

## NEW ORBITAL ELEMENTS FOR 5 DOUBLE STARS

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**SUMMARY:** In this paper are presented recalculated elliptical and Thiel-Innes orbital elements for the following double stars: WDS05255-0033, WDS12272+2701, WDS 13336+2944 and WDS 21031+0132 (two versions). The elements of the pair WDS 06074+2640 = McA 25 are calculated for the first time.

## 1. INTRODUCTION

The (O-C) residuals of the latest orbital elements for the pairs WDS 05255-0033 (Baz, 1981), WDS 12272+2701 (Hop, 1964), WDS 13336+2944 (Zul, 1969) and WDS 21031+0132 (Hop, 1960) progressively increase as follows from new observations, especially in position angle. The above references are taken from Hartkopf et al., 2000.

For the pair WDS 06074+2640 = McA 25, the orbital elements are calculated for the first time. In the case of this interferometric pair, 10 observations were available since its discovery in 1977.

## 2. RESULTS AND DISCUSSION

Table 1. contains the basic information about the analyzed pairs and obtained classical and vectorial orbital elements. For the pairs WDS12272+2701, WDS 13336+2944 and WDS 21031+0132 (two versions), masses and dynamical parallaxes are given, too. The observations and corresponding (O-C) residuals are given in Table 2. The ephemeris for the next 10 years are presented in Table 3. Graphical presentation of the above pairs orbits is given in Figs. 1-5.

The recalculated periods of all pairs are significantly shorter than previous ones, but these results are still to be considered as preliminary ones. Provided the pair WDS 06074+2640 = McA 25 is systematically observed, its orbit would be soon determined definitely.

**Table 1.** Orbital elements, masses and parallaxes

WDS	05255-0033	06074+2640	12272+2701	13336+2944	21031+0132	21031+0132
ADS	4020	BD 26° 1082	8553	8943	I 14573	II 14573
Name	A 848	McA 25	STF 1643	A 1095	STF 2744 AB	STF 2744 AB
Hipp	25365	–	60759	66149	103892	103892
m	6.7–7.3	7.0	8.24–8.68	8.35–8.85	6.24–6.81	6.24–6.81
Sp.	B9pHgSi	B9.5V	K2	G0	F7 IV	F7 IV
$P(y)$	190.209	30.799	481.533	179.414	939.744	669.613
$n(^{\circ}/y)$	1.89265	11.68864	0.74761	2.00654	0.38308	0.53762
$T$	2063.66	2004.459	2174.15	2020.99	2049.741	2135.162
$a(^{\prime\prime})$	0.3377	0.1219	2.5920	0.3901	1.6489	1.3264
$e$	0.6190	0.4061	0.7001	0.5276	0.2165	0.2123
$i(^{\circ})$	74.86	73.94	115.91	56.78	151.94	162.44
$\Omega(^{\circ})$	20.28	178.53	149.07	89.90	152.75	110.01
$\omega(^{\circ})$	277.71	266.37	285.47	288.11	69.46	88.92
$A(^{\prime\prime})$	0.072770	0.008587	-1.154216	0.203351	0.109694	1.179535
$B(^{\prime\prime})$	-0.066294	0.033437	-0.580858	0.120931	1.476297	0.456031
$F(^{\prime\prime})$	0.309767	-0.121560	-1.987433	-0.065822	1.606473	0.476086
$G(^{\prime\prime})$	0.127090	0.005264	1.543264	0.370887	-0.253233	-1.238020
$C(^{\prime\prime})$	-0.322998	-0.116909	-2.246948	-0.310170	0.726253	0.400175
$H(^{\prime\prime})$	0.043705	-0.007423	0.621959	0.101450	0.272118	0.007538
$M_A$	–	–	5.93	3.05	1.44	1.46
$M_B$	–	–	6.37	3.55	2.01	2.03
$\mathcal{M}_{A\odot}$	–	–	0.94	1.46	2.05	2.04
$\mathcal{M}_{B\odot}$	–	–	0.88	1.34	1.80	1.79
$\pi''_{dyn}$	–	–	0.0346	0.0087	0.0110	0.0111
$\pi''_H$	–	–	0.0363	0.00792	0.0152	0.0152

