On the Limits of Error in the Elements of the Orbit of α Centauri, and on the Orbits of p Eridani and 61 Cygni. By Capt. W. S. Jacob, Astronomer at Madras. Communicated by Professor Piazzi Smyth.

The substance of these communications was received by Professor Smyth from Captain Jacob, in a series of private letters; and he has thought them of sufficient importance to induce him to collect together the results of the observations and deductions, and to present them to the Society.

α Centauri.

From observations, necessarily rough, made at Madras, Captain Jacob finds for *α Centauri*, for the epoch 1849·63, the distance of the components 36″·23, and the angle of position 244°·5, which renders probable a later perihelion passage, a less excentricity, and a less inclination, than had been previously assigned by him.

On examining all the observations of *α Centauri*, available for the purpose between the years 1825 and 1849, the conclusion seems to be, that the annual motion in area is about two square seconds; but, on carrying this back to 1750, it cannot be accommodated to any ellipse whatever, so as to give a distance not exceeding 25″, and a position in the south preceding quadrant, unless a revolution be supposed to intervene.

The period is, therefore, limited to between 75 and 80 years, two revolutions in the interval being inadmissible; and the area of the apparent ellipse is thus limited to 150″ or 160″. This being assumed, it is found that the greatest possible value of the minimum distance is about 2″·5, and the latest possible time of nearest approach is 1854.

With regard to mass, the least possible value of the true semi-major axis is about 11″·5, which corresponds to a mass of about 0·325; the excentricity being, however, indeterminate, the inclination and major axis may be very great. On the whole, the mass cannot differ very widely from that of the sun.

Captain Jacob has been enabled to arrive at some conclusion with regard to the quantity of light emitted by *α Centauri*, from photometrical considerations by means of experiments on the distances at which the flashes from a heliotrope were visible with different apertures, made during his employment on the Trigonometrical Survey.

He found, after several years' observations, that for apertures of 0·5, 1, 2, 4, and 8 inches. the limits of distance ultimately resulted 15, 23, 33, 45, and 60 miles respectively.

This gives a rate of absorption which agrees pretty well with Professor Forbes' results given in the *Phil. Trans. for* 1842, vol. ii.

Applying these results to the intensity of solar light, the diameter of the object that shall be about as bright as *Venus*, is 0·0205 inch per mile, or subtends an arc of 0″·0668. Making also due allowance for the circumstance that the object viewed was the reflexion of the sun from a metallic surface after passing twice through glass,

and assuming that the mean altitude of the sun for the times of observation may be taken to be about 23°, the portion of the zenith seen equal in brightness to *Venus* is 0·035.

Assuming also that the brightness of *Venus* is four times as great as that of *Sirius*, and that of *Sirius* four times as great as that of *α Centauri*, the brightness of *α Centauri* will be equivalent to a circular area of the sun's disk, whose diameter subtends an angle of 0″·009, or the sun must be removed to 213333 times its present distance to have a brightness equal to that of *α Centauri*. Its parallax must, therefore, be 0″·97.

Captain Jacob earnestly recommends astronomers who have *α Centauri* above their horizon to lose no time in commencing observations upon it.

Orbit of p Eridani

This star is one of the quick-moving double stars, but the data are rather anomalous. All the observations found by Capt. Jacob are,—

Dunlop	1825·96	Position 16° 54′	Dist. 2″·5
Herschel	1835·0	— 122 18	— 3·65
Jacob	1845·88	— 186 0	— 4·16
—	1846·83	— 277 0	— 4·32
—	1849·82	— 270 0	

Herschel's position should probably be 302° 18′, and the first of Jacob's observations should, doubtless, have 90° added.

Captain Jacob computes an orbit from the above observations, of which the elements are,—

a = 5″·37
e = 0·454
π = 1° 30′
Ω = 295 27
γ = 57 24
P = 123 yrs.
τ = 1827·08

but finding that these elements would give the distances of the stars for Dunlop's epoch only 1″·56 instead of 2″·50, an error quite inadmissible, as the stars would then not have been separable by the telescope used, he assumes an error in Dunlop's position, and presumes that this should be 163° 6′ or 343° 6′.

On this supposition, the following elements of the orbit result:—

a = 4″·25
e = 0·323
π = 36° 30′
Ω = 290 40
γ = 46 36
P = 107 yrs.
τ = 1819·83

61 *Cygni.*

Captain Jacob supposes that this star will arrive at a minimum distance of 17″ or 17″·5 within the next 30 years; that the period is about 660 years; and that $a = 21''$ or $22''$, and $e =$ about 0·25; the mass being not much inferior to that of the sun.

Proper Motion of B.A.C. 535. By Mr. Johnson.

In comparing the results of the Oxford Observations with those of other catalogues, the true proper motion of this star has been detected :—

Right Ascension.

B. A. C. 535 = B. F. 203 = P. I, 159 = Groombridge 376 = Taylor 571 = Greenwich 12-Year, 150.

Piazzi	1800	R.A. =	1 h 33 m 26·20 s	Prec. = +4·104
Groombridge	1810		34 8·02	4·114
Taylor	1835		35 54·22	4·138
Greenwich	1845		36 36·12	4·147
Oxford	1845	=	1 36 36·05	4·147
—	1850		.....	+4·152

The above reduced to 1850 by the Prec. due to the middle period, become

Piazzi	1850	R.A. =	1 h 36 m 52·60 s
Groombridge	—		53·34
Taylor	—		56·40
Greenwich	—		56·87
Oxford	—	=	1 36 56·80

The mean epoch of the observations on which the Greenwich R.A. depends is 1843. The Oxford epoch is 1844. These R.A. compared with Piazzi's give an Annual Proper Motion = +0ˢ·0974.

Applying the correction + 0ˢ·0974 (1850 − t), t being the epoch of the respective catalogues, we have

Piazzi	1850	R.A. =	1 h 36 m 57·47 s
Groombridge	—		57·24
Taylor	—		57·86
Greenwich	—		57·55
Oxford	—	=	1 36 57·38

The mean of the above is $1^h\ 36^m\ 57^s{\cdot}50$. The R.A. of B.A.C. is $1^h\ 36^m\ 52^s\ 95$.

Mr. Baily supposed that there was a mistake of one year's precession in Mr. Taylor's R.A. He was led to this supposition, apparently, by a mistake in the Madras catalogue, where the proper motion in R.A. is given = 0ˢ·009, instead of 0ˢ·09.