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Preliminary report

ORBITAL ELEMENTS FOR 8 DOUBLE STARS

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SUMMARY: The orbital elements and the corresponding astrophysical quantities are given for the following double stars: ADS 48 = OΣ 547, ADS 2491 = Σ 380, ADS 5400 = Σ 948, ADS 6526 = A 1580, ADS 8082 = h 2562, ADS 9025 = OΣ 270, ADS 9170 = β 939, ADS 11339 = β 1203.

1. INTRODUCTION

The paper reports the results of analysis of 8 double stars. In addition to the orbital elements presented are the orbital parallaxes, masses and the absolute magnitudes of the components.

The Thiele–Innes elements A, B, F and G are determined by applying Popović–Pavlović's procedure (1995). The orbital elements thus obtained are further used as initial in applying Eichhorn–Xu's (1990) procedure.

In Table 1 are presented the basic data concerning the systems treated here, their Campbell and Thiele–Innes elements, as well as the corresponding astrophysical quantities. The orbital elements are given for the epoch 2000.00. The parallaxes and absolute magnitudes are determined according to Angelov (1993).

In Table 2 are presented the measurements and deviations from the calculated orbits. The measurements taken from BDS and ADS, in cases when there appeared more then one observer, in column 'Obs.' are given only partial lists.

Table 3 gives the ephemeris covering the period 1995 – 2015.

The comments concerning the analyzed systems are given after the tabular presentations.

The measurements as well as the apparent orbits are presented graphically too. In each Figure are showed the line of nodes(Ω) and the periastron position (Π).

2. ORBITAL ELEMENTS, MEASUREMENTS, EPHEMERIS

Table 1 Orbital elements, masses and parallaxes

Name	OΣ 547	Σ 380	Σ 948	A 1580
ADS	48	2491	5400	6526
IDS	00054N4549	03218N0845	06463N5927	08017NS0836
m	8.8–8.9*	8.3–9.3	5.37–5.95	7.4–8.9
Sp.	dK6–dM0*	G0	A2n	F5
$P(y)$	1550.6370	520.7540	706.0900	299.7384
$n(^\circ/y)$	0.23216	0.69131	0.50985	1.20105
T	1970.4381	2114.3401	2446.2100	1957.1635
$a(")$	11.7613	0.9424	1.6605	0.3366
e	0.4973	0.2705	0.0300	0.0011
$i(^\circ)$	56.68	164.14	178.03	60.80
$\Omega(^\circ)$	175.14	67.75	90.00	117.19
$\omega(^\circ)$	349.37	164.38	244.86	90.62
A	-11.41692	-0.11775	-1.50223	-0.14437
B	2.16627	-0.93244	-0.70561	-0.07827
F	-2.70002	-0.90412	-0.70520	0.15538
G	-6.14293	0.09573	1.50310	-0.29854
C	$\mp$1.81365	$\pm$ 0.06935	$\mp$0.05155	$\pm$0.29379
H	$\pm$9.65932	$\mp$ 0.24803	$\mp$0.02419	$\mp$0.00318
T_1	1983.83	1891.50	2665.89	1881.82
T_2	1312.17	2126.90	2325.05	2031.47
M_A	8.7	3.5	0.6	0.4
M_B	8.8	4.5	1.2	1.9
$\mathcal{M}_A\odot$	0.4	1.3	2.5	2.6
$\mathcal{M}_B\odot$	0.4	1.1	2.1	1.8
$\pi(")$	0.097	0.011	0.013	0.005

* – Eggen O.(1956)

Table 1 (continued)

Name	h 2562	OΣ 270	β 939	β 1203
ADS	8082	9025	9170	11339
IDS	11107N3109	13473N1727	14141S0831	18261N0046
m	9.8–11.3	4.8–11.4*	9.4–9.5	7.6–7.8
Sp.	G	F7V–M2*	F2	A3
$P(y)$	619.9300	389.2500	602.2958	495.7300
$n(^\circ/y)$	0.58071	0.92486	0.59771	0.72620
T	2043.7700	2061.6599	2398.2202	2315.0200
$a(")$	1.3822	6.3001	0.8016	0.5151
e	0.2048	0.4189	0.1379	0.4634
$i(^\circ)$	162.85	70.60	116.10	59.29
$\Omega(^\circ)$	135.96	169.96	172.76	17.64
$\omega(^\circ)$	286.72	0.67	332.39	317.13
A	-1.16516	-6.20740	-0.72531	0.41398
B	-0.63285	1.07436	-0.07253	-0.05615
F	-0.68745	-0.29187	-0.32909	0.27553
G	1.19337	-2.07309	0.35686	0.28988
C	$\mp$0.39035	$\pm$0.06992	$\mp$0.33359	$\mp$0.30127
H	$\pm$0.11726	$\pm$5.94206	$\pm$0.63794	$\pm$0.32457
T_1	2133.14	2061.39	2433.20	2335.39
T_2	1900.21	2254.67	2156.72	2191.30
M_A	5.9	4.8	3.7	0.9
M_B	7.4	11.4	3.8	1.1
$\mathcal{M}_A\odot$	0.8	1.0	1.2	2.3
$\mathcal{M}_B\odot$	0.6	0.1	1.2	2.2
$\pi(")$	0.017	0.114	0.008	0.005

* – Eggen, O.(1956)

Table 2 Measurements and $(O-C)$

ADS 48 = IDS 00054N4549 = OΣ 547						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1876.07	$110\overset{\circ}{.}9$	$4\overset{''}{.}49$	3	OΣ	$0\overset{\circ}{.}43$	$0\overset{''}{.}19$
1876.29	111.3	4.24	4	Δ	0.64	-0.06
1879.81	113.9	4.35	2	HI	0.34	0.03
1880.73	114.9	4.47	4	β	0.59	0.14
1881.72	114.5	4.42	2	Big	-0.62	0.09
1882.70	116.4	4.55	1	OΣ	0.48	0.21
1889.82	121.1	4.35	2	HΣ	-0.51	-0.07
1894.19	123.7	4.90	3	Frhj	-1.30	0.43
1895.68	124.3	4.38	3	A	-1.84	-0.12
1895.88	126.5	4.36	3	Con	0.21	-0.14
1898.75	129.0	4.62	3	Hu	0.56	0.08
1901.66	130.9	4.67	1	Hu	0.33	0.08
1905.93	133.8	4.47	4	β	0.17	-0.20
1907.97	135.5	4.74	6	Prz2...	0.45	0.03
1911.12	137.0	4.75	10	Dob 4,...	-0.20	-0.02
1913.41	139.3	4.87	11	Slc 4,...	0.57	0.06
1915.90	140.8	4.74	4	Dob 2,...	0.44	-0.12
1920.24	142.4	4.94	8	VBs 3,...	-0.71	-0.01
1920.826	143.1	4.99	4	Bzt	-0.38	0.03
1920.845	143.0	5.00	2	GΣ	-0.49	0.04
1921.39	143.1	5.01	20	Abt3	-0.73	0.03
1921.72	144.0	4.84	4	B	-0.03	-0.14
1921.772	143.85	4.97	1	Btz	-0.21	-0.01
1923.130	145.2	4.86	2	GΣ	0.30	-0.15
1923.792	145.3	5.04	2	d	0.00	0.01
1923.82	145.1	5.03	13	GΣ,...	-0.22	0.00
1923.948	145.7	5.03	3	GΣ	0.31	0.00
1924.90	145.9	5.02	4	B	-0.07	-0.03
1925.41	149.8	5.10	4	Dob 3,...	3.53	0.04
1926.73	145.0	4.82	3	Bz	-2.06	-0.27
1926.96	146.5	5.24	3	Kom	-0.69	0.15
1927.851	147.5	5.02	4	GΣ	-0.22	-0.09
1942.64	155.5	5.15	5	Bz	-0.04	-0.26
1943.89	156.5	5.37	2	VBs	-0.04	-0.07

