FAYE'S COMET.

CAMBRIDGE. Northumberland Equatoreal. (Professor Challis.)

	Green. M.T. h m s	App. R.A. h m s	Log $\frac{p}{P}$	App. N.P.D ° ′ ″	Log $\frac{q}{P}$	No. of Comps. R.A.	N.P.D.	Star of Comp.
1850. Dec. 25	7 8 7·5	22 18 9·35	+8·475	95 23 50·8	−9·9154	1	1	(*d*)
1851. Jan. 5	6 35 25·0	22 40 52·19	8·450	94 9 1·0	9·9116	6	5	(*e*)
22	6 15 9·7	23 18 31·93	8·467	91 43 48·2	9·9027	1	1	(*f*)
	6 40 50·1	35·56	8·509	32·3	9·9018	8	8	(*g*)
24	6 50 55·0	23 12·86	8·528	91 24 11·8	9·9004	6	5	(*g′*)
27	6 58 34·6	30 13·33	8·543	90 54 50·4	9·8986	8	8	(*h*)
Feb. 6	6 51 16·1	23 54 3·45	8·552	89 10 55·3	9·8935	6	6	(*i*)
26	7 20 33·4	0 44 7·24	8·599	85 26 13·0	−9·8875	2	2	(*k*)
Mar. 4	7 35 25·0	0 59 42·09	+8·609			3		(*l*)

P = the equatoreal horizontal parallax in *arc*, *p* = correction for parallax in R.A. *in time*, *q* = correction for parallax in N.P.D. in *arc*.

Notes.

Dec. 25. Bad observation. Power 240 was tried: on all other occasions power 166 was used.

Jan. 5. Comet extremely faint: observations difficult and uncertain.

22. Comet very faint: an appearance of a nucleus at times.

24. So faint as to be barely visible.

27. Brighter than on any previous occasion, and easily observed. A slight tendency of the coma to the south-following direction.

Feb. 6. Observations excessively difficult, on account of moonlight. The comet appeared at intervals to have a sparkling nucleus.

26. Comet scarcely perceptible: too near the horizon to be observed satisfactorily.

March 4. Of the last degree of faintness on account of the zodiacal light: could scarcely be observed.

Assumed *Apparent* Places of the Stars.

	App. R.A. h m s	App. N.P.D. ° ′ ″	Star and Authority for its Place.
(*d*)	22 22 40·31	95 34 55·9	Bessel (Weisse) xxii, 478
(*e*)	22 41 16·36	94 10 29·5	— — xxii, 870
(*f*)	23 19 28·04	91 38 15·5	— — xxiii, 389
(*g*)	23 21 7·65	91 39 10·2	Lamont's Zones.
(*g′*)	23 21 7·63	91 39 10·4	— —
(*h*)	23 27 28·21	90 38 2·4	Bessel (Weisse) xxiii, 564
(*i*)	23 55 7·47	88 41 51·4	— — xxiii, 1143
(*k*)	0 43 17·05	85 10 16·2	— — 0, 751
(*l*)	0 58 58·73	84 8 4·2	— — 0, 1044

The star (*g*) was observed four times by Dr. Lamont in the Munich zones: the mean result of the four observations has been used. This star, which was not found in any other catalogue, was estimated by Dr. Lamont to be of the 7·8 magnitude, which appeared to be its magnitude when it was compared with the comet.

On the Vibration of a Free Pendulum in an Oval differing little from a Straight Line. By G. B. Airy, Esq. Astronomer Royal.

"In a paper communicated to this Society several years since, and printed in the eleventh volume of their *Memoirs*, I investigated the motion of a pendulum in the case in which it describes an oval differing little from a circle; and I showed that, if the investigation is limited to the first power of ellipticity, and if α is the mean value of the angle made by the pendulum rod with the vertical, then the proportion of the time occupied in passing from one distant apse to the next distant apse, to the mean time of a revolution, is the proportion of 1 to the square root of $4 - 3 \sin^2 \alpha$. When α is small, this proportion is nearly the same as the proportion of $\frac{1}{2}$ to $1 - \frac{3}{8} \sin^2 \alpha$; or the time of moving from one distant apse to another distant apse is equal to the time of half a revolution divided by $1 - \frac{3}{8} \sin^2 \alpha$. This shows that the major axis of the oval is not stationary, but that its line of apses progresses, and that, while the ellipticity is small, the velocity of progress of the apses is sensibly independent of the ellipticity, and may be assigned in finite terms for any value of the mean inclination of the pendulum-rod.

