

Note on the Cambridge Magnitude Equation. By
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A year ago (*M.N.*, lxxii., p. 93) Professor Turner drew attention to a discontinuity in the Cambridge magnitude equation, indicating that a change of method apparently occurred about the year 1878 or 1879.

To ascertain the epoch of the change more exactly the residuals for the single observations were collected as below. Though these single observations are naturally rougher than the means of several, they carry the exact date of observation; the means of two or more observations may be, for instance, a combination of an observation before 1875 with one in 1885, or even later. An inspection of the residuals in ξ seemed to justify six or seven groups being made as follows:—A (zone 1–255), B (256–425), C (426–650), D (651–1000), E (1001–1350), F (1351–2024). The unit adopted in this note is $\cdot 0001$ of a *réseau* interval ($0''\cdot 03$).

Residuals in $\Delta\xi$ outside the limits of -250 and $+250$ were omitted. The fainter stars (9.2 to 9.5) have been kept separate for obvious reasons and are given in Table I.; the observations of the brighter stars are in Table II. The subscript number shows the number of stars in each group.

TABLE I.

Mean Residuals for the Fainter Stars.

Group	A. 1–255	B. 256–425	C. 426–650	D. 651–1000	E. 1001–1350	F. 1351–2024	
Period 1800+ }	72.4–74.8	74.8–77.1	77.1–79.3	79.3–83.6	83.6–87.1	87.1–96.8	
							Wtd. Mean for Mag.
Camb. Mag. 9.5 }	– 16 ₂₉₇	– 5 ₃₂	– 50 ₃₂	– 74 ₁₄₉	– 36 ₄₀	– 43 ₄₈	– 35 ₅₉₈
9.4	– 20 ₂₈	– 24 ₂₃	– 21 ₂₄	– 44 ₁₀₃	– 13 ₂₉	– 17 ₂₃	– 30 ₂₃₀
9.3	– 11 ₂₇	– 18 ₃₃	– 30 ₂₂	– 33 ₈₅	– 20 ₃₅	– 52 ₃₃	– 29 ₂₃₅
9.2	+ 1 ₁₈	– 12 ₂₆	– 11 ₁₀	– 32 ₃₆	– 20 ₃₃	– 29 ₂₆	– 20 ₁₄₉
Wtd. Mean	– 15	– 14	– 32	– 52	– 23	– 38	– 31
In Arc	– 0''.45	– 0''.42	– 0''.96	– 1''.56	– 0''.69	– 1''.14	– 0''.93
No. of Stars	370	114	88	373	137	130	1212

TABLE II,

Mean Residuals for the Brighter Stars.

	A.	B.	C.	D.	E.	F	
9.1	– 10 ₅	+ 22 ₅	+ 20 ₅	– 39 ₁₅	– 32 ₄	– 24 ₂₂	– 14 ₇₆
9.0	– 5 ₂₉	– 26 ₁₃	+ 4 ₅	– 9 ₁₀	– 47 ₆	– 14 ₇	– 13 ₇₀
>8.9	– 40 ₁	...	+ 12 ₄	0 ₆	+ 50 ₂	– 3 ₉	+ 4 ₂₂
Wtd. Mean	– 7	– 13	+ 12	– 22	– 8	– 17	– 11
In Arc	– 0''.21	– 0''.39	+ 0''.36	– 0''.66	– 0''.24	– 0''.51	– 0''.33
No. of Stars	35	18	14	31	32	38	168

From which we get

$$\left. \begin{array}{l} \text{Ft.-Bt.} \\ \text{Stars} \end{array} \right\} \begin{array}{ccccccc} -0''.24 & -0''.03 & -1''.32 & -0''.90 & -0''.45 & -0''.63 & -0''.60 \end{array}$$

The groups in these two tables show (1) that we cannot obtain the precise epoch this way; (2) that the change was before group C (1877.1), if we may trust the differences for the fainter *minus* the brighter stars; and (3) that the fainter stars alone suggest some time during C (1877.1 to 1879.4) for the change.

