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TWO ORBITS FOR THE VISUAL BINARY STAR ADS 3395

Raymond H. Wilson

Armagh Observatory, Armagh BT61 9DG, Northern Ireland

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SUMMARY

Two possible short-period orbits of high inclination, the first highly eccentric and the second circular, are shown here for the first time to represent all observations of the visual binary star ADS 3395 almost equally well. However, the relative radial velocity ephemeris shows that, at the next occultation due to closeness in 1978, Orbit I predicts 53 km s^{-1} while Orbit II predicts zero, so the orbital ambiguity could be resolved by spectroscopic observations at that time.

This star, first seen double by Aitken with the 36-in. refractor in 1911, was observed exclusively by him until 1935 on 12 nights. Although the measured decrease in position angle was only about 30° with separations less than 0″·18, a definite occultation during 1930–34 left no doubt as to its rapid orbital motion. Aitken's final note about this star (1937) reads: '. . . quadrant always indeterminate, and period probably less than 20 years '.

Measures since 1935 show the same range as found by Aitken, but, considering the additional occultation during 1951–55 observed by Van Biesbroeck with the 82-in. reflector, a period greater than 20 yr is indicated. So far as I know, no orbit has been calculated before now.

Orbit I, having a period 23·5 yr, was calculated on the hypothesis that there was a rapid double reversal of quadrant during occultations, and therefore high eccentricity $e = 0{\cdot}90$. All measures of angle were placed in the discovery quadrant (the first). Elements were first estimated and roughly checked using the tables of Ekenberg (1945), as explained by the present writer (1950) for the case of ADS 11468.

Orbit II, having exactly double the period and only single reversal at occultations with a low eccentricity, was obtained by the same method. The data do not justify any distinction from an exact circle in this case, nor any angle between the nodal line and the apparent major axis in either orbit. The Thiele–Innes Elements in Table II were calculated from the Campbell Elements.

The visual measures and residuals listed in Table I indicate no basis of preference for either orbit, but spectroscopic observation of relative radial velocities dz/dt at the next occultation as shown in Table III could provide such a decision. However, the predicted date 1978·8 is uncertain by several months, and the maximum velocity, 53 km s^{-1} at periastron, is predicted to decrease to below 20 km s^{-1} within four months on either side of periastron, so these potentially valuable spectroscopic observations should begin soon. The similar case for β 1163 has been discussed by van den Bos (1962).

Table I

ADS 3395 = *A* 2424

Measures and residuals

Date 1900+	PA (°)	Sep. (″)	*n*	Aper. (in.)	Observer	Orbit I PA (O–C) (°)	Orbit I Sep. (″)	Orbit II PA (O–C) (°)	Orbit II Sep (″)
12·48	49·5	0·17	3	36	Aitken	+0·8	+0·02	+1·0	+0·03
20·61	211·6	0·16	4	36	Aitken	−9·6*	0	−9·9*	0
30·48	Too close		2	36	Aitken		(0·04c)		(0·02c)
34·48	Too close		2	36	Aitken		(0·10c)		(0·10c)
34·85	37·8	0·12	1	36	Aitken	−14·0	0	−14·0*	+0·01
35·79	72	0·14	3	24	Voûte	+21·6	+0·01	+21·9*	+0·02
35·94	55	0·16	2	26	Van den Bos	+4·8	+0·02	+5·2*	+0·03
37·03	48·5	0·14	2	26	Van den Bos	−0·3	−0·01	+0·1*	0
38·23	57·0	0·15	8	24	Voûte	+9·5	0	+9·9*	−0·01
43·83	36·1	0·13	1	82	Van Biesbroeck	−6·3	−0·03	−6·5*	−0·04
45·98	41·5	0·18	2	82	Van Biesbroeck	+1·2	+0·03	+0·8*	+0·03
48·73	35·6	0·12	3	82	Van Biesbroeck	−1·3	−0·01	−1·4*	0
51·41	Round	(<0·1)	2	82	Van Biesbroeck		(0·09c)		(0·06c)
53·02	Round	(<0·1)	2	82	Van Biesbroeck		(0·05c)		(0·03c)
53·77	(36·9)	(0·129)	1	36	Muller	(359·6c)	(0·02c)	(164·5c)	(0·02c)
55·77	Round	(<0·1)	1	82	Van Biesbroeck		(0·05c)		(0·04c)
60·67	221·0	0·15	4	36	Worley	−8·9*	+0·01	−8·5*	+0·02
62·79	48·5	0·12	4	36	Van den Bos	+1·0	−0·03	+1·4	−0·03
63·44	45·0	0·13	4	26	Worley	−1·8	−0·03	−1·6	−0·03
70·73	45·1	0·13	3	26	Worley	+5·1	−0·02	+4·7	−0·02

* Quadrant reversed.

