

that the agreement in this respect is *closer* than that which subsists between the elements of the new comet and those of any other comet whose orbit has been hitherto calculated. This is all which we are warranted in affirming in the present state of the subject. The question of identity, however, can only be *established* by a rigorous computation of the disturbing forces acting upon either of the two comets during the period comprised between their respective apparitions. The following comparison of the orbits of the two bodies will serve to exhibit the extent of their resemblance. The elements of the comet of 1664 are those given by M. D'Arrest. Both comets are referred to the mean equinox of 1853.0.

Comet of 1664.		Comet (1) of 1853.	
T	1664, Dec. 4.501 M.T. Par.	1853, Feb. 24.2797 M.T. Par.	
π	$133^{\circ} 18'$	$153^{\circ} 21' 11''$	
Ω	$83^{\circ} 51'$	$69^{\circ} 49' 47''$	
i	$21^{\circ} 18'$	$20^{\circ} 19' 47''$	
Log q	0.011104	0.038920	
	Motion retrograde.	Motion retrograde.	

The comet has been rapidly receding from the earth since its first apparition in Europe. When it passed its perihelion on the 24th of February, its declination *south* was $56^{\circ} 32'$. On the 30th of March, its declination *north* was $9^{\circ} 22'$. It would, consequently, have been very favourable for observation in the southern hemisphere. In all probability it has been observed at the Cape and other places on the southern side of the equator, several weeks previous to its apparition in Europe.

Reduction of the Observations of Eclipses of Jupiter's Satellites, Occultations of Stars by the Moon, and other Astronomical Phenomena, made by the late Rev. Thomas Catton, B.D., Fellow of St. John's College, Cambridge. By G. B. Airy, Esq., Astronomer Royal.

There is a preface to this paper by Mr. Airy, from which the following particulars are extracted.

The observations embrace a period of years extending from 1791 to 1832. The expense of their reduction, and of the printing of the results, has been defrayed from the fund placed by the Lords Commissioners of her Majesty's Treasury at the disposal of the Royal Society, for the aid of scientific enterprises undertaken by private individuals.

Mr. Catton's observatory was situate on one of the towers of St. John's College, Cambridge. Its exact position with respect to the Cambridge observatory was determined geodetically, previous to the reduction of the observations, by Professor Miller and Mr. Adams.

Mr. Catton's observations in right ascension were made with a

transit instrument of 3 feet 5 inches focal length, and 1ⁱⁿ.4 aperture, executed by Sisson. The instrument was originally intended for a simple lens object-glass, but it is believed to have been fitted achromatically before Mr. Catton commenced his observations with it.

The clock had a gridiron pendulum. Its rate was found by Mr. Airy to be steady enough for the wants of extra-meridional observations.

The telescope used for observations out of the meridian appears to have been a 46-inch achromatic. It may be presumed that it had the usual aperture of $3\frac{3}{4}$ inches. An instrument (apparently a quadrant) was also occasionally used for taking altitudes or equal altitudes. It appears from the records of the observations that a divided object-glass was sometimes used for micrometric purposes.

The copy of observations furnished to the Astronomer Royal by Professor Miller consists of two parts.

The first contains meridional observations, principally with the transit instrument, together with notes on the intervals of the wires, the adjustments in collimation, level, and azimuth, &c., commencing with 1791, June 3, and ending on 1832, March 9. Sometimes (but rarely) there are nearly forty observations in one day; but there are numerous interruptions, extending to one or more months, and in one instance even to $2\frac{1}{2}$ years.

The second part contains observations of extra-meridional phenomena, eclipses of *Jupiter's* satellites, occultations of stars by the moon, solar eclipses, and transits of *Mercury*. The observations are accompanied with copious notes, which give a high opinion of Mr. Catton's care in observations. The first observation was on 1791, June 12, and the last on 1831, October 23.

It was evident that the only part of the observations which could possess any peculiar value are the extra-meridional. In the reduction, therefore, the results of which are exhibited in the above paper, the meridional observations have been considered as useful only for the determination of time.

There was exhibited at the meeting, a model of a mounting for a reflecting telescope of large dimensions, designed by the Astronomer Royal, who, at the close of the usual business of the meeting, gave an oral explanation of its construction.

It has been found to be desirable, in making observations with reflecting telescopes, that the same edge of the mirror should always be lowest. The main object of the contrivance proposed by Mr. Airy is to give an equatoreal motion to the telescope consistently with this condition.

The telescope is supposed to be 30 feet long, and to have a four-foot mirror and five-foot tube. It is intended that the mounting of the instrument shall satisfy the following conditions:—

1. The same edge of the mirror will always be lowest.

2. The motion of the telescope will be truly equatoreal.
3. The speed of the telescope for three hours on each side of the meridian will be truly equatoreal.
4. The micrometer-wire in the field of view will continue during the movement of the telescope to pass in the same direction through the same cluster of objects.

