striking is the apparent diminution in the intensity of daylight up to within a few minutes of the total phase, and how suddenly the first ray of the reappearing Sun illumines the sky and blots out the stars. Computation shows that Venus was very favourably situated for observation during the eclipse of -430, and it may well be doubted whether any other star or planet could have been visible, even if the phase were annular. It is also to be considered that the ratio of the illuminations of the sky in the two cases is less than that of the uncovered Sun. Altogether, we may make an ample allowance for exaggeration and misapprehension without overstepping the bounds of reasonable probability.

Note on Professor Newcomb's Paper on "Comparison of the Ancient Eclipses of the Sun with Modern Elements of the Moon's Motion." By J. K. Fotheringham, M.A.

(*Communicated by Professor H. H. Turner, D.Sc., F.R.S.*)

[This note was written before the paragraph was added to Professor Newcomb's paper: "It may also be remarked that an increase of 1″ in the secular acceleration of the mean longitude . . . . is difficult to admit."]

Of the eclipses discussed in Professor Newcomb's paper, two only, those of -1062 and -128, are definitely described as total, within a closely defined locality. It has therefore occurred to me to seek values which will satisfy these two eclipses. I have to thank Professor Turner for kind assistance in the following discussion.

Professor Newcomb's equations for these eclipses are

$$-1062 \qquad -16\Delta\lambda + 15\Delta\Omega - 0\Delta L' + 516 = 0.$$

$$-128 \qquad -21\Delta\lambda - 15\Delta\Omega + 34\Delta L' + 018 = 0$$

These give practically

$$\Delta(\lambda - \Omega) = \frac{516}{16} = 32.$$

$$\Delta(L' - \Omega) = \frac{21 \times 32 - 18}{34} = \frac{654}{34} = 19.$$

But this ignores the fact that these quantities increase as t^2. If we adopt their values for the second eclipse as standard (roughly 2000 years ago), the first eclipse (which was 3000 years ago) must have factor $\frac{9}{4}$ introduced into the variable terms. The equations then become

$$\Delta(\lambda - \Omega) = 32 \times \frac{4}{9} = \frac{128}{9} = 14.$$

$$\Delta(L' - \Omega) = \frac{21 \times 14 - 18}{34} = \frac{276}{34} = 8.$$

These are to be multiplied by the appropriate values of t^2, referred to -128 as standard. Professor Newcomb's equations may then be written with these values:—

Date.	Factor for t^2.		Δ	Radius of Shadow.	
−1062	2·2 ×	$-16\,\Delta(\lambda-\Omega) - 0\,\Delta(L'-\Omega)$	+516 = + 13	+ 94	Total.
− 762	1·7 ×	$-3\,\Delta(\lambda-\Omega) - 12\,\Delta(L'-\Omega)$	+684 = +450	+151	Partial.
− 647	1·6 ×	$-26\,\Delta(\lambda-\Omega) + 8\,\Delta(L'-\Omega)$	+567 = + 87	+178	Total.
− 430	1·4 ×	$+23\,\Delta(\lambda-\Omega) - 39\,\Delta(L'-\Omega)$	+577 = +587	− 55	Partial.
+ 197	0·7 ×	$-14\,\Delta(\lambda-\Omega) + 30\,\Delta(L'-\Omega)$	−436 = −401	− 6	Partial.
− 309	1·2 ×	$-8\,\Delta(\lambda-\Omega) + 22\,\Delta(L'-\Omega)$	−227 = −146	+145	Just total (?).
− 128	1·0 ×	$-21\,\Delta(\lambda-\Omega) + 34\,\Delta(L'-\Omega)$	+018 = − 4	+ 15	Total.

It will be observed that this supposition satisfies not only the two eclipses on which it is based, but also the eclipse of −647. Of the eclipses which it does not render total, that of −762 is recorded only on the Assyrian eponym canon which records the events of a kingdom, not of a city, and cannot, in consequence, be located with precision. The eclipses of −430 and +197 are recorded as not total; and, though I should like a larger magnitude for the eclipse of −430, I cannot call the magnitude just obtained impossible.

