The orbit of Bu G.C. 2159, β 744, by *W. H. van den Bos.*

$4^h\ 17^m\ 22^s \quad -25°58'$ (1900) $\qquad$ 6·6 — 6·7 *F*o

The duplicity of this star was discovered by BURNHAM with his 6-inch refractor. It had been listed as *h* 3644, a wide triple, by JOHN HERSCHEL at the Cape. Measures of the Herschel companions are:

AB, C 5·9 — 11·7

1835·9	*h*	18 refl.	1*n*	20°	± 25″	± 14ᵐ0
1891·79	β	36	2	6·8	35·42	11·7
1898·93	Boothroyd	24	1	7·2	35·80	11·0
1926·95	van den Bos	26½	3	4·58	37·07	12·0

AB, D 5·9 — 8·3

1835·9	*h*	18 refl.	1*n*	37°5	40″ ±
1891·78	β	36	3	40·4	44·63
1898·93	Boothroyd	24	1	40·8	44·88
1926·95	van den Bos	26½	3	40·77	44·53

Centennial pression + 0°58.

Assuming *C* to be fixed in space, the measures of BURNHAM and VAN DEN BOS give a proper motion of 0″.065 in 143°, in good agreement with the value 0″.063 in 157° derived by NYRÉN from meridian observations. The star *D* belongs to the system; there may be some direct motion.

A preliminary orbit for the close pair has been published by DAWSON (*A. J.* 795), based on the measures 1891—1921, the observed arc being about 100°. The motion is so rapid, that the observed arc has been more than doubled, and is now about 220°; and as the measures cover both ends of the apparent ellipse, the present orbit should be a fair approximation.

The position angles were plotted against the time and for every four years 1891—1927 normal values were read from the interpolation curve. The mean distance in every sector was taken as $f.\ \Delta\theta^{-\frac{1}{2}}$, where the factor f is immaterial but was taken = 2 in this case. This value represents the observed distances closely. The circular sectors found in this way were drawn on a second diagram on transparent coordinate-paper, and a free-hand curve, as nearly as possible an ellipse and giving sectors of equal area, was drawn by means of them. By folding the paper so as to obtain the best symmetry, the direction of the minor axis was found. The major axis could not be found in this way, as the observed arc lies almost wholly on one side of it; by shifting the centre along the minor axis, keeping the major axis perpendicular, the best position was easily found, as the observed arc extends a short distance beyond both extremities of the major axis.

The coordinates x_0, y_0 ($x = \rho \cos\theta,\ y = \rho \sin\theta$) of the centre, x_1, y_1 of the extremity of the major and $x_2\, y_2$, of the minor axis, as well as the semi-axes a and b were read from the coordinate-paper, checking by:

$$(x_1 - x_0)^2 + (y_1 - y_0)^2 = a^2$$
$$(x_2 - x_0)^2 + (y_2 - y_0)^2 = b^2.$$

No further constructions are required and the apparent orbit has not been drawn, but the eccentricity e and the INNES-elements A, B, F, G computed from the simple formulas:

$$\tan\psi = \frac{y_1 - y_0}{x_1 - x_0}$$

$$m' = \frac{y_0}{x_0}$$

$$\alpha = b^2 \cos^2\psi + a^2 \sin^2\psi$$
$$\beta = -\cos\psi \sin\psi\ (a^2 - b^2)$$
$$\gamma = b^2 \sin^2\psi + a^2 \cos^2\psi$$
$$e = a^{-2} b^{-2} (\alpha x_0^2 + 2\beta x_0 y_0 + \gamma y_0^2)$$
$$m = -\frac{\alpha + m'\beta}{\beta + m'\gamma}$$
$$A = -\frac{x^{\circ}}{e}$$
$$B = -\frac{y^{\circ}}{e}$$
$$F = \pm\ a b\ (\alpha + 2m\beta + m^2\gamma)^{-\frac{1}{2}} (1 - e^2)^{-\frac{1}{2}}$$
$$G = m F$$

From A, B, F, G we compute a, i, ω, ☊ and change the normal angles to mean anomalies, which, plotted against the time, give the remaining elements P and T. Final corrections to a and ☊ may be made from the residuals in distance and angle; in the present case there was no reason for this.

The resulting elements are:

P	64·86 years	A	−″·274	a	″·521
n	5°555	B	+″·413	i	± 32°9
T	1924·80	F	−″·416	ω	329°0
e	0·565	G	−″·193	☊	151°1

Dynamical parallax $\sqrt[3]{\tfrac{1}{2}}\ a\ P^{-\frac{2}{3}} =$ ″·026

The following list gives the same data as in the case of β Tuc, but the angles are for 1900.