The first of these conditions is satisfied by giving the telescope a motion similar to that of an altitude and azimuth instrument. This object is accomplished by supporting the tube of the telescope by means of pivots or trunnions at its centre of gravity, on forks carried by a turn-table of a construction similar to that employed at railway stations. The turn-table is to turn with its centre bearing by a hollow cone upon a centre-pin, and with its circumference bearing upon six or nine wheels. Of these wheels, three will have their centres on firm bearings, and these will determine the position of the turn-table. All the others, as well as the centre-pin, will be carried on levers pressed upwards by springs or weights. The central pin will prevent horizontal unsteadiness.

The motion of the telescope is rendered equatoreal by bridling the elevated end of the tube to an upright pillar placed to the north of the instrument (supposing the place of observation to be in the northern hemisphere), the connexion of the tube with the pillar being such that an imaginary line joining the centre of motion in altitude and azimuth, with the point at which the bridling rod is attached to the pillar, is parallel to the axis of the earth's diurnal motion. The polar bridle is connected at the other end with an apparatus of small bars fixed to the mouth of the tube, and converging to the centre of the opening. It is adjustable in length, according to the polar distance of the object.

Placed to the east of the telescope, parallel to the imaginary polar axis above mentioned, is a real axis, which carries a quadrantal arc revolving in the plane of the equator; and also on the side of the quadrantal arc next the telescope, a graduated meridional arc, having a radial bar moveable along its face. The length of the radial bar is equal to the distance from the centre of motion of the telescope to the centre of the frame of small bars at the mouth of the tube. The radial bar is to be clamped on the meridional arc at the graduation corresponding to the polar distance of the object. The connexion between the telescope and the equatoreal quadrant revolving about the real axis is effected by means of a rod,—whose length is equal to the distance between the centre of motion of the telescope and the centre of the meridional arc,—uniting the upper end of the radial bar which moves upon the meridional arc, with the apparatus at the mouth of the tube. It is manifest from this arrangement that any increase or diminution of the equatoreal motion of the quadrant will be propagated in an equal degree to the tube of the telescope.

The speed of the telescope will, therefore, be rendered truly equatoreal by causing the quadrantal arc (the edge of which for this purpose is toothed) to be worked by a pinion placed on the

spindle of a clock-movement adjusted to sidereal time. When the telescope is in the meridian, the middle point of the quadrant is at the pinion. Hence it is evident that the range of the telescope will extend to three hours on each side of the meridian.

The fourth condition is satisfied by placing the small inclined mirror and the lateral eye-piece on a spindle passing upwards through the centre of the frame-work of small bars at the mouth of the tube, and connecting itself with the polar bridle. By this arrangement the spindle with the mirror and eye-piece are made to rotate within the tube, so that a line seen in the field of view of the telescope will always necessarily maintain the same position with respect to the meridian under view. The spindle is perforated, and when the small mirror is removed, an eye-piece for front view or a photographic plate may be inserted in the perforation.

With respect to an objection which might be urged against this contrivance, in consequence of the obstruction offered to the passage of the light by the apparatus at the mouth of the tube, Mr. Airy remarked that no serious inconvenience would arise from this cause, since the bars composing the apparatus might be constructed of such small dimensions as to occasion only a very trifling loss of light. Nor could the diffraction of light produce any sensible effect, since it is a well-established fact that the influence of this physical principle diminishes continually as the aperture of the telescope is increased.

An objection, which seems to be better founded than either of the above, was offered to this mode of mounting, on the ground that it would be impracticable with such a contrivance to make observations near the zenith. This is a difficulty which presents itself in every form of mounting combining equatoreal movement with an arrangement that keeps the same edge of the mirror downwards. When the question, however, refers, as it does in the present case, to a large reflecting telescope, which is designed mainly for the purpose of making *physical* observations of the celestial bodies, it does not appear that this circumstance is calculated materially to impair the practical utility of the instrument.

It will readily be seen from the foregoing description, that one of the leading features of the mounting proposed in the present instance, consists in the adaptation of its construction to the principles by which the engineer is guided in giving stability to his mechanical arrangements, and in properly adjusting the pressure upon their various points of support. The recent history of the Greenwich Observatory has amply demonstrated, that when instruments of large size are constructed with a due regard to the strains which their different parts have to sustain, their working becomes as practicable as that of smaller instruments, while the advantages arising from such a combination of magnitude, stability, and equable wearing, vastly outweigh those derivable from mere artistic excellence.

It may be mentioned that the model still remains for inspection at the apartments of the Society.

B 2