Table 2 (continued)

ADS 48 = IDS 00054N4549 = OΣ 547						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1949.931	159°.26	5″.528	4	Mul	-0°.35	-0″.02
1951.05	160.1	5.37	3	Bz	-0.06	-0.20
1952.509	160.9	5.42	1	Luplau–Janssen	0.02	-0.17
1952.952	160.8	5.60	4	W.Knudsen	-0.30	0.00
1953.864	161.18	5.514	7	R	-0.36	-0.10
1955.949	162.33	5.572	5	R	-0.22	-0.08
1958.95	343.9	5.72	4	HØG	-0.08	0.02
1959.620	164.32	5.694	?	Kamper	0.03	-0.01
1960.708	164.87	5.724	1	Kiselev	0.07	0.00
1961.745	165.41	5.714	1	Kiselev	0.13	-0.02
1962.85	165.8	5.77	3	Cou	0.00	0.02
1964.920	166.5	5.80	5	Soulie	-0.25	0.02
1966.89	167.7	5.80	?	?	0.05	-0.00
1968.798	168.44	5.817	1	Cou	-0.08	-0.01
1969.721	168.77	5.837	1	Cou	-0.16	0.00
1969.884	–	5.862	1	Kamper	–	0.03
1970.944	169.56	5.844	1	Kamper	0.09	-0.00
1971.804	169.84	5.865	1	Kamper	-0.02	0.01
1972.704	170.30	5.913	1	Kamper	0.04	0.05
1973.797	170.81	5.898	1	Josties et al.	0.06	0.02
1973.812	350.6	5.94	4	Wor	-0.15	0.07
1973.901	170.88	5.897	1	Kiselev	0.09	0.02
1974.711	170.6	6.06	4	Walker	-0.55	0.18
1974.748	171.17	5.909	1	Josties	0.00	0.03
1974.882	171.46	5.908	1	Kiselev	0.23	0.02
1975.655	171.50	5.925	1	Josties	-0.07	0.03
1975.677	171.53	5.910	1	Kiselev	-0.05	0.02
1976.700	171.90	5.933	1	Kiselev	-0.13	0.03
1977.876	172.49	5.964	1	Kiselev	-0.06	0.06
1978.69	172.62	5.959	3	Pannunzio et al.	-0.28	0.04
1978.820	172.93	5.974	1	Kiselev	-0.03	0.06
1979.680	173.27	5.979	1	Kiselev	-0.06	0.06

Table 2 (continued)

ADS 48 = IDS 00054N4549 = OΣ 547						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1980.755	$173^\circ.86$	$5''.987$	1	Kiselev	$0^\circ.06$	$0''.06$
1981.700	174.07	5.989	1	Stz	-0.14	0.05
1983.750	175.15	6.017	1	Stz	0.05	0.07
1984.232	175.1	5.87	2	Zul	-0.21	-0.08
1985.758	175.85	6.015	1	Stz	-0.12	0.06
1985.977	175.2	5.86	2	Pop	-0.87	-0.10
1985.978	176.0	5.93	2	Zul	-0.07	-0.03
1992.883	179.7	5.99	1	Doc	0.66	0.02
1994.796	180.64	6.178	5	Pop	0.78	0.20
1994.796	179.02	6.158	5	Pav	-0.83	0.18

ADS 2491 = IDS 03218N0845 = Σ 380						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1831.62	90°.1	1″.20	3	Σ	-0°.94	0″.02
1864.83	76.1	1.12	5	Δ	-1.78	-0.07
1880.02	74.0	1.19	2	Hl	2.13	0.00
1888.10	71.9	1.19	3	Hl	3.25	0.01
1890.87	70.0	1.27	6	Sp	2.47	0.09
1899.22	61.9	1.29	6	Doo	-2.25	0.12
1904.31	63.2	1.04	2	β	1.14	-0.13
1908.73	61.6	1.18	5	Lau1,Wz3,Fur1	1.37	0.02
1911.84	61.6	1.14	5	Fox3,Wz2	2.67	-0.02
1916.95	55.2	0.98	4	GrO1,Phl3	-1.57	-0.17
1921.86	53.8	1.05	5	Chan2,Nvl1,GrO2	-0.86	-0.09
1924.13	54.3	1.14	2	Gcb	0.62	0.00
1924.78	47.5	1.15	3	GrO	-5.90	0.01
1927.906	52.3	1.21	5	GΣ	0.27	0.08
1934.45	49.5	1.21	3	Bz	0.38	0.09
1936.957	44.4	1.38	2	Dick	-3.59	0.27
1942.48	45.7	1.07	3	Voûte	0.24	-0.03
1951.109	42.88	1.08	4	Rabe	1.50	-0.00
1954.125	38.78	1.07	3	Rabe	-1.14	-0.00
1955.066	40.34	1.17	3	Rabe	0.88	0.10
1956.048	36.86	0.92	2	Rabe	-2.12	-0.15
1959.86	36.4	1.14	3	VBs	-0.68	0.08
1962.947	38.0	0.91	4	Wor	2.48	-0.14
1969.11	34.1	1.04	3	Bz	1.78	0.01
1970.838	30.5	1.04	4	Wor	-0.91	0.01
1975.71	30.7	0.90	1	Ole	1.92	-0.12
1975.914	28.1	1.05	3	Wor	-0.57	0.04
1984.756	22.4	0.91	4	Wor	-1.29	-0.08
1988.683	24.6	1.88	1	Tho	3.21	0.90