Table 2. Measurements and (O - C)

WDS 05255-0033						
$t$	$\theta_t$	$\rho_t$	$n$	Obs.	$\Delta\theta$	$\Delta\rho$
1904.88	35 $^{\circ}$ .6	0 $''$ .22	3	A	-1 $^{\circ}$ .2	-0 $''$ .021
1910.09	43.2	0.26	1	Bry	2.2	0.028
1917.76	45.8	0.22	2	A	-2.0	0.006
1924.06	47.2	0.15	1	A	-7.3	-0.047
1931.16	57.5	0.19	2	A	-6.1	0.013
1935.864	84.	0.16	4	Voû	13.2	-0.004
1937.137	70	0.2	1	Fin	-2.9	0.039
1937.787	77.8	0.17	4	Voû	3.7	0.010
1938.785	72.6	0.17	4	Voû	-3.2	0.012
1944.81	92.1	0.16	4	Voû	4.7	0.013
1944.85	75.2	0.16	2	VBs	-12.3	0.013
1953.11	119.1	0.14	4	Fin	13.5	0.000
1954.14	118.4	0.144	2	Fin	10.5	0.003
1954.79	129.2	0.12	4	VBs	19.9	-0.021
1956.17	98.	0.14	2	Mul	-14.4	-0.001
1958.104	124.5	0.13	10	Bos	7.8	-0.012
1960.19	138.4	0.16	2	VBs	17.2	0.015
1961.899	128.3	0.13	4	Bos	3.5	-0.017
1966.880	131.2	0.11	1	Worley	-3.3	-0.046
1977.550	152.4	0.196	4	McA	1.2	0.012
1978.09	154.9	0.16	2	hz	3.0	-0.025
1980.02	155.9	0.19	3	Tok1, McA2	1.5	-0.001
1982.7634	158.9	0.213	1	McA	1.3	0.013
1985.802	161.0	0.222	2	Tok1, McA1	0.2	0.013
1986.8892	161.6	0.222	1	McA	-0.3	0.009
1988.2545	159.9	0.224		Har et al.	-3.3	0.007
1989.9414	165.6	0.237	1	Har	0.8	0.014
1990.8442	166.0	0.240	2	Har1, Bal1	0.4	0.015
1993.0924	167.6	0.25		Har et al	0.1	0.017
WDS 06074+2640						
1977.1798	177.0	0.097	1	McA82a	1.0	0.000
1982.847	199.7	0.076	1	Tok83	3.1	-0.027
1984.779	201.9	0.079	1	Tok85	-4.3	-0.006
1985.742	220.6	0.065	1	Tok88	7.7	-0.010
1985.8380	219.4	0.065	1	McA76	5.8	-0.009
1986.8865	218.4	0.068	1	McA89	-5.0	0.004
1987.2717	224.3	0.068	1	Mca89	-3.5	0.008
1988.2491	228.7	0.070	1	McA89	-12.8	0.017
1988.6637	234.7	0.062	1	McA90	-13.7	0.012
1995.9187	342.7	0.111	1	Har et al.97	4.0	0.016
WDS 12272+2701						
1830.36	71.2	1.94	5	STF	-0.3	0.240
1844.38	65.4	1.76	1	Ma	1.3	0.019

Table 2. (continued)

