·13	1432	98	III	1·21
1907 IV	4·32	3·58	·17	— 3·3	7·1	·72	1·52	236	1	III	·51
1908 III	4·00	5·00	·32	— 5·3	9·0	1·01	1·40	16	5	II	·94
1910 II 3)	5·70	3·71	·65	— 3·9	8·8	·77	1·66	5590		IV	·59
1911 V	5·60	3·43	·08	— 2·4	7·5	·70	1·38	613	4	III	·49
1911 VI	6·31	3·55	·32	— 1·7	7·6	·89	1·09	229	5	III	·79
1914 V	1·78	3·50	·13	— 3·7	5·3	1·05	1·93	1	0	I	1·10
1915 II	4·79	3·84	·59	— 0·5	5·4	1·18	1·61	42:	6	II	1·00
1917 III	8.29	1·97	·67	+ 5·2	2·9	1·30	1·50	95:	1	II	1·69
1919 III 4)	10·44	5·76	·32	— 3·0	13.0	·79	1·08	5950		IV	·48
1925 I	5·88	3·28	·43	+ 0·4	5·3	1·08	1·34	5	3	I	1·11
1930 III	8·67	4·67	·12	— 2·8	11·0	·70	1·20	1665	3 months	III	·48
1932 VI	5·08	2·46	·41	+ 2·5	2·9	1·65	1·86	4	± .00000	I	2.31
1932 X 5)	8·92	2·09	1·08	— 0·5	8·5	1·06	1·18	4095	4 months	III	1·13
1935 I	9·81	2·88	·50	+ 3·1	6·3	·90	1·04	1073	4½ months	III	·81
1936 II	6·75	4·62	·66	— 2·3	8·7	1·05	1·15	684	3½ months	III	1·10
1937 IV	6·18	3·25	·53	+ 1·2	4·9	1·32	1·53	69:	9 months	II	1·73

1) 1874 III. $1/a$ refers to the original orbit; for all other comets of group III it refers to the osculating orbit. 2) 1884 I. Comet Pons-Brooks (period 72 years). The comet was exceedingly variable in brightness (cf. BOBROVNIKOFF, *Perkins Contr.* No. 16, p. 35) so that it is uncertain whether much weight can be attached to the result for B. 3) 1910 II. Halley's comet (period 76 years). 4) 1919 III. Comet Brorsen-Metcalf (period 69 years). 5) 1932 X. The value of n is probably erroneous.

TABLE 3

Values of A and B from observations collected by the author.

Comet	A	B	range $\sqrt{r}$		$1/a$	m.e. or interv. of obs.	Group	q
1853 III	— 1·6	7·3	·92 to	1·60	·00008	± ·00002	I	·31
1861 I	— 6·6	13·1	·99	1·35	1796	5 months	III	·92
1873 V	— 5·1	12·3	·87	1·30	135:	± ·00018	II	·38
1882 I	+ 1·8	5·8	·90	1·20	16	7	II	·06
1882 II	— 3·8	4·6	·89	1·84	1188	3	III	·01
1886 I	— 4·1	10·2	·80	1·48	— 1	2	I	·64
1889 I	+ 2·8	2·1	1·36	2·86	2	6	I	1·81
1889 II	+ 7·8	0·4	1·55	2·25	112	4	II	2·26
1892 I	— 2·3	5·6	1·01	2·07	102	1	II	1·03
1893 III	+ 0·4	5·8	·84	1·50	147:	5 months	II	·67
1894 II	— 7·5	13·3	1·02	1·38	1028	± ·00049	III	·98
1896 III 1)	— 2·4	11·4	·75	1·19	— 20:	18	II	.57
1898 VII	+ 3·4	3·1	1·45	2·29	— 2	1	I	1·70
1898 VIII	— 1·8	6·1	1·53	1.94	430	8	III	2·28
1905 IV	+ 3·3	2·0	1·88	2.43	10:	3½ years	II	3·34
1907 I	+ 3·9	3·0	1·43	2·07	3	± ·00004	I	2·05
1910 I 2)	— 2·8	7·5	·50	1·71	69	15	II	·13
1910 III	+ 4·8	2·3	1·40	1·87	75:	9 months	II	1·95
1917 I	— 1·8	6·9	·57	·89	3617	± ·00012	III	·19
1919 V	— 8·9	11·7	1·07	1·37	46:	6 months	II	1·12

1) 1896 III. The observation of June 20, according to which the comet would be at the limit of visibility in a 36-inch refractor, is quite discordant, and has not been used. 2) 1910 I. The values of A and B given are improved values derived by Mr FOKKER from a somewhat more extensive material than that given in Table 1.