ADS 5400 = IDS 06463N5927 = Σ 948						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1782.37	$181^\circ.4$	$1''.0$	1	h	$1^\circ.45$	$0''.09$
1831.10	153.7	1.53	5	Σ	-0.67	-0.10
1842.25	148.7	1.51	3	Gsh	0.12	-0.12
1847.92	146.8	1.60	10	OΣ	1.15	-0.03
1858.32	143.3	1.66	3	OΣ	3.00	0.02
1863.05	138.6	1.72	4	Dembovski	0.73	0.08
1869.32	136.4	1.76	7	OΣ	1.74	0.12
1879.30	130.9	1.63	3	Hl	1.32	-0.02
1891.06	122.5	1.65	3	Hl	-1.12	-0.00
1891.47	121.9	1.64	8	Amb2,Sp6	-1.52	-0.01
1897.89	120.0	1.56	4	Hu	-0.18	-0.09
1903.08	118.0	1.90	2	Pos1, Th1	0.42	0.24
1903.11	118.0	1.60	2	Bryant	0.44	-0.06
1905.58	115.6	1.59	18	L1,Frm1,Maw6,...	-0.72	-0.07
1910.18	114.2	1.68	22	Fox3,Dob3,...	0.18	0.02
1914.84	111.4	1.66	20	Vou4,FBn6,...	-0.30	-0.00
1920.068	109.68	1.67	1	Btz	0.58	0.01
1920.59	108.9	1.67	20	Es4,Chan5,...	0.06	0.01
1921.150	110.2	1.64	2	Btz	1.64	-0.02
1921.83	112.6	1.69	1	Gui	4.38	0.03
1923.250	107.4	1.93	4	d	-0.12	0.27
1923.297	106.9	1.58	1	GΣ	-0.59	-0.08
1923.57	106.0	1.76	21	Kpz5,BerO5,GrO4,B4,Peek3	-1.36	0.10
1925.91	106.4	1.69	18	Lv3,Phl4,Berm5,Dob4,Bz2	0.20	0.02
1927.194	104.3	1.64	3	GΣ	-1.26	-0.03
1927.758	102.7	1.61	1	Bz	-2.58	-0.06
1929.56	103.9	1.67	5	Bz	-0.49	0.00
1932.55	103.0	1.82	5	Bz	0.08	0.15
1933.113	101.0	1.72	1	GΣ	-1.64	0.05
1935.21	101.0	1.83	3	Bz	-0.61	0.16
1937.37	99.0	1.68	5	Mul	-1.54	0.01
1938.22	98.8	1.68	1	Mul	-1.32	0.01
1938.708	98.7	1.71	4	Mul	-1.18	0.04
1940.335	97.6	1.72	6	Sémirot	-1.48	0.05
1941.235	101.6	1.80	1	Korbut	2.96	0.13
1943.28	97.3	1.72	3	Bz	-0.34	0.05

ADS 5400 = IDS 06463N5927 = Σ 948						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1947.35	95.3	1.79	3	Mul	-0.34	0.11
1949.11	94.0	1.71	4	Dubois	-0.78	0.03
1949.238	94.33	1.701	6	R	-0.39	0.02
1949.932	93.43	1.720	1	Hzg	-0.95	0.04
1950.183	92.94	1.686	8	R	-1.32	0.01
1951.200	92.02	1.654	8	R	-1.74	-0.02
1952.212	92.47	1.662	6	R	-0.80	-0.02
1953.15	92.4	1.73	3	Mul	-0.41	0.05
1953.183	91.37	1.636	9	R	-1.42	-0.04
1954.176	91.8	1.61	4	Wieth–Knudsen	-0.51	-0.07
1954.188	90.73	1.682	8	R	-1.57	0.00
1955.074	90.4	1.68	3	Djk	-1.47	0.00
1955.211	90.50	1.682	7	R	-1.30	0.00
1956.027	90.5	1.67	4	Djk2,Dc2	-0.90	-0.01
1956.206	90.08	1.687	8	R	-1.24	0.01
1957.19	89.5	1.64	4	Sagot	-1.34	-0.04
1957.198	89.86	1.686	5	R	-0.97	0.01
1957.25	89.8	1.77	3	Clouet	-1.01	0.09
1957.25	91.1	1.70	3	Mul	0.29	0.02
1959.04	88.3	1.73	2	Wor	-1.64	0.05
1959.08	90.0	1.75	3	GrO	0.08	0.07
1960.96	90.0	1.73	4	Wor	1.00	0.05
1965.012	87.0	1.72	5	Walker Jr.	-0.03	0.04
1966.093	89.7	1.78	1	Pop	3.19	0.10
1966.095	86.4	1.56	2	Djk	-0.11	-0.12
1966.099	87.2	1.54	1	Zul	0.69	-0.14
1973.358	84.4	1.69	3	Wor	1.41	0.00
1975.140	82.3*	1.73	4	Walker Jr.	0.17	0.04
1977.19	82.0*	1.64	2	Zul	0.86	-0.05
1978.124	84.0	1.79	3	Wor	3.31	0.10
1980.588	80.6	1.61	3	Zul	1.10	-0.08
1981.239	80.8	1.76	1	Pop	1.61	0.07
1981.239	80.4	1.71	1	Zul	1.21	0.02
1985.181	81.4	1.76	3	Wor	4.11	0.07
1988.11	76.6	1.73	3	Mul	0.72	0.04
1990.130	76.6	1.69	3	Zul	1.69	-0.00
1990.133	75.7	1.80	3	Pop	0.79	0.11
* – quadrant reverse						

Table 2 (continued)

ADS 6526 = IDS 08017S0836 = A 1580						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1907.24	132.8	0.30	3	A	-0.00	-0.00
1917.12	138.6	0.28	2	A	-2.22	0.01
1933.16	comes not seen		1	A	–	–
1944.294	181.7	0.14	1	VBs	3.34	-0.04
1944.88	188.8	0.25	4	Voûte	9.23	0.07
1951.058	187.1	0.16	1	VBs	-6.26	-0.01
1951.069	188.3	0.14	1	VBs	-5.08	-0.03
1986.8895	261.1	0.247	1	McAlister et al	-2.54	0.01
1987.2745	265.4	0.239	1	McAlister et al	1.32	-0.00
1989.9363	268.3	0.246	1	Hartkopf et al.	1.27	-0.00
1990.3488	266.9	0.249	1	Hartkopf et al.	-0.57	-0.00
ADS 8082 = IDS 11107N3109 = h 2562						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1830	347.2	1.5+-	1	h	-1.48	-0.05
1881.36	327.6	1.24	1	β	2.27	-0.22
1903.23	313.0	1.24	2	β	-1.23	-0.16
1906.12	315.6	1.44	2	β	2.90	0.05
1911.11	312.6	1.22	3	Doo	2.60	-0.16
1911.39	313.6	2.33	1	L	3.76	0.96
1925.16	302.2	1.57	6	GrO	0.14	0.24
1933.53	297.9	1.47	3	VBs	0.83	0.17
1944.07	292.0	1.57	3	Voûte	1.52	0.30
1949.290	283.57	1.417	6	Rabe	-3.50	0.17
1950.34	287.8	1.26	2	VBs	1.42	0.01
1953.78	286.9	1.27	2	Cou	2.83	0.03
1954.335	279.08	1.30	4	Rabe	-4.61	0.07
1955.323	279.12	1.26	5	Rabe	-3.90	0.03
1960.39	278.5	1.07	3	Bz	-1.00	-0.14
1962.21	277.6	1.32	3	Cou	-0.62	0.11
1963.185	279.1	1.12	4	Wor	1.58	-0.08
1968.368	271.8	0.97	4	Walker Jr.	-1.97	-0.22
1971.181	272.0	1.18	4	Wor	0.31	0.00
1977.35	263.6	1.07	2	Zul	-3.41	-0.09
1982.27	263.5	1.22	2	hz	0.34	0.08
1983.303	264.7	1.08	3	Wor	2.36	-0.06