WDS 12272+2701							
$t$	$\theta_t$	$\rho_t$	$n$	<i>Obs.</i>	$\Delta\theta$	$\Delta\rho$	
1865.64	53°.6	1".82	3	Dem	0°.1	-0".004	
1873.24	50.7	1.88	2	Dem	0.7	0.021	
1878.29	46.6	1.76	1	Bu	-1.2	-0.124	
1888.34	44.6	1.86	4	Hl	1.2	-0.076	
1890.16	43.6	2.08	8	Cel3, Sp5	0.9	0.134	
1893.36	41.7	2.01	2	Lewis	0.3	0.046	
1894.26	40.9	1.85	1	Com	-0.1	-0.118	
1897.40	40.2	1.82	1	Brown	0.5	-0.166	
1899.32	39.6	2.03	2	Lewi	0.6	0.033	
1900.30	38.1	2.02	3	Bowyer	-0.5	0.018	
1902.52	38.9	2.12	8	Pos	1.2	0.105	
1903.42	35.4	1.83	1	A	-2.0	-0.190	
1903.50	38.4	2.10	28	GrO	1.1	0.079	
1904.86	36.9	2.03	5	Sbk1, Th2, VBs1, Frm1	0.1	0.002	
1908.62	35.0	2.09	19	Doo3, Wz5, Has3, Dob4	-0.4	0.040	
1912.69	34.2	2.07	25	Vou4, GrO16, Dob4, VBs1	0.3	-0.004	
1917.22	34.1	1.82	3	Ptt	1.8	-0.281	
1920.21	27.1	1.63	2	Dob	-4.1	-0.488	
1923.57	28.6	2.09	20	GrO7, Phl3, Plq2, Dob4, Fatou4	-1.4	-0.048	
1924.32	30.0	(2.54)	2	Prz	0.2	0.397	
1924.88	28.8	1.97	4	Fat	-0.8	-0.176	
1928.240	27.8	2.22	2	Hinz	-0.7	0.054	
1929.206	28.3	2.20	2	Hinz	0.2	0.028	
1933.498	28.5	1.83	3	Bar	1.8	-0.367	
1937.309	23.7	2.47	3	Hinz	-1.8	0.250	
1941.29	26.0	2.27	3	Kor	1.8	0.027	
1944.04	23.8	2.18	3	Voù	0.4	-0.079	
1948.328	21.5	2.35	4	Fok	-0.6	0.066	
1950.366	21.9	2.271	7	Rabe	0.4	-0.025	
1951.379	21.38	2.307	5	Rabe	0.2	0.005	
1953.367	19.91	2.282	7	Rabe	-0.7	-0.031	
1954.376	20.6	2.36	2	Jeff an Vail.	0.3	0.041	
1954.397	19.37	2.282	5	Rabe	-0.9	-0.037	
1955.396	18.61	2.264	7	Rabe	-1.4	-0.060	
1956.365	18.67	2.278	6	Rabe	-1.0	-0.052	
1959.14	18.6	2.64	2	Hog	-0.3	0.295	
1959.38	19.3	2.29	5	hz	0.5	-0.057	
1959.42	19.3	2.26	7	GrO	0.5	-0.087	
1962.26	17.3	2.35	4	hz	-0.7	-0.012	
1967.30	15.0	2.45	2	Cou	-1.6	0.060	
1973.15	15.2	2.36	2	Zul	0.2	-0.060	
1974.373	14.6	2.66	3	Hold	-0.1	0.234	
1976.29	15.0	2.45	3	hz	0.8	0.014	
1976.36	13.8	2.39	4	Zul	-0.4	-0.046	
1976.89	15.1	2.52	3	Arm. et al.	1.1	0.081	
1977.35	15.4	2.40	2	Zul	1.5	-0.041	
1979.24	13.6	2.27	2	Zul	0.2	-0.180	

Table 2. (continued)