TABLE 3 (*continued*)

Comet	A	B	range $\sqrt{r}$		$1/a$	m.e. or interv. of obs.	Group	q
1922 II	+ 7·2	0·4	1·51	1·97	0	± ·00002	I	2.26
1925 III	+ 2·8	3·1	1·45	2·10	279	3	III	1·63
1925 VII	+ 3·6	2·2	1·29	1·80	12	2	II	1·57
1927 IV	+ 2·2	2·1	1·92	3·40	118:	4 years	II	3·68
1930 IV	+ 8·2	0·6	1·44	1·79	47:	± ·00001	II	2·08
1931 III	— 2·6	6·9	1·11	2·04	2412	3 months	III	1·04
1932 I	+ 4·6	4·7	1·08	1·38	1496	?	III	1·26
1937 VI [1]	— 2·1	11·6	·89	1·41	45200		IV	·33
1947 XI [1]	— 1·5	10·2	·76	1·02				
1941 I	+ 1·5	4·0	·71	1·30	(e = 1)			·37
1941 VIII	+ 0·4	6·0	·94	1·66	(e = 1)			·87
1947 XII [2]	— 2·1	8·6	·58	1·10	(e = 1)			·11

[1]) 1937 VI and 1947 XI are two returns of Encke's comet. The constants A and B derived from the two oppositions are in satisfactory agreement. Quite recently two magnitude determinations at very large distance have been made by CUNNINGHAM with the 60-inch Mt Wilson reflector. Pg magnitudes 21·0 and 20·1 were found on July 21 and August 16–17, 1950 at $r = 3·05$ and 2·83 a.u. respectively. If no correction Δm is applied we get $m' = 18·6$ for the average of these two, and the value of B from all available observations at the three oppositions becomes 11·8. On the other hand, if a correction $\Delta m = -1·5$ is applied, we obtain $B = 10·8$. On the whole, CUNNINGHAM's observations fit well into the linear relation between m' and $\sqrt{r}$. *Note added to proof*: In an article in *A.N.* **278**, 217, 1950, that has just appeared, BEYER published extensive measures of the brightness of Encke's comet. From these we find $B = 12·8 \pm 0·5$ and $B = 13·1 \pm 0·8$ at the 1937 and 1947 returns respectively. [2]) 1947 XII. The variation of this comet cannot well be represented by the formula $m' = A + B\sqrt{r}$. The interval $\sqrt{r}$ 0·58 to 0·80 gives $A = -14$, $B = 26$, while the interval $\sqrt{r}$ 0·95 to 1·10 gives $A = -2$, $B = 8$.

nitude visible in the telescope [1]) corrected for instrumental aperture as indicated above. The values of r and Δ were generally taken from the published ephemerides; in some cases values had to be computed from the elements. No magnitudes estimated from photographic plates have been included, because the uncertainty of the reduction to visual magnitudes was deemed to be too great.

A and B were determined graphically.

As a rough check on the consistency of my magnitude system with that in BOBROVNIKOFF's list I have compared the average values of A and B in the two lists. If, in order to reduce to comparable average values of q, we exclude the comets with $q > 1·80$ we find for 23 remaining comets in BOBROVNIKOFF's article $\bar{A} = -1·6$, $\bar{B} = 7·7$, and for 18 in my list $\bar{A} = -1·7$, $\bar{B} = 7·5$. The satisfactory agreement may be considered to indicate that the systems of magnitudes are not too different for the two investigations.

In order to facilitate eventual further investigations I have given in Table 1 all the material concerning the visual magnitudes that has been collected, including also those comets for which no determination of the photometrical parameters was made. In this table m gives the observed magnitude, the source of which is indicated in the next to last column. The correction for instrumental aperture is given under "corr", m' is the magnitude corrected for this amount and reduced to $\Delta = 1$.

[1]) RUSSELL, DUGAN and STEWART, *Astronomy*, p. 614, 1938.

The values of A and B derived from this material are contained in Table 3, which is similar to Table 2. It should be emphasized that Table 1 contains in no way a complete bibliography of published visual observations of the comets investigated, and further that in some cases the values of A and B are not very accurate owing to a short range in r, to the roughness of the observations which had to be used, or to irregular variations in brightness as displayed by several comets. For the comets 1853 II, 1887 IV, 1897 I and 1903 I a considerable fading (amounting to several magnitudes) around the time of perihelion passage is indicated by the observations listed in Table 1. The significance of this is not clear; in none of these cases it can be ascribed to differences in r (see the notes following Table 1). For comet 1897 I (which is a new one) the abnormal decrease in brightness after perihelion was also commented upon by MÖLLER [1]).

In the following paper the results of Tables 2 and 3 will be used in an investigation of the photometric differences between old and new comets.

I am indebted to Mr KRIEST for checking the data given in Tables 1 to 3.

[1]) *Astr. Abh., Erg.h. A.N.*, No. 2, p. 5, 1901.