Table 2 (continued)

ADS 9025 = IDS 13473N1727 = OΣ 277						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1849.54	347.8	10.26	5	OΣ	-0.34	1.43
1867.36	348.7	9.03	3	Dembovski	-1.88	0.09
1873.64	350.8	8.91	4	Dembovski	-0.63	-0.01
1878.31	351.9	8.71	4	β	-0.17	-0.17
1881.47	354.3	8.90	3	β	1.79	0.05
1883.41	352.4	8.89	6	Hl	-0.38	0.07
1891.40	353.6	8.72	2	HΣ	-0.31	0.02
1895.95	356.0	8.41	4	Com	1.43	-0.19
1898.26	355.1	8.45	3	Hu	0.19	-0.10
1898.57	354.8	8.54	2	Ser	-0.16	0.00
1901.14	355.8	8.66	3	Doo	0.45	0.19
1911.71	356.8	7.28	3	Wz	-0.21	-0.87
1915.39	356.4	–	3	Rabe	-1.22	–
1923.15	359.1	7.35	9	VBs3,B4,Fur2	0.10	-0.35
1925.39	359.5	6.96	4	GrO	0.09	-0.64
1929.41	1.7	7.06	6	VBs	1.51	-0.35
1940.43	3.5	6.40	2	Bz	0.93	-0.43
1945.31	5.1	6.15	3	VBs	1.34	-0.40
1946.47	5.1	6.09	3	Bz	1.04	-0.38
1952.43	6.0	5.87	4	Bz	0.28	-0.23
1958.230	6.8	5.40	3	Bos	-0.75	-0.31
1960.89	7.8	5.32	4	Wor	-0.68	-0.20
1965.38	11.4	5.14	4	Cou	1.20	-0.05
1968.842	8.0	4.94	4	Wor	-3.69	0.01
1970.42	13.5	5.17	3	Bz	1.08	0.36
1995.44	B not seen		1	Pop,Pav	–	–

Table 2 (continued)

ADS 9170 = IDS 14141S0831 = β 939						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1879.92	156.1	0.65	2	β	0.76	0.02
1887.46	147.9	0.45	2	Sp	-4.09	-0.15
1888.34	147.5	0.68	2	Lv	-4.09	0.08
1892.39	149.3	0.6	2	Sp	-0.35	0.01
1897.39	152.8	0.38	2	Sp	5.69	-0.19
1898.27	147.5	0.71	3	Doo	0.85	0.15
1905.03	141.0	0.65	3	Doo	-1.88	0.11
1905.75	150.4	0.55	3	Wz	7.94	0.02
1914.42	136.7	0.56	4	Fox	-0.29	0.06
1944.10	108.1	0.44	4	Voûte	-3.22	0.04
1945.33	105.5	0.39	3	VBs	-4.49	-0.00
1955.53	96.1	0.30	4/3	VBs	-2.20	-0.07
1956.16	90.	0.4	1	Mul	-7.55	0.03
1957.28	91.2	0.32	4	VBs	-5.00	-0.05
1958.455	93.9	0.34	4	Bos	-0.87	-0.03
1959.33	94.8	0.40	2	Cou	1.09	0.03
1962.94	89.3	0.38	4	Bz	0.02	0.01
1966.317	87.1	0.37	2	Walker Jr.	1.99	0.00
1976.723	72.7	0.28	3	Wor	0.18	-0.10
1980.246	69.1	0.36	3	Wor	0.64	-0.02
1982.346	74.8	0.41	1	Wor	8.70	0.02
1990.3411	57.6	0.425	1	Hartkopf...	-0.06	0.02

Table 2 (continued)

ADS 11339 = IDS 18261N0046 = β 1203						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1890.67	67.8	0.30	3	β	4.06	0.00
1892.40	66.8	0.32	1	β	1.35	0.02
1893.77	48.0	0.25+-	1	Sp	-18.81	-0.04
1896.74	72.6	0.43	1	Lewis	2.80	0.14
1899.46	72.0	0.31	3	A	-0.57	0.02
1900.67	90.2	0.20	1	Lewis	16.38	-0.09
1900.98	74.1	0.38	4	Doo	-0.04	0.09
1901.12	68.3	0.23	5	Bryant	-5.98	-0.06
1910.55	85.0	0.28	1	J	0.87	-0.01
1911.06	76.9	0.30	4	Wz2,Bry2	-7.77	0.01
1915.50	88.0	0.32	5	A2,Lv3	-1.34	0.03
1921.68	94.5	0.32	2	A	-1.27	0.03
1924.92	103.9	0.31	6	Bail5,Plq1	4.81	0.02
1933.04	116.4	0.30	2	VBs	9.28	-0.00
1943.36	113.3	0.33	3	VBs	-3.27	0.01
1944.9	123.5	0.36	3	Voûte	5.61	0.04
1948.63	120.1	0.32	2	VBs	-0.91	-0.01
1950.654	122.6	0.34	2	WM. Markowitz	-0.04	0.01
1952.533	122.2	0.32	1	WM. Markowitz	-1.92	-0.01
1956.56	133.6	0.34	3	Wor	6.42	-0.00
1957.497	128.0	0.33	4	Bos	0.13	-0.01
1958.542	128.3	0.32	5	Bos	-0.33	-0.03
1960.02	133.6	0.33	5	VBs	3.92	-0.02
1962.482	132.3	0.33	4	Bos (12in)	0.90	-0.03
1962.496	132.8	0.36	4	Bos (36in)	1.40	0.00

Table 2 (continued)