WDS 12272+2701						
$t$	$\theta_t$	$\rho_t$	$n$	<i>Obs.</i>	$\Delta\theta$	$\Delta\rho$
1983.178	13° 5	2'' .56	6	Zul	1° .1	0'' .091
1983.333	13.4	2.21	2	Pop	1.0	-0.260
1984.355	11.8	2.51	3	Worley	-0.3	0.035
1984.396	14.2	2.42	4	Pop	2.1	-0.055
1984.786	11.6	2.35	4	Zul	-0.4	-0.127
1986.306	12.6	2.50	3	Pop	1.0	0.016
1986.307	11.9	2.48	3	Zul	0.3	-0.004
1991.720	8.6	2.61	5	Doug. et al.	-1.6	0.102
1995.211	8.5	2.64	1	Germ. et al.	-0.9	0.118
1997.27	8.1	2.69	2	Alz	-0.8	0.159
1997.39	10.3	2.70	2	hz	1.5	0.169
1997.081	8.7	2.50		Doug. et al.	-0.2	-0.030
1997.286	8.6	2.61		Doug. et al.	-0.3	0.079
1997.302	9.2	2.53		Doug. et al.	0.3	-0.001
1999.2751	8.2	2.71		Mas. et al.	-0.2	0.171
WDS 13336+2944						
1905.54	176.9	0.31	3	A	-0.5	0.003
1918.43	195.2	0.35	2	A	-0.4	0.020
1925.39	203.9	0.38	2	Plq	-0.3	0.034
1928.58	205.3	0.35	4	WBs	-2.6	-0.004
1933.51	211.5	0.33	2	A	-1.8	-0.037
1943.22	220.9	0.37	3	Voû	-2.0	-0.022
1944.27	223.4	0.41	2	VBs	-0.4	0.016
1952.288	230.1	0.36	4	VBs	-0.7	-0.051
1952.43	230.9	0.41	4	Bz	0.0	-0.002
1954.38	235.6	0.42	3	Cou	3.1	0.005
1955.49	232.8	0.44	2	Worley	-0.7	0.023
1956.18	236.2	0.39	3	Mul	2.2	-0.028
1958.378	236.9	0.38	10	Bos	1.1	-0.042
1959.34	237.5	0.44	3	Cou	1.0	0.017
1960.46	238.8	0.43	4	Worley	1.4	0.006
1961.44	235.9	0.45	4	hz	-2.3	0.025
1963.10	241.6	0.39	6	Bos	2.1	-0.037
1964.39	242.7	0.44	3	Cou	2.2	0.012
1965.33	239.8	0.45	4	hz	-1.4	0.021
1966.40	236.4	0.42	2	Mul	-5.6	-0.009
1969.366	246.2	0.36	4	Zul	1.9	-0.070
1973.653	248.8	0.45	4	Worley	1.2	0.021
1974.443	251.1	0.40	3	Hol	2.9	-0.028
1976.33	251.9	0.47	3	hz	2.2	0.044
1981.319	254.9	0.42	6	hz2, Pop2, Zul2	1.3	0.002
1986.433	262.8	0.39	3	Worley	4.9	-0.013
1993.263	265.3	0.44	2	Lin1, Lan1	0.9	0.069
1994.39	261.3	0.35	2	hz	-4.2	-0.014
1997.43	267.4	0.41	2	hz	-1.6	0.067
1999.4093	271.	0.41	1	Mas	-0.5	0.084

Table 2. (continued)