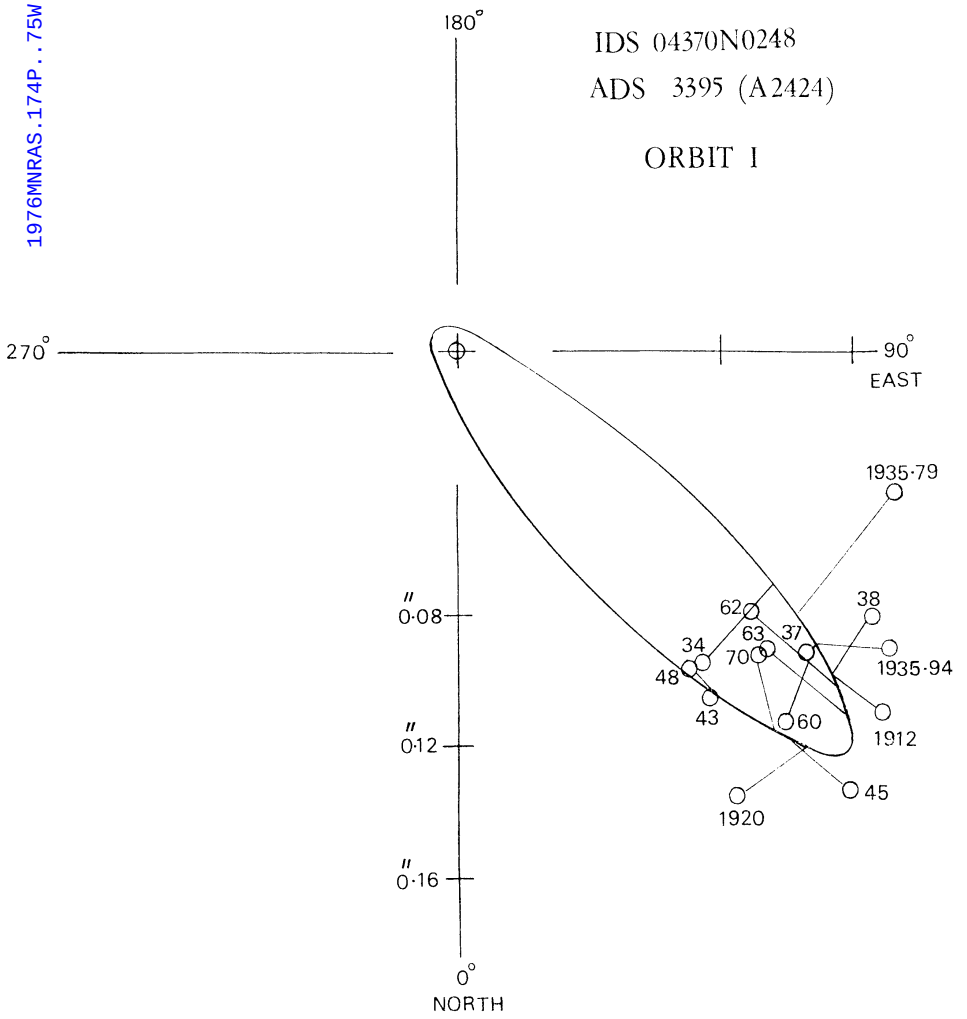

FIG. 1. *Orbit I and corresponding measures.*

TABLE II

IDS 04370N0248 = *ADS* 3395 (*A* 2424) *Magn.* 8·6–8·6 *Spectr. A*

Elements (Centennial precession 0°·5 neglected)

	Orbit I	Orbit II
P	24·5 yr	49·0 yr
n	14°·69	7°·347
T	1978·75	1942·00
e	0·90	0
a	0″·0875	0″·1750
i	120°	96°
Ω	44	44
ω	180	180
A	−0″·0629	−0″·1259
B	−0″·0608	−0″·1216
F	−0″·0304	−0″·0127
G	+0″·0315	+0″·0132
C	0	0
H	∓0″·0758	∓0″·1740
pL	0	0
pN	∓5·275	∓6·056
p (Dyn. Parallax)	0″·0073	0″·0090
M_A+M_B	3·42 ⊙	3·08 ⊙
L_A+L_B	15·36 ⊙	10·32 ⊙