ADS 11339 = IDS 18261N0046 = β 1203						
t	θ_t	ϱ	n	Obs.	$\Delta\theta$	$\Delta\varrho$
1962.578	132.5	0.31	4	Wor	1.04	-0.05
1962.67	134.1	0.26	5	hz	2.58	-0.10
1962.77	128.4	0.32	5	Baize	-3.19	-0.04
1966.59	131.8	0.35	2	Mul	-2.33	-0.02
1978.621	138.0	0.44	5	A.L.Behall	-3.31	0.04
1980.4794	143.3	0.400	1	A8	0.98	-0.00
1980.7199	141.4	0.400	1	A8	-1.05	-0.00
1981.4653	143.2	0.395	1	A9	0.35	-0.01
1981.4681	142.6	0.392	1	A9	-0.25	-0.01
1981.7028	143.3	0.396	1	A9	0.33	-0.01
1981.733	140.8	0.38	3	Wor	-2.19	-0.02
1983.4312	143.7	0.406	1	C2	-0.17	-0.00
1986.4047	145.5	0.415	1	C4	0.12	-0.00
1991.3927	147.2	0.431	1	Hartkopf et al.	-0.57	0.00

Table 3 Ephemeris

	ADS 48		ADS 2491		ADS 5400		ADS 6526	
t	θ_t	ϱ	θ_t	ϱ	θ_t	ϱ	θ_t	ϱ
1996.0	$180\overset{\circ}{.}37$	$5\overset{''}{.}98$	$16\overset{\circ}{.}95$	$0\overset{''}{.}95$	$72\overset{\circ}{.}63$	$1\overset{''}{.}69$	$273\overset{\circ}{.}00$	$0\overset{''}{.}27$
1997.0	180.80	5.98	16.32	0.95	72.14	1.69	273.89	0.27
1998.0	181.23	5.98	15.69	0.94	71.65	1.69	274.76	0.28
1999.0	181.66	5.98	15.05	0.94	71.16	1.69	275.62	0.28
2000.0	182.09	5.97	14.40	0.94	70.68	1.69	276.45	0.28
2001.0	182.52	5.97	13.76	0.93	70.19	1.69	277.26	0.29
2002.0	182.94	5.97	13.10	0.93	69.70	1.70	278.06	0.29
2003.0	183.37	5.97	12.45	0.93	69.21	1.70	278.84	0.29
2004.0	183.80	5.97	11.78	0.92	68.72	1.70	279.60	0.30
2005.0	184.23	5.96	11.12	0.92	68.23	1.70	280.35	0.30
2006.0	184.66	5.96	10.45	0.92	67.26	1.70	281.09	0.30
2007.0	185.10	5.95	9.77	0.91	66.77	1.70	281.82	0.30
2008.0	185.53	5.95	9.09	0.91	66.28	1.70	282.53	0.31
2009.0	185.96	5.95	8.40	0.91	65.79	1.70	283.23	0.31
2010.0	186.40	5.94	7.71	0.90	65.31	1.70	283.92	0.31
2011.0	186.83	5.94	7.01	0.90	64.82	1.70	284.60	0.31
2012.0	187.26	5.93	6.31	0.90	64.33	1.70	285.27	0.32
2013.0	187.70	5.93	5.60	0.89	63.84	1.70	285.94	0.32
2014.0	188.14	5.92	4.89	0.89	63.36	1.70	286.59	0.32
2015.0	188.57	5.91	4.17	0.89	62.87	1.70	287.24	0.32

Table 3 (continued)

	ADS 8082		ADS 9025		ADS 9170		ADS 11339	
t	θ_t	ϱ	θ_t	ϱ	θ_t	ϱ	θ_t	ϱ
1996.0	251.92	1.11	33.76	2.74	52.23	0.43	149.83	0.44
1997.0	251.07	1.10	35.27	2.67	51.33	0.43	150.27	0.45
1998.0	250.22	1.10	36.87	2.59	50.44	0.44	150.71	0.45
1999.0	249.37	1.10	38.57	2.51	49.56	0.44	151.14	0.45
2000.0	248.51	1.10	40.38	2.44	48.70	0.44	151.56	0.45
2001.0	247.64	1.10	42.29	2.37	47.86	0.45	151.99	0.46
2002.0	246.77	1.09	44.32	2.30	47.02	0.45	152.40	0.46
2003.0	245.90	1.09	46.48	2.23	46.21	0.45	152.81	0.46
2004.0	245.03	1.09	48.77	2.17	45.40	0.46	153.22	0.46
2005.0	244.15	1.09	51.20	2.10	44.61	0.46	153.62	0.47
2006.0	243.27	1.08	53.77	2.05	43.83	0.47	154.02	0.47
2007.0	242.39	1.08	56.49	1.99	43.07	0.47	154.41	0.47
2008.0	241.50	1.08	59.36	1.94	42.32	0.47	154.80	0.48
2009.0	240.61	1.08	62.38	1.89	41.58	0.48	155.18	0.48
2010.0	239.72	1.08	65.55	1.85	40.86	0.48	155.56	0.48
2011.0	238.82	1.08	68.85	1.81	40.15	0.49	155.94	0.48
2012.0	237.93	1.07	72.28	1.78	39.45	0.49	156.31	0.49
2013.0	237.02	1.07	75.82	1.76	38.76	0.50	156.68	0.49
2014.0	236.12	1.07	79.46	1.74	38.08	0.50	157.04	0.49
2015.0	235.21	1.07	83.16	1.72	37.42	0.50	157.40	0.49

3. COMMENTS CONCERNING THE ANALYZED SYSTEMS

ADS 48 = IDS 00054N4549 = OΣ 547

The position angle of this, for the observation convenient, pair has increased since O.Struve's discovery in 1876 by 70°, its ρ having meanwhile augmented likewise from $4\farcs2$ to $6\farcs2$.

First derived for this pair was a hyperbolic orbit by J. Hopmann, whereupon elliptic elements were published by the following authors:

Brosche (1954): P= 327.30 y.

Güntzel–Ligner (1955): P= 362.30 y.

Hopmann (1964): P=1506.68 y.

Kiselev et al.(1980): P= 448.0 y.

Kiselev's orbit relies also on his photographic observations in the period 1960–1980, which are well satisfied by obtained elements. However, earlier measurements display clear systematic deviations.

The elements here reported are derived for the purpose of removing all systematic deflections in the ephemeris, as well as to answer what value of the period is more real. Simultaneously, one of the values of separation, obtained from the newly derived set of the orbital elements served the authors as one of standards in deriving the CCD camera constants.

Besides the A and B components, belonging physically to ADS 48 system, is also component C. All three of the components are entered by O. Eggen in his list "The nearest visual binaries" while their trigonometric parallaxes are reported as $0\farcs088$, $0\farcs095$, $0\farcs086$ respectively.

The orbital elements of this system have also been published in I.C. No128, Comm 26, IAU.

ADS 2491 = IDS 03218N0845 = Σ 380

This Struve's pair is well covered by observations since its discovery in 1831 up to our days. Its position angle has changed by about 65°, but the abundant observational material allowed to pass from the well defined elliptic arc over to an elliptic orbit. Heretofore no elements have been derived.

The elements have also been published in I.C. No 127, Comm. 26, IAU.