WDS 21031+0132								
$t$	$\theta_t$	$\rho_t$	$n$	<i>Obs.</i>	$\Delta\theta$ (I)	$\Delta\rho$ (I)	$\Delta\theta$ (II)	$\Delta\rho$ (II)
1830.16	190°5	1".52	5	STF	1°.3	-0".092	-0°.1	-0".008
1843.24	184.5	1.93	2	STT	-0.1	0.332	-1.1	0.407
1863.74	177.4	1.49	7	Dem	0.2	-0.083	-0.3	-0.021
1882.20	171.8	1.56	4	H14	1.5	0.015	1.4	0.063
1883.66	170.0	1.64	3	Per	0.2	0.097	0.2	0.144
1884.71	171.2	1.62	1	Gnd	1.8	0.079	1.8	0.125
1889.00	167.6	1.39	7	HStruve	-0.1	-0.144	-0.1	-0.101
1890.84	167.6	1.40	17	Cel7, Sp10	0.6	-0.130	0.6	-0.089
1892.66	167.7	1.28	2	Gla	1.4	-0.247	1.5	-0.207
1895.85	166.6	1.44	2	Collins	1.5	-0.081	1.7	-0.044
1897.73	165.1	1.54	3	Doo	0.8	0.022	0.9	0.058
1901.72	163.0	1.37	3	Bryant	0.3	-0.140	0.4	-0.107
1902.66	162.0	1.47	2	Hu	-0.4	-0.039	-0.2	-0.006
1903.10	160.8	1.63	13	Cel2, KgsO5 et al.	-1.4	0.122	-1.2	0.154
1904.74	163.8	1.42	4	Gr. Obsy.	2.3	-0.085	2.5	-0.054
1908.94	159.9	1.52	23	Dob2, Moth1 et al.	0.0	0.024	0.3	0.051
1913.46	158.2	1.34	16	Dob3, Wz2 et al.	0.2	-0.147	0.5	-0.123
1921.72	154.7	1.47	28	Lord3, Chan6 et al	0.1	0.001	0.4	0.018
1925.54	152.7	1.52	38	Prz2, Vou4 et al	-0.3	0.060	0.0	0.073
1925.674	155.4	1.64	1	Bz	2.5	0.180	2.8	0.193
1928.830	150.3	1.38	1	Hinz	-1.3	-0.073	-1.0	-0.062
1930.785	149.6	1.45	1	Hinz	-1.1	0.002	-0.8	0.011
1933.924	149.6	1.32	2	Bar	0.2	-0.121	0.5	-0.114
1937.73	147.4	1.40	1	Mul	-0.3	-0.031	0.0	-0.028
1937.91	143.6	1.47	1	Mul	-4.0	0.039	-3.7	0.042
1938.30	144.1	1.47	2	Mul	-3.3	0.040	-3.1	0.043
1942.40	145.5	1.38	3	Vou	-0.1	-0.040	0.1	-0.041
1946.65	141.5	1.46	3	Mul	-2.2	0.051	-2.0	0.047
1948.68	139.0	1.38	3	Bz	-3.8	-0.023	-3.6	-0.030
1948.754	141.7	1.47	5	Rabe	-1.0	0.067	-0.8	0.060
1949.66	140.0	1.49	3	Mul	-2.3	0.089	-2.1	0.082
1949.669	142.0	1.35	1	Arm?	-0.3	-0.051	-0.1	-0.058
1949.730	140.6	1.45	7	Rabe	-1.7	0.049	-1.5	0.042
1950.769	139.6	1.46	10	Rabe	-2.2	0.062	-2.0	0.054
1951.71	139.3	1.55	3	Mul	-2.1	0.155	-1.9	0.146
1951.714	139.9	1.45	7	Rabe	-1.5	0.055	-1.3	0.046
1952.849	138.1	1.44	7	Rabe	-2.7	0.048	-2.6	0.038
1953.814	138.5	1.39	9	Rabe	-1.9	0.000	-1.8	-0.011
1954.779	137.2	1.41	7	Rabe	-2.7	0.023	-2.6	0.011
1955.68	140.7	1.44	3	Worley	1.2	0.055	1.3	0.043
1955.752	137.5	1.37	7	Rabe	-2.0	-0.015	-1.9	-0.027
1956.786	137.3	1.38	6	Rabe	-1.7	-0.002	-1.6	-0.015
1957.503	139.0	1.48	4	Bos	0.4	0.100	0.4	0.086
1957.805	137.2	1.43	6	Rabe	-1.3	0.051	-1.2	0.037
1959.54	137.6	1.50	4	Worley	-0.1	0.126	0.0	0.110
1960.63	137.0	1.32	4	GrO	-0.1	-0.052	-0.1	-0.068
1962.689	135.3	1.31	3	Dju1, Pop1, Zull	-0.8	-0.056	-0.9	-0.074
1963.148	136.0	1.36	4	Worley	0.1	-0.005	0.0	-0.023