It is not easy, in the absence of definite notes by the observer, to say what the change was. In the introduction to the Cambridge A.G.C., p. (6), it is stated that Mr. Graham observed all the transits from 1872 to 1896, except during some revision work in the latest years, when the transits were observed over all seven wires by Miss Walker; (previously, for the greater part of the zone work, not more than three wires, often only one, had been observed). At this stage, as no other note or intimation of any change could be found in the Cambridge Catalogue or the annual reports, I wrote to Mr. A. R. Hinks asking whether there were any unpublished notes by the observer or other information which would explain the changes in the curve, which I had sent him. I give two extracts from one of his letters, dated 1912 Nov. 27: "The whole of the transits up to early in 1890 were taken by Mr. Graham. After that Miss Walker began to observe occasionally, and gradually did more and more, so that by the end of 1893 she was doing it all." . . . "there is no record of any changes in the method of observation, or of the state of the observer's sight. It is known that Graham was going blind in one eye during his later years, that is, for some time before 1892, and it is believed that he altered the eye which he used: but that is uncertain."

Having the definite information that all the transits up to the end of 1889 were by Mr. Graham, 1890-1893 by Mr. Graham and Miss Walker, and all by Miss Walker afterwards, I split up the group F (1887-1896) for the fainter stars into F, G, and H, that is, before 1890, and after 1893, so that the observations from 1887 to 1890 go to the new group F, G includes those from 1890 to 1893, and H those after, we get the revised results as in Table III. and, similarly, for the brighter stars in Table IV.—these are few in number. A to E remain as in Tables I. and II.

TABLE III.

Mean Residuals for the Fainter Stars.

	Revised F.	G.	H.
Group	1351-1543	1544-1762	1763-2024
Period	1887.1-1890.0	1890.0-1893	1893-7
Mag. 9.5	-49 ₁₆	-70 ₂₇	+119 ₆
9.4	-51 ₁₇	+20 ₁	+57 ₃
9.3	-63 ₁₉	-58 ₁₃	+25 ₂
9.2	-54 ₁₄	-21 ₉	+110 ₂
Wtd. Mean	-54 ₆₆	-56 ₆₀	+88 ₁₃
In Arc	-1''.62	-1''.68	+2''.64

TABLE IV.
Bright Stars.

9.1	- 33 ₁₃	- 12 ₃	- 10 ₁
9.0	- 88 ₄	- 15 ₂	+ 70 ₁
> 8.9	- 14 ₅	+ 12 ₄	+ 30 ₁
Wtd. Mean	- 38 ₂₂	+ 11 ₄	+ 30 ₃
In Arc	- 1".14	+ 0".03	+ 0".90

One might have expected that the elimination of the influence of Miss Walker's observations in the revised group F and of the inclusion of her observations in group G would have largely increased the mean value for F and decreased that for G; as an explanation of the relatively small change it should be repeated that this paper deals only with *single* observations in R.A., and that Miss Walker was mainly engaged upon the re-observation of the single observations by Mr. Graham, so that probably very few stars in the G group in Tables III. and IV. were stars with single observations by Miss Walker.

This is as far as the single observations will permit the discussion to go; the whole material contained in the Catalogue must now be utilised; the analysis into separate years and magnitudes is being proceeded with at the Observatory by means of a card system.

1912 December 10.

Observations of the Magnitude of Nova Geminorum No. 2, made at the Royal Observatory, Edinburgh. By H. Jameson, B.Sc.

(Communicated by the Astronomer Royal for Scotland.)

The following observations of the magnitude of Nova Geminorum No. 2 were made with a 2-inch monocular, except that of March 22, made with 2-inch binoculars, and that of April 27, made with the 2-inch finder of a larger telescope.

The comparison stars used, and their number and magnitude in the Harvard Revised Photometry and the Potsdam Durchmusterung, are given in the following table. The stars *m* and *n* are not found in H.R.P., and their B.D. magnitudes are reduced to the Harvard scale by means of Table C, page xix of T. W. Backhouse's *Catalogue of 9842 Stars*.