Professor Newcomb finds that, to satisfy Mr. Cowell's five eclipses, it is necessary to assume

$$\Delta\lambda = \Delta L' = 36', \text{ if } \Delta\Omega = 0,$$

corresponding to secular accelerations of 3″·5, which means that he divides 36′ by $(25)^2$. The same rough process gives for the values obtained in this paper

$$\Delta\lambda = \frac{32'}{(25)^2} = 3''\cdot 1, \text{ and } \Delta L' = \frac{19'}{(25)^2} = 1''\cdot 8.$$

But, introducing the time factor, we get

$$\Delta\lambda = \frac{14'}{(20)^2} = 2''\cdot 1, \text{ and } \Delta L' = \frac{8'}{(20)^2} = 1''2.$$

This seems much more reasonable than

$$\Delta\lambda = 3''\cdot 5, \text{ and } \Delta L' = 3''\cdot 5.$$

A small refinement might be introduced by substituting Mr. Cowell's centennial motion of the node for Professor Newcomb's. As Mr. Cowell's value exceeds Professor Newcomb's by 8″, it will be necessary to reduce $\Delta\lambda$ and $\Delta L'$ by $\frac{8''}{25}$ to compensate for the increase in the centennial motion of the node. This gives us for $\Delta\lambda$, $2''\cdot1 - 0''\cdot3 = 1''\cdot8$, and for $\Delta L'$, $1''\cdot2 - 0''\cdot3 = 0''\cdot9$.

Mr. Cowell, in *Monthly Notices*, lxvi. p. 532, finds from the Ptolemaic lunar eclipses a value of $2''\cdot6$ for $\Delta L'$, but finally adopts $4''\cdot1$ on the strength of the solar eclipses. It will be observed that the value just found suits the lunar eclipses very nearly as well as that adopted by Mr. Cowell.

Reducing these corrections to Mr. Cowell's notation (see *Monthly Notices*, lxvi. p. 535) we get with Professor Newcomb's values for the centennial motions $s_F - s_D = +1''\cdot2$, and $s_D = +0''\cdot9$. As Professor Newcomb's value for the centennial motion of F – D exceeds Mr. Cowell's by 8″, while his value for the centennial motion of D exceeds Mr. Cowell's by 4″, the substitution of Mr. Cowell's centennial motions for Professor Newcomb's would give

$$s_F - s_D = +1''\cdot2 - \frac{8''}{25} = +0''\cdot9, \text{ and } s_D = +0''\cdot9 - \frac{4''}{25} = +0''\cdot7.$$

The resultant corrections to Professor Newcomb's secular terms are therefore quite small. The value obtained for $s_F - s_D$ suggests that there is in existence either a very small acceleration of the Sun, or some very small, hitherto unexplained, retardation of the node; but when we allow for the possibility of errors in the centennial motions, and for the slight disturbance in the results that might be occasioned by an error in the position of perigee, it seems impossible to affirm such small corrections on the basis of so few eclipses. It would appear, therefore, that these eclipses do not by themselves prove the existence of a secular acceleration of the Sun, though they are consistent with an acceleration of about 1″ a century.

12 *Holywell, Oxford:*
1909 *March* 19.

Errata in Mr. Fotheringham's Papers.

Page 19, line 21, *for* $53^{s}\cdot50$ *read* $44^{s}\cdot63$.
Page 27, line 43, *for* 10·61 *read* 10·77.
Page 206, lines 27 to 30, the values of G should be increased by 180°, and the values of sin *g* should be positive instead of negative.

Errata in Annual Report, vol. lxix.

Note on Minor Planets, p. 293, line 15 from bottom:—*delete* "BL with 198 Ampella" *and substitute* "an image on a photograph taken by Metcalf 1908 Jan. 30 was announced as belonging to BL, but really belonged, not to this planet, but to 198 Ampella."

Also the three planets announced as discovered 1908 Jan. 24 (p. 292) were really discovered on Jan. 23.

Note on Variable Stars, p. 310:—In 3rd. paragraph, line 1, and 4th. paragraph, line 7, *for* vol. I. *read* vol. l.