ADS 5400 = IDS 06463N5927 = Σ 948

The first orbit of this pair was derived by Gore as early as 1887 (Aitken, 1932), and the last one by Brosche in 1957, with a period $P = 699.0y$. The ephemeris computed in accordance with Brosche's elements exhibit, already twenty–odd years, departures from this pair's observations, making the correction to the elements indispensable.

The elements have also been published in I.C. No 126, Comm.26, IAU, but the errors in ω and Ω were made. The accurate values have been published here.

ADS 6526 = IDS 08017S0836 = A 1580

No orbital elements of the Aitken's pair have so far been derived. Since its discovery in 1907 up to now the position angle has increased by about 134°, enabling the deriving of its orbital elements to be undertaken.

The elements have also been announced in I.C. No 128, Comm. 26, IAU.

ADS 8082 = IDS 11107N3109 = h 2562

No orbital elements have been derived thus far. An arc of about 82° allowed the calculation of its preliminary elements, which will have a promoting effect on this pair's observation. Otherwise, probably on account of its faintness, this pair is deficient in observations.

In the ADS catalogue the value of the dynamical parallax of this pair is found as $0''.019$, (J.& F).

The orbital elements are published also in I.C. No 127, Comm. 26, IAU.

ADS 9025 = IDS 13473N1727 = OΣ 277

The orbital elements of this pair are reported for the first time. The pair is distinguishing itself by great difference in brightness of its primary and secondary components 6^m, along with substantial change in its component's distance: from $\rho = 10''.26$ (1849) to $\rho = 5''.17$ in 1970. A large proper motion of this pair has been registered $W484N034\,sec/1000y$ (IDS) but it might at present be said that this was a consequence of orbital motion.

This system also appears in Eggen's (1956) list of 155 double and multiple stars, $\pi > 0''.05$. In the same paper Eggen (1956) established orbital motion of this pair (conclusion based on the observations up to 1945), The spectra of the A and B components are given as F7V and M respectively. For the system's parallax the following values are found:

ADS: π(tr.) $= 0''.059$ (Yale)
ADS: π(sp.) $= 0''.050$ (Mt.W.)
ADS: π(sp.) $= 0''.090$ (DAO)
ADS: π(dyn) $= 0''.096$ (R. & M.)
A.J.61,405: π(tr.) $= 0''.056$ (Eggen).
Our orbital parallax: π(orb.)$= 0''.109$.

The ephemeris show that the observations of this pair will not be possible for a long time.

The elements are published also in I.C. No 126, Comm.26, IAU, but for a, i, ω and Ω in I.C. were made errors. The accurate values are given in this paper.

ADS 9170 = IDS 14141S0831 = β 939

This Burnham's pair too obtains its orbital elements for the first time. They are based on its position angle's change by 98°. Especially the separations have large discordance.

The pair deserves an attention of observers.

ADS 11339 = IDS 18261N0046 = β 1203

Since Burnham's discovery in 1890 till 1991 the position angle of this pair has increased by about 80° with a slight increase in distance. This bright (IDS: 7.6 – 7.8 mag.) but far-off system (ADS: π(dyn.) $= 0''.005$ (J.& F.) or $0''.004$ (R. & M.) did not yet have its orbital elements specified. Interferometric measurements by Mc Alister (1988) in the period 1980–1986 defined rather reliably the ellipses in this interval, contributing thereby to the determining of its first orbital elements.

The elements have been published in I.C. No 126, Comm.26, IAU.

4. PlOTS OF THE ORBITS

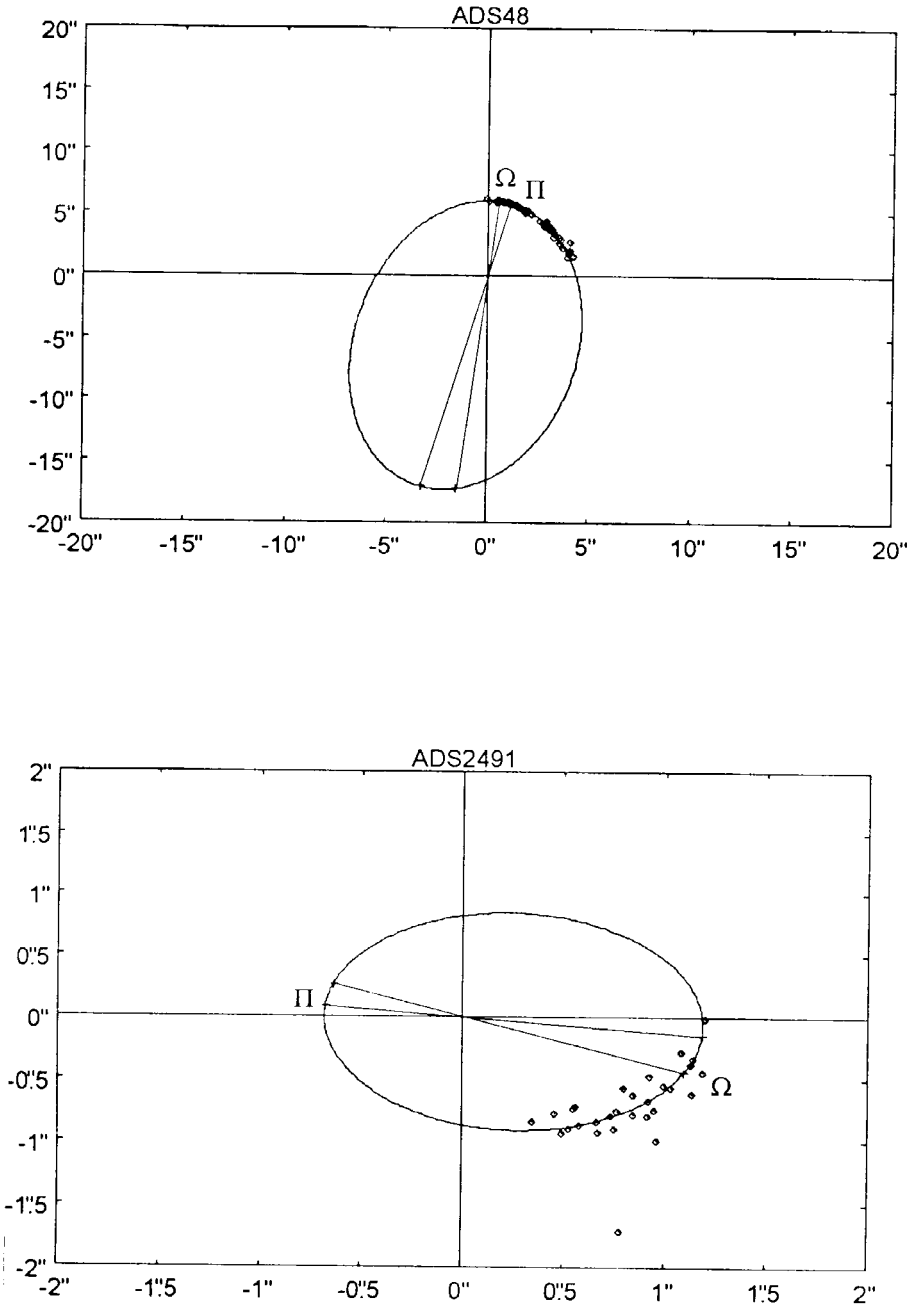


Fig. 1.