"This theorem, however, fails totally when the minor axis of the oval is small. It is then found that the velocity of progress of the apses is nearly proportional to the minor axis. But, although the movement of the pendulum in this case may be defined to any degree of accuracy by infinite series, it does not appear that it can be expressed in finite terms of any ordinary function of the time. This is to be expected, inasmuch as, when the problem is reduced to its utmost state of simplicity by making the minor axis = 0, the motion of the pendulum can be expressed only by series. The utmost, therefore, for which we can hope is, to determine the general form of the curve and the rate of progress of its apses, on the supposition that the minor axis is small, in series proceeding by powers of the major axis. This might be so extended as to include higher powers of the minor axis, if it were judged desirable.

"I have thought that an exhibition of the first steps of solution (carried so far as to include the principal multiplier of the first power of the minor axis) might be acceptable to this Society, not purely as a mechanical problem, but more particularly because it bears upon every astronomical or cosmical experiment in which the movement of a pendulum is concerned. The difficulty of starting a free pendulum so as to make it vibrate at first in a plane is extremely great; and every experimenter ought to be prepared to judge how much of the apparent torsion of its plane of vibration is really a progression of apses due to its oval motion."

After a careful analysis of the problem, when the pendulum describes an extremely elongated ellipse, the Astronomer Royal arrives at the following conclusion, which is the principal object of his present investigation. If the length of the pendulum be a, the semi-major axis of the ellipse described by the pendulum-bob be b, and the semi-minor axis be c, then the line of the apses of the ellipse will perform a complete revolution in the time of a complete double vibration (*i.e.* the time of describing the ellipse) multiplied by $\frac{8}{3}\frac{a^2}{bc}$.

"Thus if a pendulum, 52 feet long (which performs its double vibration in 8 seconds), vibrates in an ellipse whose major axis is 52 inches and minor axis 6 inches, the line of apses will perform a complete revolution *from this cause* in 30 hours nearly.

"If a common seconds pendulum (which performs its double vibration in 2 seconds) vibrates in an ellipse whose major axis is 4 inches and minor axis $\frac{1}{13}$ inch, the line of apses will perform a complete revolution *from this cause* in 30 hours nearly.

"The direction of rotation of the line of apses is the same as the direction of revolution in the ellipse.

"It is worthy of remark, that the expression which is thus found for the progression of the apse on the supposition that the minor axis is much smaller than the major, will, if we make in it c very nearly equal to b, correspond exactly to the formula cited in the beginning of this paper, as found by an accurate investigation when the ellipse approaches very near to a circle. It appears, therefore, very probable that, while b is moderately small, the expression for the progression of the apses is true for all values of c up to b.

"Although the principal object of this paper, as mentioned in the beginning, was to point out how far an apparent rotation of the plane of a pendulum's vibration may depend on causes which would exist if the suspension were perfect, and if the point of suspension were unmoved and the direction of gravity invariable, still it may not be uninteresting to point out how an effect, in some respects similar, may be produced by a fault in the suspension. If a pendulum be suspended by a wire passing through a hole in a solid plate of metal, the orifice of that hole may be oval. If the wire be part of a thicker rod tapering to the size of the wire, it may taper unequally on different sides. In either case, there will be two planes of vibration, at right angles to each other, in which, if the pendulum is vibrating, it will continue to vibrate, and in one of which the time of vibration is greater, and in the other less, than in any other plane; and, the amplitude of vibration being very small, the complete motion may be found by compounding the vibrations corresponding to these two planes."

After investigating the effect of these causes of error, the Astronomer Royal arrives at the following conclusion:—"It appears, therefore, that the effect of faulty suspension may be sensibly eliminated between two experiments in which the azimuths of the first vibration differ by 45°; and it may be prudent, in making any important experiment, thus to change the commencement-azimuth in successive trials."