Table 2. (continued)

WDS 21031+0132								
$t$	$\theta_t$	$\rho_t$	$n$	<i>Obs.</i>	$\Delta\theta$ (I)	$\Delta\rho$ (I)	$\Delta\theta$ (II)	$\Delta\rho$ (II)
1965.489	134°.3	1".26	3	Zul	-0°.5	-0".098	-0°.6	-0".118
1970.658	130.7	1.25	2	Ole	-1.5	-0.094	-1.8	-0.117
1970.745	131.1	1.21	1	Pop	-1.1	-0.134	-1.3	-0.157
1971.271	133.1	1.41	4	Worley	1.2	0.068	0.9	0.044
1973.685	127.9	1.22	1	Ole	-2.8	-0.115	-3.1	-0.141
1974.57	135.1	1.30	2	Zul	4.9	-0.033	4.5	-0.059
1975.714	133.7	1.57	1	Erc	4.0	0.240	3.7	0.213
1976.092	129.7	1.32	3	Pop	0.2	-0.009	-0.1	-0.036
1977.60	129.8	1.24	4	Zul	1.1	-0.084	0.7	-0.113
1978.129	127.4	1.27	5	Pop	-1.0	-0.053	-1.5	-0.081
1978.391	126.5	1.43	5	Erc	-1.8	0.108	-2.2	0.079
1979.63	130.1	1.24	3	Zul	2.5	-0.079	2.0	-0.108
1980.59	128.3	1.41	3	hz	1.2	0.094	0.6	0.064
1980.657	127.5	1.35	3	Worley	0.4	0.034	-0.1	0.004
1980.660	129.0	1.20	3	Zul	1.9	-0.116	1.4	-0.146
1981.724	128.3	1.17	1	Zul	1.7	-0.143	1.2	-0.173
1982.767	127.1	1.26	6	Zul	1.1	-0.050	0.5	-0.081
1984.156	125.9	1.20	2	Zul	0.6	-0.106	0.0	-0.138
1985.711	126.5	1.26	4	Zul	2.1	-0.042	1.4	-0.074
1986.767	125.0	1.40	4	Worley	1.1	0.101	0.4	0.068
1986.869	123.2	1.33	4	Zul2, Pop2	-0.6	0.032	-1.3	-0.002
1988.577	126.8	1.23	4	Zul	3.9	-0.063	3.1	-0.097
1989.686	124.5	1.43	2	Pop	2.2	0.140	1.4	0.105
1991.7152	122.3	1.33	1	Har et al.	1.1	0.045	0.2	0.010
1997.6	119.	1.28	7	Doug. et al.	1.1	0.011	-0.1	-0.026
1999.7188	118.4	1.27	1	Mas et al.	1.7	0.007	0.4	-0.030