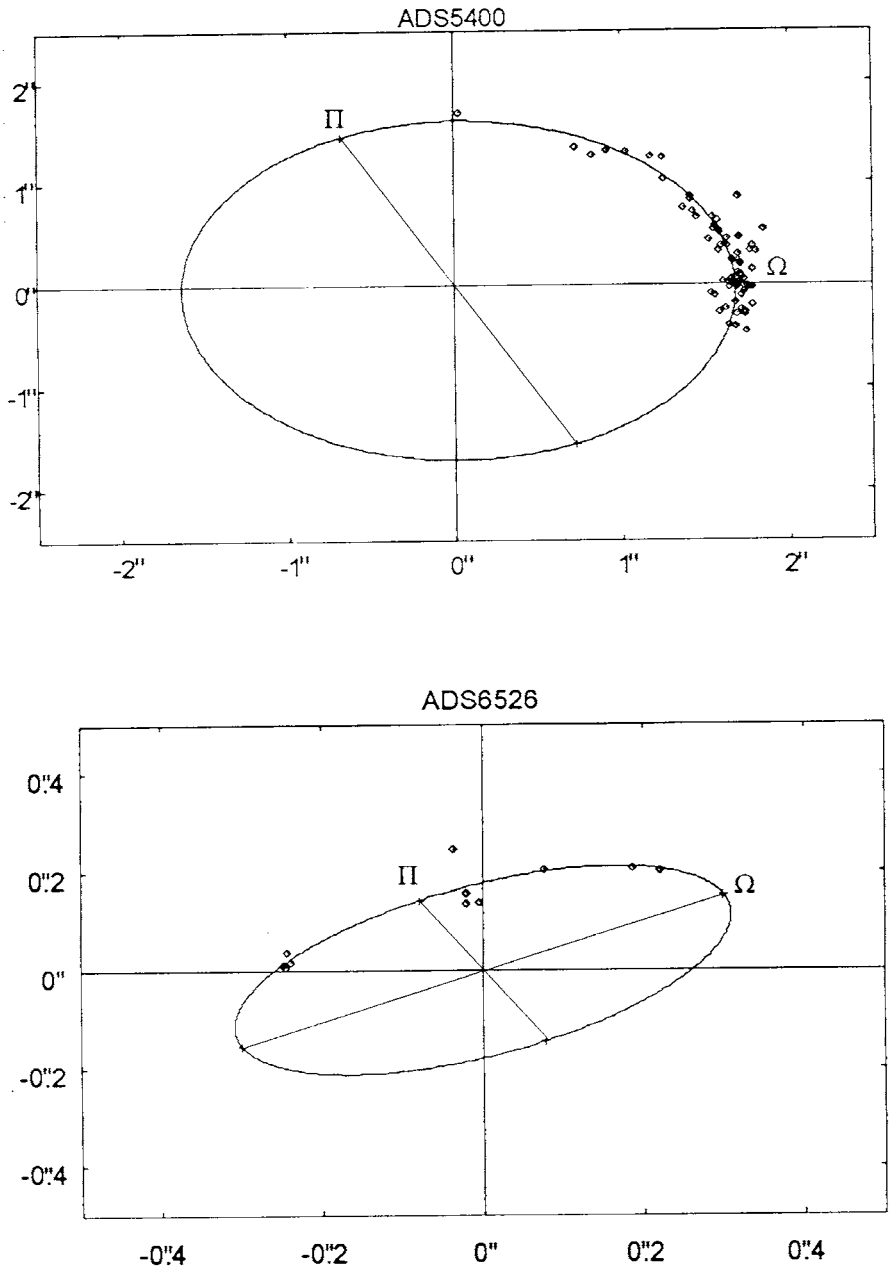
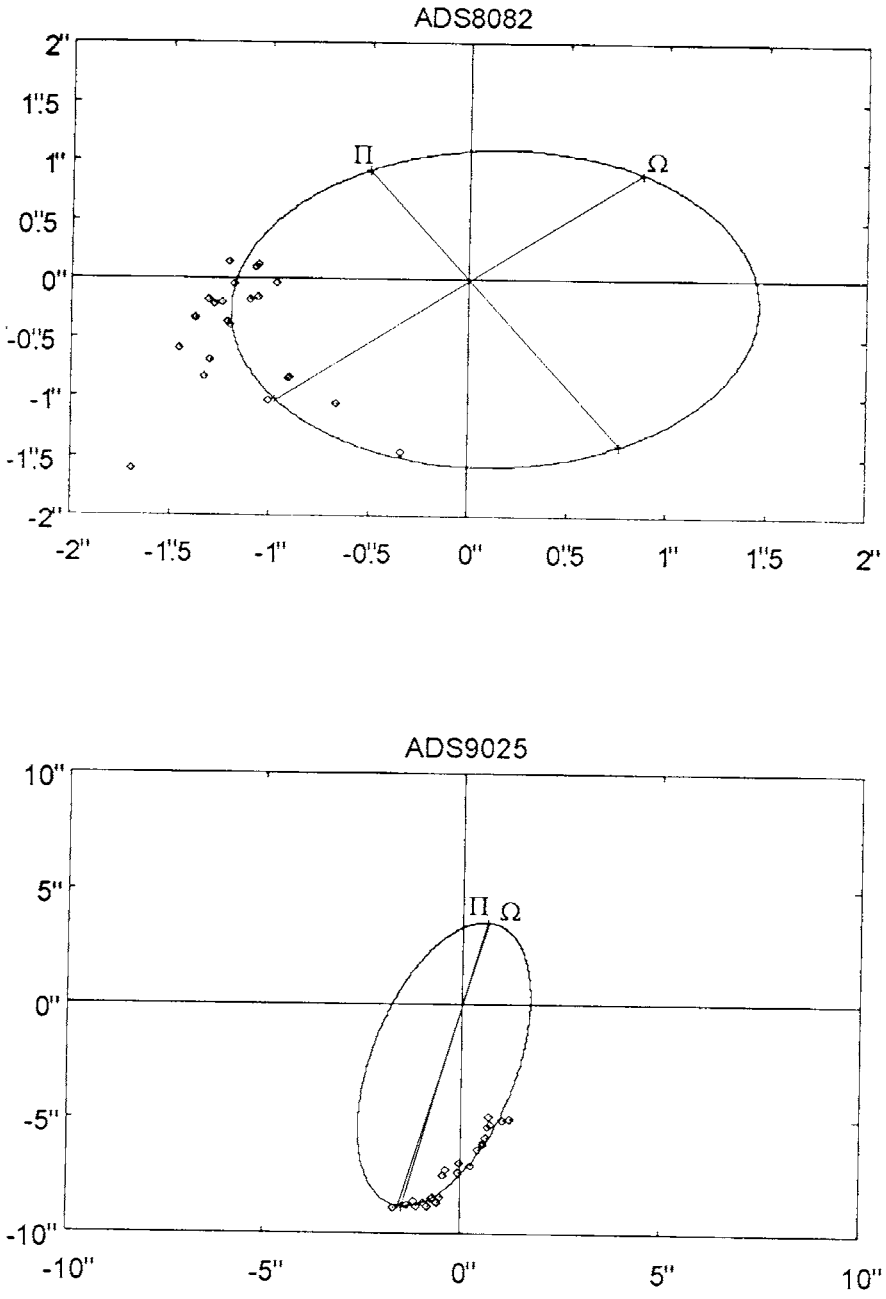


