UDC 524.382:520.872 *Astrofiz. Issled. (Izv. SAO)*, 1993, **35**, 5-8

INTERFEROMETRIC ORBITS OF FOUR BINARY STARS

I.I. BALEGA, YU.YU. BALEGA
Special Astrophysical Observatory of the Russian AS,
Nizhnij Arkhyz 357147, Russia

J.J. MCMANUS
Florida Institute of Technology, 150 West University Blvd
Melbourne, FLA 32901, USA

Received August 10, 1992

ABSTRACT. *Orbital elements of four binary stars have been derived from recent speckle interferometric observations obtained mainly at the KPNO 4 m and the SAO 6 m telescopes. These new orbits are given together with a brief discussion of the results.*

Key Words: Interferometric binaries - orbits

This is the second paper including interferometric orbits of short period binaries computed on the basis of recent speckle measurements. The Second Catalogue of Interferometric Measurements of Binary Stars (McAlister and Hartkopf, 1988), based mainly on the data from the Mayall 4 m telescope at Kitt Peak, together with the new observations at the 6 m telescope in Zelenchuk were used. As mentioned earlier (Balega and Balega, 1988), the computation of binary orbits on the basis of exclusive interferometric measurements is of special interest. This method of orbit calculation produces the most accurate results due to the higher angular resolution and the high precision of speckle data from large telescopes.

The orbital elements for four binaries were computed using the differential cor-

rection of preliminary orbits found by the classical Thile-Innes-van den Boss method. The orbits of HR 6469 and HD 184467 were derived for the first time. Both of these systems are spectroscopic binaries. Another two orbits, for the binaries Fin 331 and Bu 612 are revised versions of already published visual orbits, and are significantly improved on the basis of interferometric data. The same weights were given to all the measures used for computations. The elements of these orbits are given in Table 1 which includes also the names of the stars and their coordinates for the epoch 2000, and mean-squared residuals of angles and distances. A brief discussion is given in the following notes.

Table 1.

Catalogue Name Coord. 2000	T 1980.+	P years	e	a ″	i deg.	Ω deg.	ω deg.	σ_θ (deg.) σ_ρ (″)
ADS 4890 Fin 331 06171N0957	4.213 ±0.035	9.20 ±0.05	0.239 ±0.008	0.090 ±0.001	59.1 ±0.9	123.6 ±1.0	125.3 ±1.6	1.9 0.003
ADS 8987 Bu 612 13396N1045	18.30 ±2.78	23.72 ±1.39	0.500 ±0.033	0.207 ±0.006	47 ±1	32 ±5	7 ±11	1.2 0.005
HR 6469 McA 47 17217N3958	0.835 ±0.031	5.504 ±0.023	0.679 ±0.011	0.074 ±0.002	53.7 ±1.8	141.7 ±2.0	221.1 ±3.1	1.2 0.003
+58°1929 McA 56 19311N5835	1.205 ±0.033	1.36 ±0.003	0.40 ±0.02	0.084 ±0.002	148 ±6	61 ±15	172 ±21	1.3 0.004

Fin 331 Aa is a fast binary with an early A type companion. It is a member of the 75 Ori system which includes at least five stars. It is very likely that the B companion at the distance 62″, as well as a remote pair CD at 120″ separation from Aa, are optical. W.S. Finsen and G.A. Starikova published a few orbits for Fin 331 Aa based on micrometric observations of the binary system. Later, it turned out that all of them were inexact, including the last one published by Finsen (1978). The main difficulty for determining the ellipse of relative motion was connected with the small angular separation between the components. Only a small fraction of the orbit lies beyond a 0.1″ radius. We decided to find new orbital elements using only speckle interferometric data. Twenty-five speckle measurements of Fin 331 Aa published before 1988 (McAlister and Hartkopf, 1988) cover more than one cycle of visual motion. For the A2V type binary with $\Delta m=0$ from Baize-Romani empirical mass-luminosity relation we find the dynamic parallax of the system $\pi_d=0.012$" and the masses $\mu_A=\mu_a=2.48$.

Bu 612 was discovered by Burnham in 1878. Burnham also mentioned later the existence of an 11.5 magnitude star at 130″ from the AB pair. The 22 year period binary has speckle measurements starting from 1976. The second grade orbit of Danjon (Worley and Heintz, 1983) published in 1956 describes the relative motion of the pair in satisfactory agreement with the latest interferometric data. The orbit requires a small correction since recent residuals in angle are all negative. With 43 speckle measurements the pair can now be defined as having a first grade orbit. Due to a small magnitude difference and moderate angular separation it can be very useful for calibration of interferometric observations with various interferometric instruments.

Bu 612 has had a wide range of spectral classifications. To give a more precise definition of the system we used a high resolution photographic spectrum (dispersion 9 A/mm) obtained in February 1991 with the Main Stellar Spectrograph of the 6 m telescope. Visual classification of the spectrum using H and K lines of CaII and FeII doublet λλ 4172, 4179 gives the spectral class FOIV. The evident blue asymmetry of absorption lines in the spectrum indicates the presence of a companion.

HR 6469 is a composite spectrum triple system consisting of an eclipsing 2.23 day pair with a main star of spectral type F2V and chromospherically active G5 subgiant (Strassmeier and Fekel, 1990). Nine years of speckle observations of the wide components produced 22 measurements from which only 2 were made at the 6 m telescope. One of our two points was obtained during the periastrum passage, when the angular separation between the components was less than the diffraction limit. This explains the large residual in distance for this point.

McA 56. A nearby star HD 184467 = Gliese 762.1 was found to be a double-line spectroscopic binary from photoelectric radial-velocity measurements in 1979 on the 1.2 m telescope of the Dominion Observatory (McClure, 1983). In 1980.5 it was directly resolved by McAlister et al. (1983) with a speckle interferometer at the 4 m Mayall Telescope and received the designation McA 56. To find an orbital solution for this K1V pair we used 8 published observations of the CHARA group from Georgia State University together with one measurement of A. Tokovinin (McAlister and Hartkopf, 1988) and 2 recent, yet unpublished, measurements at the 6 m telescope (1989.8041 - 92.2°, 0.100″, and 1989.8096 - 88.2°, 0.102″). These points cover almost 7 revolutions of the binary. The orbital elements found from speckle data are in good agreement with a spectroscopic orbit published by McClure (1983). By combining the spectroscopic and interferometric elements we estimated the masses to be μ_A=1.07, μ_B=1.00, and the parallax of the system to be π=0.055″.

REFERENCES

Balega, I.I., Balega, Yu.Yu.: 1988, *Soviet Astron. (Letters)*, **14**, 927.

Finsen, W.S.: 1978, *IAU Commission 26 (Binary Stars) Inform. Circular*, No. 74.

McAlister, H.A., and Hartkopf, W.I.: 1988, *Second Catalog of Interferometric Measurements of Binary Stars*, CHARA Contrib. No.2, Georgia State Univ., Atlanta, Georgia, USA.

McAlister, H.A., Hendry, E.M., Hartkopf, W.I. and Campbell, B.G.: 1983, *Ap.J. Suppl. Ser.* **51**, 309.

McClure, R.D.: 1983, *Publ. Astron. Soc. Pacif.*, **95**, No.565, 201.

Strassmeier, K.G. and Fekel, F.C.: 1990, *Astron. Astrophys.* **230**, 389.

Worley, C.F., Heintz, W.D. 1983, *Fourth Catalog of Orbits of Visual Binary Stars*. Publ. USNO, vol.XXIV, part VII.