Table 3. Ephemeris

<i>WDS</i>	05255-0033		06074+2640		12272+2701		13336+2944		21031+0132 (I)		21031+0132 (II)	
$t$	$\theta(^{\circ})$	$\rho(^{\prime\prime})$	$\theta(^{\circ})$	$\rho(^{\prime\prime})$	$\theta(^{\circ})$	$\rho(^{\prime\prime})$	$\theta(^{\circ})$	$\rho(^{\prime\prime})$	$\theta(^{\circ})$	$\rho(^{\prime\prime})$	$\theta(^{\circ})$	$\rho(^{\prime\prime})$
2002.0	174.0	0.259	4.6	0.082	7.7	2.549	275.2	0.302	115.4	1.257	116.8	1.295
2003.0	174.7	0.262	13.7	0.058	7.5	2.553	276.8	0.292	114.9	1.254	116.2	1.292
2004.0	175.3	0.265	39.9	0.029	7.2	2.556	278.6	0.281	114.3	1.251	115.7	1.289
2005.0	175.9	0.268	127.5	0.025	7.0	2.560	280.4	0.270	113.7	1.249	115.2	1.287
2006.0	176.6	0.270	160.5	0.054	6.7	2.563	282.5	0.258	113.2	1.246	114.6	1.284
2007.0	177.2	0.273	170.7	0.079	6.5	2.567	284.7	0.245	112.6	1.244	114.1	1.282
2008.0	177.8	0.275	176.2	0.098	6.3	2.570	287.2	0.232	112.0	1.241	113.6	1.279
2009.0	178.3	0.278	180.3	0.109	6.0	2.573	290.1	0.218	111.4	1.239	113.0	1.276
2010.0	178.9	0.280	183.8	0.114	5.8	2.577	293.3	0.204	110.8	1.236	112.5	1.274
2011.0	179.5	0.282	187.1	0.115	5.6	2.580	296.9	0.189	110.2	1.233	111.9	1.271

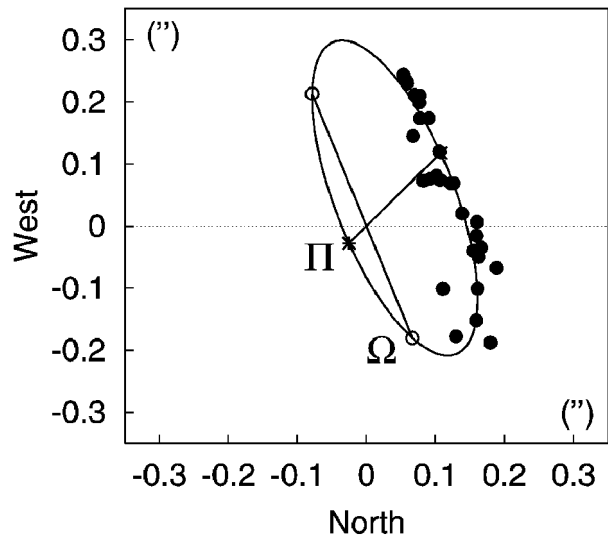


Fig. 1. *ADS 4020*.

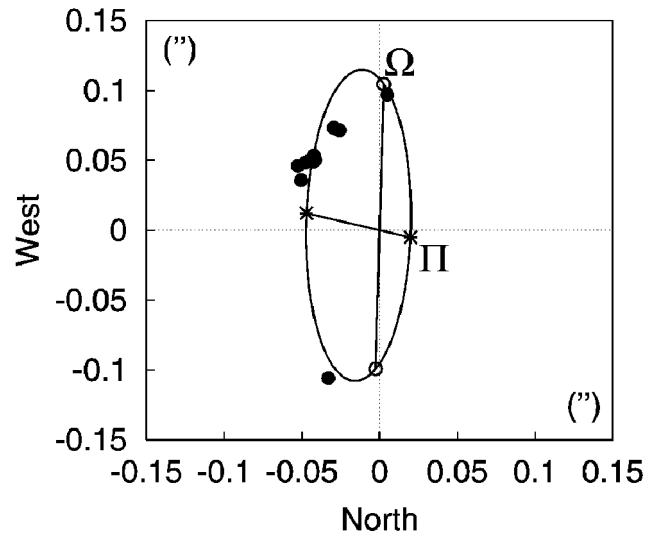


Fig. 2. *McA 25*.

