

XXIV. *Advertisement of the expected Return of the Comet of 1532 and 1661 in the Year 1788. By the Rev. Nevil Maskelyne, D. D. F. R. S. and Astronomer Royal.*

Read June 29, 1786.

THE comet of 1531, 1607, and 1682, having returned in the year 1759, according to Dr. HALLEY'S prediction in his *Synopsis Astronomiæ Cometicæ*, first published in the Philosophical Transactions in 1705, and re-published with his Astronomical Tables in 1749, there is no reason to doubt that all the other comets will return after their proper periods, according to the remark of the same author.

In the first edition of the *Synopsis* he supposed the comets of 1532 and 1661, from the similarity of the elements of their orbits, to be one and the same; but in the second edition he has seemed to lessen the weight of his first conjecture by not repeating it. Probably he thought it best to establish this new point in astronomy, the doctrine of the revolution of comets in elliptic orbits, as all philosophical matters in the beginning should be, on the most certain grounds; and feared that the vague observations of the comet, made by APIAN in 1532, might rather detract from, than add to, the evidence arising from more certain *data*. Astronomers, however, have generally acquiesced in his first conjecture of the comets of 1532 and 1661 being one and the same, and to expect its return to its perihelium accordingly in 1789.

The

The interval between the passages of the comet by the perihelium in 1532 and 1661 is 128 years, 89 days, 1 hour, 29 minutes (32 of the years being bissextile), which added to the time of the perihelium in 1661, together with 11 days to reduce it from the Julian to the Gregorian stile, which we now use, brings out the expected time of the next perihelium to be April 27th, 1 h. 10' in the year 1789.

The periodic times of the comet, which appeared in 1531, 1607, and 1682, having been of 76 and 75 years alternately, Dr. HALLEY supposed, that the subsequent period would be of 76 years, and that it would return in the year 1758; but, upon considering its near approach to Jupiter, in its descent towards the sun in the summer of 1681, he found, that the action of Jupiter upon the comet was, for several months together, equal to one-fiftieth part of the sun upon it, tending to increase the inclination of the orbit to the plane of the ecliptic, and lengthen the periodic time. Accordingly, the inclination of the orbit was found by the observations made in the following year 1682 to be 22' greater than in the year 1607. The effect of the augmentation of the periodic time could not be seen till the next return, which he supposed would be protracted by Jupiter's action to the latter end of the year 1758, or the beginning of 1759. M. CLAIRAUT, previous to its return, took the pains to calculate the actions both of Jupiter and Saturn on it during the whole periods from 1607 to 1682, and from 1682 to 1759, and thence predicted its return to its perihelium by the middle of April; it came about the middle of March, only a month sooner, which was a sufficient approximation to the truth in so delicate a matter, and did honour to this great mathematician, and his laborious calculations.

The comet in question is also, from the position of its orbit, liable to be much disturbed both by Jupiter and Saturn, particularly in its ascent from the sun after passing its perihelium, if they should happen to be near it, when it approaches to or crosses their orbits; because it is very near the plane of them at that time. When it passed the orbit of Jupiter in the beginning of February 1682, O. S. it was  $50^{\circ}$  *in consequentia* of that planet; and when it passed the orbit of Saturn in the beginning of October 1663, it was  $17^{\circ}$  *in consequentia* of it. Hence its motion would be accelerated while it was approaching towards the orbit of either planet by its separate action, and retarded when it had passed its orbit; but, as it would be subjected to the effect of retardation through a greater part of its orbit than to that of acceleration, the former would exceed the latter, and consequently the periodic time would be shortened; but probably not much, on account of the considerable distance of the comet from the planets when it passed by them; and therefore we may still expect it to return to its perihelium in the beginning of the year 1789, or the latter end of the year 1788, and certainly some time before the 27th of April 1789. But of this we shall be better informed after the end of this year, from the answers to the prize question proposed by the Royal Academy of Sciences at Paris, to compute the disturbances of the comet of 1532 and 1661, and thence to predict its return\*.

\* Since this was written, I received the unwelcome news, in a letter from M. MECHAIN, of the Royal Academy of Sciences at Paris, that the Academy has not received satisfactory answers concerning the disturbances of the comet between 1532 and 1661, and 1661 and the approaching return, and that the prize is referred to be adjudged of at Easter 1788, and that it will be 6000 livres. N. M.