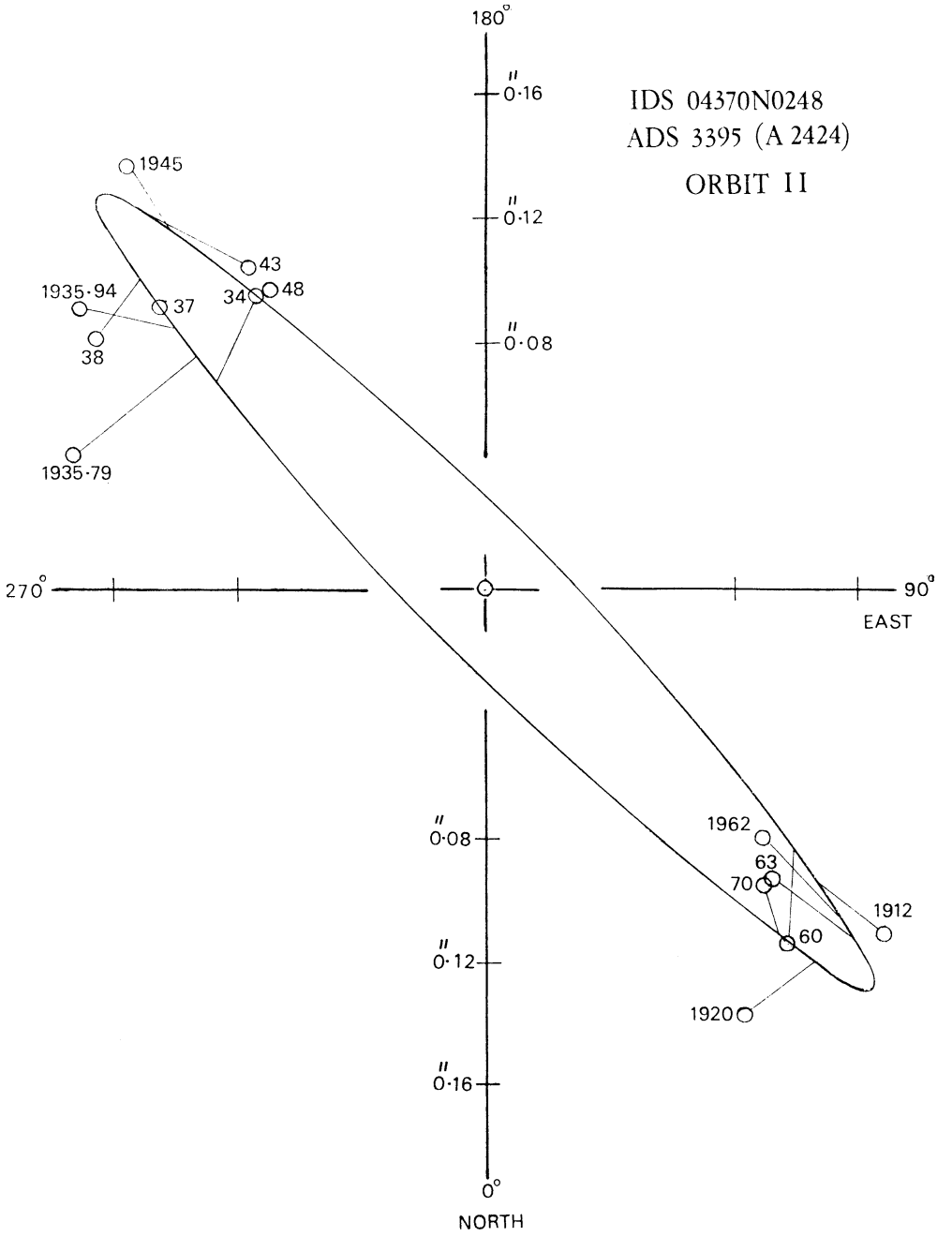

FIG. 2. *Orbit II and corresponding measures.*

TABLE III

IDS 04370N0248 = *ADS* 3395 (*A* 2424)

Ephemeris

	Orbit I			Orbit II		
t	PA (°)	Sep. (″)	*dz*/*dt* (km s^{-1})	PA (°)	Sep. (″)	*dz*(*dt* (km s^{-1})
1974·7	34·5	0·11	2	33·7	0·09	6
78·8	224·0	0·01	53	313·9	0·02	0
82·8	53·6	0·11	2	234·2	0·09	6
84·9	50·2	0·14	2	230·0	0·12	8
86·9	47·9	0·15	3	227·5	0·15	10
1991·0	44·1	0·17	3	224·0	0·18	12

The dynamical parallax was derived by the formulas of Baize & Romani (1946) as amended by W. D. Heintz (1971).

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