Fig. 2.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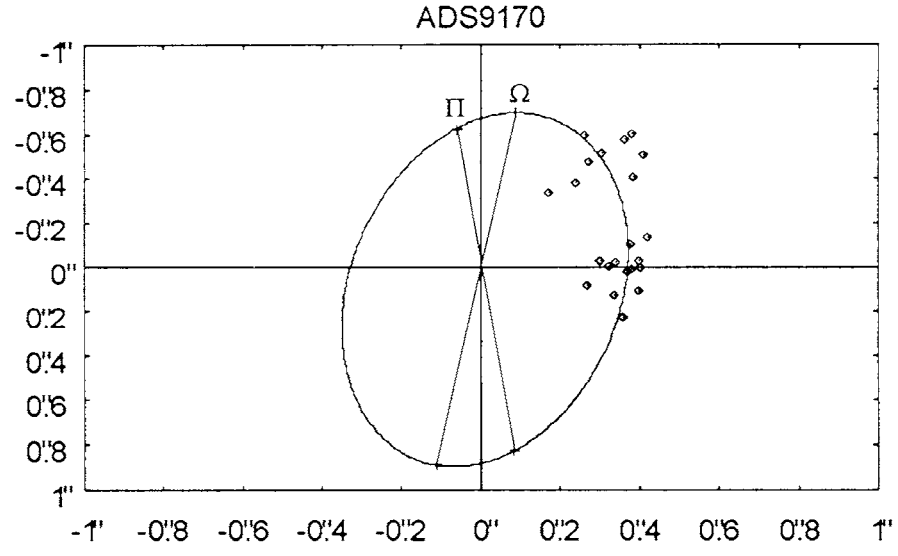
1''
0''.5
0''
-0''.5
-1''
-1''.5
-2''
-2''
-1''.5
-1''
-0''.5
0''
0''.5
1''
1''.5
2''
Π
Ω
ADS9025
10''
5''
0''
-5''
-10''
-10''
-5''
0''
5''
10''
Π
Ω

Fig. 3.


ADS9170
Π
Ω
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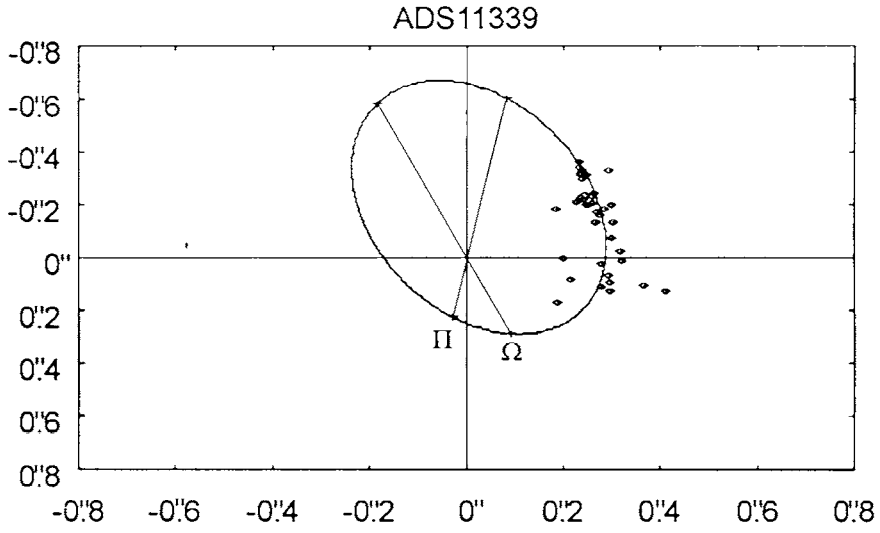
-0''.6
-0''.4
-0''.2
0''
0''.2
0''.4
0''.6
0''.8
1''


ADS11339
Π
Ω
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-0''.6
-0''.4
-0''.2
0''
0''.2
0''.4
0''.6
0''.8

Fig. 4.

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REFERENCES

Angelov, T.: 1993, *Bull. Obs. Astron. Belgrade*, **148**, 1.
Aitken R.G.: 1932, *New General Catalogue of Double Stars*, The Carnegie Institution of Washington
Brosche P.: 1954, *Circulaire d'Information Commision 26*, UAI, No 7.
Brosche P.: 1957, *Astron. Nachr.*, **283**, 280.
Burnham S.W.: 1906, *A General Catalogue of Double Stars*, The Carnegie Institution of Washington
Eggen O.: 1956, *Astron. J.*, **61**, 405.
Eichhorn H.K., Xu Yu–lin: 1990, *Astrophys. J.*, **358**, 575.
Günzel , Linger: 1955, *Astron. Nachr*, **282**, 183.
Hopmann J.: 1964, *Ann. Sternw. Wien*, **26**, 7.
Kiselev A.A. et al.: 1961, *Astr.Zh.*, **57**, 1227.
McAlister H.A., Hartkopf W.I.: 1988, *CHARA Contribution* No 2.
Popović G.M., Pavlović R.: 1995, *Information Circular Commision 26*, IAU, No 126.
Popović G.M., Pavlović R.: 1995, *Information Circular Commision 26*, IAU, No 127.
Popović G.M., Pavlović R.: 1995, *Information Circular Commision 26*, IAU, No 128.
Popović G.M., Pavlović R.: 1995, *Bull. Obs. Astron. Belgrade*, **152**, 55.

ПУТАЊСКИ ЕЛЕМЕНТИ ОСАМ ДВОЈНИХ СИСТЕМА

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УДК 521.328
Претходно саопштење

Саопштавају се путањски елементи и одговарајуће астрофизичке величине следећих двојних система: ADS 48 = OΣ 547, ADS 2491 = Σ 380, ADS 5400 = Σ 948, ADS 6526 = A 1580, ADS 8082 = h 2562, ADS 9025 = OΣ 270, ADS 9170 = β 939, ADS 11339 = β 1203.