If it should come to its perihelium on the 1st of January 1789, it might probably be visible, with a good achromatic telescope, in its descent to the sun, the middle of September 1788, and sooner or later, according as its perihelium should be sooner or later. It will approach us from the southern parts of its orbit, and therefore will first appear with considerable south latitude and south declination; so that persons residing nearer the equator than we do, or in south latitude, will have an opportunity of discovering it before us. It is to be wished that it may be first seen by some astronomer in such a situation, and furnished with proper instruments for settling its place in the heavens, the earliest good observations being most valuable for determining its elliptic orbit, and proving its identity with the comets of 1532 and 1661. The Cape of Good Hope would be an excellent situation for this purpose.

In order to assist astronomers in looking out for this comet, I have here given its heliocentric and geocentric longitudes and latitudes and correspondent distances from the sun and earth, on supposition that it shall come to its perihelium on January 1, 1789. But if that should happen sooner or later, the heliocentric longitudes and latitudes and distances from the sun will stand good if applied to days as much earlier or later, as the time of the perihelium may happen sooner or later; and the geocentric longitudes and latitudes and distances from the earth must be re-computed accordingly. The calculations are made for a parabolic orbit from the elements determined by Dr. HALLEY from HEVELIUS's observations in 1661, only allowing for the precession of the equinoxes. The elements made use of were as follows:

Time of perihelium January 1, 1789, at noon.

Perihelium distance 0,44851.

K k k 2

Place

Place of ascending node  $2^{\circ} 24' 18''$ .

Inclination of orbit to the ecliptic  $32^{\circ} 36'$ .

Perihelium forwarder in orbit than the ascending node  $33^{\circ} 28'$ .

Its motion is direct.

Computed places of the comet, on supposition that it shall return to its perihelium January 1, 1789, at noon.

Times.	Dist. from $\odot$ .	Dist. from the earth.	Heliocentric longitude.	Heliocentric latitude.	Geocentric longitude.	Geocentric latitude.	Product of distances from $\odot$ and earth.
1788			S. D. M.	D. M.	S. D. M.	D. M.	
Apr. 23, 7	4, 0	4,52	11 3 52	30 56 S	11 16 30	27 58	18,07
June 4, 1	3, 5	3,54	11 7 6	31 25	11 26 31	31 4	12,38
July 14, 5	3,	2,57	11 11 16	31 55	0 3 21	38 11	7,70
Aug. 2, 46	2,75	2,15	11 13 47	32 10	0 4 8	42 59	5,90
— 20, 43	2, 5	1,79	11 16 39	32 22	0 2 0	48 16	4,48
Sept. 7, 3	2,25	1,51	11 20 9	32 32	11 25 0	53 28	3,39
— 24, 0	2,	1,29	11 24 16	32 36	11 13 12	56 45	2,58
Oct. 10, 26	1,75	1,13	11 29 24	32 30	10 28 22	56 36	1,75
— 26, 64	1,50	1,01	0 5 51	32 4	10 15 50	52 6	1,51
Nov. 9, 34	1,25	0,88	0 14 19	31 0	10 8 30	46 47	1,10
— 23, 39	1, 0	0,76	0 26 4	28 32	10 4 10	39 0	0,76
Dec. 7, 21	0,75	0,62	1 13 58	22 29	9 29 18	27 45	0,46
— 23, 32	0,50	0,50	2 20 58	2 8	9 14 31	2 7 S	0,25
— 24, 35	0,49	0,51	2 24 18	0 0	9 12 50	0 0	0,25
1789							
Jan. 1, 0	0,45	0,59	3 23 25	17 17 N	9 2 50	13 8 N	0,26

The last observation made by HEVELIUS on the comet in 1661 was when its distance from the earth was 0,986, and from the sun 1,37, with what he calls a very long and good telescope; at which time it appeared faint and small with it, though

though still sufficiently visible. Let us suppose this to have been a telescope of 9-feet focal length, with an aperture of 1,65 inch; then, because the diameter of the aperture of a telescope sufficient to render the comet equally visible should be as the product of its distances from the sun and earth, and the product of the numbers above-mentioned 0,986 and 1,37 is 1,35, we shall have the following analogy to find the aperture of a refracting telescope sufficient to shew the comet as it appeared to HEVELIUS. As 1,35 : 1,65 inch :: 9 : 11 inches, so is the product of distances from the sun and earth to the diameter of the aperture required in inches.