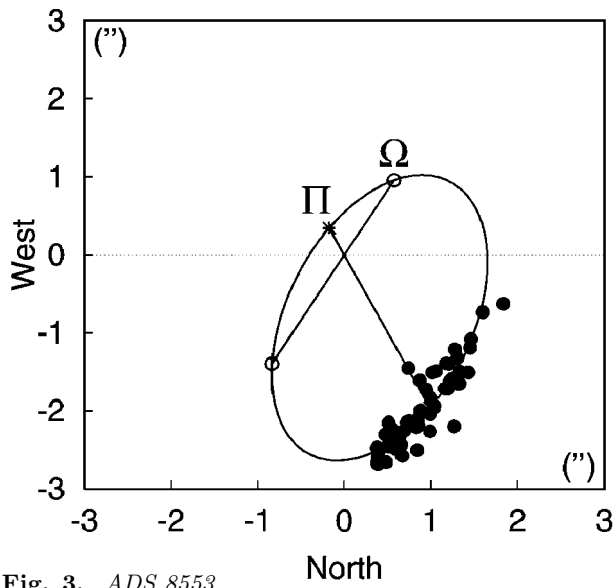


Fig. 3. *ADS 8553*.

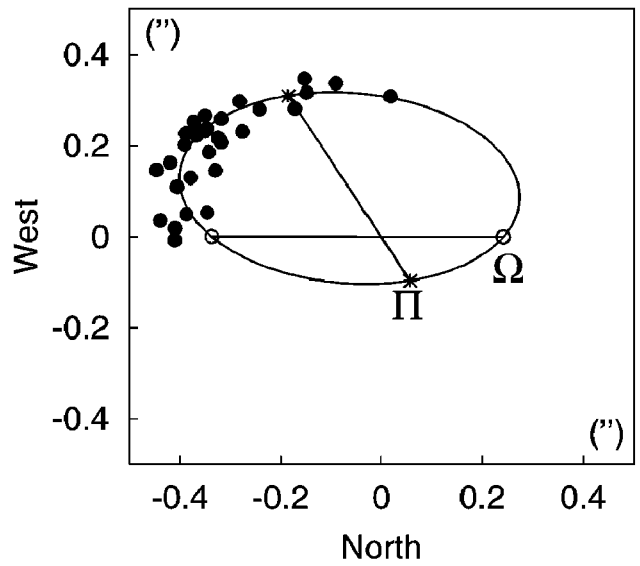


Fig. 4. *ADS 8943*.



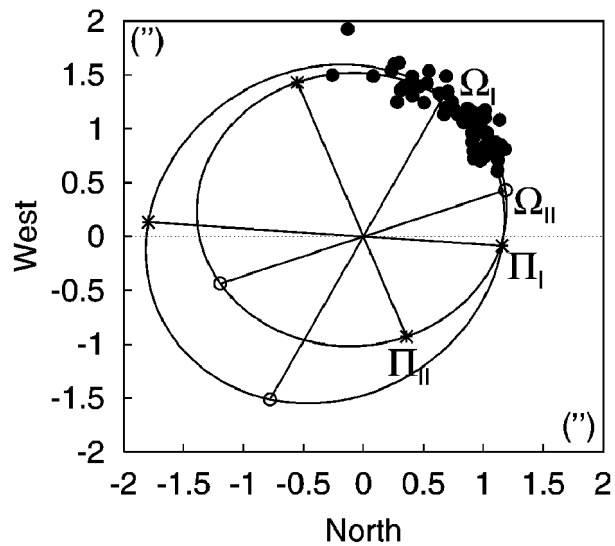


Fig. 5. *ADS 14573*.

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## НОВИ ОРБИТАЛНИ ЕЛЕМЕНТИ ЗА 5 ДВОЈНИХ ЗВЕЗДА

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*Оригинални научни рад*

У раду су дати рекалкулисани елиптични и Thiel-Innes-ови путањски елементи за следеће парове двојних звезда: WDS 05255-0033, WDS 12272+2701,

WDS 13336+2944 и WDS 21031+0132 (две верзије). Елементи пара WDS 06074+2640 = McA 25 су израчунати по први пут.